

Playing Our Full Part

How Manchester's Residents and Businesses
can benefit from ambitious action on climate
change

Technical Appendix by Anthesis (UK) Ltd



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Document purpose

This document is a technical appendix to the Manchester Climate Change Board's paper entitled "Playing Our Full Part: How Manchester's Residents and Businesses can benefit from ambitious action on climate change". This Technical Appendix should be read in association with this paper and Appendix 2 and 3.

1. Why Act?



The next 20 years are likely to see dramatic changes in our lives in response to meeting the commitments to the Paris Climate Agreement. These changes have the potential to enhance our wellbeing, economy and environment. They also represent a great opportunity for Manchester to play a leading role in setting the much needed, accelerated pace for progress amongst an elite group of global cities. This section explores the current city context, other relevant initiatives taking place both locally and globally, and how the city could benefit across a number of wellbeing, economic and environmental areas.

Quality of life, health, liveability and good, secure jobs

- High quality housing and no fuel poverty

Domestic property is the largest emitting sector within the city of Manchester. At present 14.5% of households are in 'fuel poverty' (i.e. the occupants are unable to afford to keep their home adequately heated) which is higher than the national average of 10.6%¹.

Transition to a zero carbon city will require at least 60% of homes to be significantly better insulated than at present. This would undoubtedly benefit the city's fuel poor population. Those not in fuel poverty would also benefit from reduced energy bills and opportunity to modernise or redesign their homes.

Energiesprong have completed the UK's whole house retrofit trial in Nottingham which has seen an 80%+ improvement in the fabric thermal performance of homes². The UK's first 'Passive House Plus' retrofit has recently been achieved in the City of Manchester³, the learnings from which have the potential to be exploited for the wider benefit of the City.

- Excellent public transport, zero emission vehicles and no early deaths due to poor air quality

Currently, transport is the second largest source of emissions behind buildings and is the most significant contributor to poor air quality in the city. On average, 10 people a day die early in Greater Manchester as a result of poor air quality, and traffic congestion accounts for a £1.3 billion annual cost to Greater Manchester businesses⁴.

By addressing air quality in the right way, there is a huge opportunity to improve the health and well-being of the city, the economy and reduce emissions in the process.

London's introduction of a Toxicity Charge (or T-Charge) and Clean Air Zone's, are currently being considered by other UK cities. Paris is using a sticker system to restrict vehicle access into city centres whereby the most polluting have been banned from the city and other categories may be refused entry to the city on a given day, if air quality is particularly poor. New York City introduced an anti-idling law in 2009 to reduce unnecessary emissions from idling vehicles.⁵

- Extensive safe walking and cycling routes

At present, more than 600 people are killed or seriously injured on Greater Manchester's roads every year and 50% of adults in Greater Manchester are physically inactive which costs the local NHS over £500,000 per week. In contrast, a recent UK study showed that walking or cycling to work led to an overall 46% reduction in the risk of cardiovascular disease.⁴

¹ Greater ManchesterCA, Home Energy Conservation Act: Greater Manchester 2017/18 –18/19

² CCC 2018 Progress Report: UK can learn from Energiesprong whole-house retrofit

³ <https://www.ecospheric.co.uk/>

⁴ TFGreater Manchester, Made to Move, 2018

⁵ City Metric, Cities across the globe are leading the charge on clean air policies. British ones can do more, 2018

The recently announced 'Beelines' network is an incredibly positive step forward to develop better infrastructure and improve safety of cyclists and pedestrians. However, there is still a lot more that can currently be done to influence behaviour and increase modal shift in the short term, within the carbon budget timeframes required.

Barcelona's urban mobility plan focuses on the idea of superblocks – the idea of redirecting traffic in grids around small neighbourhoods, with space within these superblocks dedicated to pedestrian and cycling public space. Copenhagen has invested in infrastructure to make cycling easier, faster and safer, and has introduced policies that set requirements for bike space per employee for commercial buildings, and bike parking space for residential developments. They have also closed large areas of the city centre are closed for motor vehicles.⁵

- Good jobs in growing sectors, working for successful, responsible businesses

Manchester is leading the charge in de-centralising the UK market, boasting the fastest growing economy outside of the capital and gross value added (GVA) growth projections of 45% between 2016 and 2036. The entrepreneurial culture in Manchester is reflective of a greater innovative movement in the city, making it one of the most attractive cities for relocation and professional development in the UK.⁶ Moreover, the low carbon and environmental goods sector has been valued at contributing in excess of £5bn to the Greater Manchester economy employing nearly 35,000 people in 2,000 companies⁷ – a platform that should serve the city well to build-upon for the future.

Becoming a zero carbon city is needed to sustain and encourage Manchester's innovative heritage, as it will impact and reach all industries and sectors. It will also enable businesses to continue to attract the best talent and offer the best platform for businesses to flourish.

Successful economy – attracting and supporting businesses and investors

- Skilled and well-educated workers

Manchester has the largest regional Financial, Professional and Business Services (FPBS) industry outside of London⁸. This is particularly relevant at present as Michael Bloomberg's Task Force for Climate Related Financial Disclosure (TCFD)⁹ is driving unprecedented levels of engagement and action within the investor community (over 20 private equity firms are located in Manchester alone, the greatest concentration outside of London in the UK).

Additionally, retrofit and new build construction projects in the commercial and domestic construction sectors offer great opportunities for the city. Access and availability of skilled workers is a common concern by many in the construction industry^{10&11}, which could be further amplified by Brexit in coming months. Home to over 70,000 students at the University of Manchester and Manchester Metropolitan University, 'Green Building & Retrofit' is one of many industries that could flourish if given the right support. Notably, the UK Green Building Council have estimated that 23 person years of employment could be created for every £1 million invested in retrofit¹².

- Universities and private sector collaborating to solve local and global challenges and export goods and expertise globally

Manchester has a long and powerful legacy of firsts: The Industrial Revolution, the Manchester to Liverpool Railway, the Suffragette Movement, the development of Computer Science – the list is endless. The potential for future legacies is fuelled by Manchester's pre-eminent position as

⁶ Recruitment Entrepreneur, Manchester's booming economy paves the way for entrepreneurs, 2018

⁷ <https://www.businessgrowthhub.com/green-technologies-and-services/resources/blogs/2017/03/going-low-carbon-in-greater-manchester>

⁸ Invest in Manchester, 2018

⁹ The Task Force for Climate Related Financial Disclosures

¹⁰ Sustainable Homes, Press Release: White paper challenges sector to rethink quality in retrofit projects, 2018

¹¹ UK Green Buildings Council & Aldersgate Group, Energy efficiency in the UK's buildings: key priorities for the new government, 2017

¹² UKGBC Regeneration and Retrofit Report, 2017

Europe's leading academic city. In addition to hosting the Tyndall Centre for Climate Change Research at The University of Manchester, the city is supporting exciting developments in hydrogen fuel cells at Manchester Metropolitan University, materials science through continued development of Graphene, and in the University of Salford, the School for the Built Environment has developed the Energy House to spearhead innovation in energy efficiency and retrofitting for domestic properties.

With over 70,000 students increasing the population of Manchester every September, the continued attraction of the best brains from around the world is a pre-requisite in maintaining the city (and city region's) leading position in supporting, developing and promoting scientific, technological and economic innovations.

- World class transport, energy and digital infrastructure

Smart systems and digital infrastructure go hand in hand with the transition to a low carbon economy, improving access to the city and efficiency with which businesses can operate in the city.

Many UK and international cities are piloting demonstrations and technology roll-out in areas such as City Services (better traffic management, parking, lighting, waste management and public safety), Smart Utilities (including smart meters and smart grids), Connected and Autonomous Vehicles (including driver assistance and various levels of autonomy), Last Mile Supply Chain and Logistics (including fleet management and drone delivery).¹³ The "Our Manchester" strategy has set out Council's ambition to enhancing digital connectivity to support the integration and rollout of such infrastructure across the city in the years to come.¹⁴

Climate change resilience - locally and globally

- Reduced energy costs and vulnerability to unexpected energy price rises – energy being generated, distributed, shared and used locally

The energy market and systems are changing. This is a result of diminishing fossil fuel resources, volatility of fossil fuel prices and the drastic need to cut carbon emissions and air pollution. Unexpected energy price rises further expose the fuel poor and place strain on business. However, renewable energy generation, both on and off grid, present an opportunity to protect the city from such price rises, generate revenue, create jobs and improve quality of life.

Despite the likelihood in the near term of oil prices remaining low and demand increasing, there is low investment in new exploration and extraction, creating a large risk for a shortfall in supply in the 2020s¹⁵. These global shifts will have a direct impact on Manchester, and its competitiveness, if it leaves itself open to a market it has no control over.

'Decentralised energy and storage will continue to grow rapidly'¹⁶ to 2030 led by technology. Renewable energy can feed into a localised grid that is controlled by the locality and offer competitive prices as well as reducing reliance on an ageing grid network unfit for demand-balancing technologies. Manchester can capitalise on this opportunity by investing in renewable energy generation in the region that feeds into the local area to be used, stored and managed to meet local demands. The 6 current district heating schemes in the city are a brilliant example of this, supplying heat to around 3,000 premises saving 5,000 tonnes of CO₂ a year.¹⁷ To provide the security the citizens and businesses of Manchester need to deliver future economic growth projections, such decentralised schemes need to scale to provide the city with an energy system that ensures assurance to all.

¹³ [Smart City Demonstrators A global review of challenges and lessons learned](#)

¹⁴ https://www.manchester.gov.uk/download/downloads/id/25287/a_connected_city.pdf

¹⁵ [World Energy Outlook by the International Energy Agency, 2017](#)

¹⁶ [Energy-UK, Pathways for the GB Electricity Sector to 2030, 2016](#)

¹⁷ [The Association for Decentralised Energy \(ADE\) and the Association for the Conservation of Energy \(ACE\), Energising Greater Manchester, 2018](#)

- Economy resilient to flooding and extreme weather

In December 2015, Storm Eva brought unprecedented rainfall to Greater Manchester, resulting in record river levels and flooding across the region. On Boxing Day, more than 2,250 homes and 500 businesses in the city-region were flooded, more than 31,200 properties lost their power supplies and damage to infrastructure totalled £11.5m¹⁸.



More recently, the exceptional prolonged dry and hot weather of spring and early summer of 2018 resulted in moorland fires in June and July across Saddleworth Moor (2,000 acres of sustained damaged) and Winter Hill (4,000 acres) necessitating the support of emergency services and fire brigades from across Greater Manchester and beyond¹⁹.

This has not only had obvious damage on vegetation but resulted in habitat loss with resultant impacts on bird and wildlife populations as well as livestock (sheep). The economic impacts from these fires are currently unknown, however, it can be appreciated that the cost cannot be expressed just in financial terms.

These recent events debunk beliefs that climate impacts will only be felt in coastal and low-lying areas more so than regions such as Manchester. While the local impacts may naturally be of more relevance to local policy makers, it should still be recognised that the greatest impacts are being experienced in

poorer nations with typically warmer or cooler climates relative to the UK.²⁰

The increase in frequency of such extreme weather events is likely to continue to mount: the number of floods and other hydrological events have quadrupled since 1980 and have doubled since 2004.²¹ Clearly acting on climate change will increase resilience and reduce long term impacts.

- A leading global player in a new zero carbon world

There is an elite group of cities that are driving towards decarbonisation and, in a number of instances (e.g. Copenhagen, New York and Adelaide), carbon neutrality. These cities are collectively coordinating and sharing their efforts through a number of respected best practice organisations such as C40 Cities, CDP, the Global Covenant of Mayors, ICLEI and the Carbon Neutral Cities Alliance.



Membership of such organisations raises awareness of Manchester's aspirations on an international stage and firmly places the city in a leading peer group that should attract the attention of inward investors, global business and citizens alike.

¹⁸ https://www.greatermanchester-ca.gov.uk/downloads/file/199/boxing_day_flood_report_2015

¹⁹ <https://www.manchestereveningnews.co.uk/news/greater-manchester-news/winter-hill-saddleworth-moorland-fires-14955626>

²⁰ University of Melbourne, Climate change hits poorest hardest, new research shows, 2018

²¹ European Academies' Science Advisory Council (EASAC), Extreme weather events in Europe: Preparing for climate change adaptation, 2018

- Providing leadership for others to follow

Leadership as a zero carbon city will enhance Manchester as a leader in low carbon technology, skills, finance and innovation. This will be both within Greater Manchester (i.e. by Manchester taking a leading position to support other boroughs to follow), the UK and internationally.

- Taking our fair share of the responsibility to act

The carbon budget methodology that has informed the date by which Greater Manchester needs to achieve carbon neutrality has considered the fair and equitable framing of the Paris Agreement, and ensures that Manchester takes its 'fair share' of responsibility. This is discussed in detail in the report prepared by the Tyndall Centre (document entitled "Quantifying the implications of the Paris Agreement for the city of Manchester"²³).

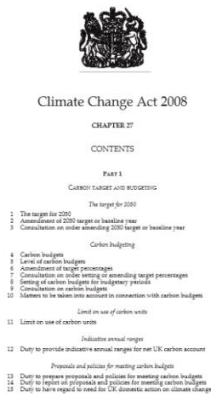
2. Policy Context



There are a number of relevant policy drivers that support plans to become a zero carbon city. These have been outlined in this section.

Policy drivers

Climate Change Act (2008)



The Climate Change Act (2008) was established to target an 80% reduction in UK greenhouse gas emissions by 2050, from the 1990 baseline. The Act provides the basis of UK climate legislation, supporting a framework of legally enforceable carbon targets and schemes to address climate change mitigation and adaptation.²²

The Act (2008) established the Committee on Climate Change (CCC) to develop carbon budgeting targets and advise the UK Government on respective policies. The carbon budgets are legally binding carbon budgets, set for 5-year periods and span only to 2032 at this point in time.

The Paris Agreement (2016)



The United Nations Framework Convention on Climate Change (UNFCCC) executed the Paris Agreement on the 4th of November 2016, following COP21 (2015) in Paris. The Paris Agreement (2016) was a landmark agreement in global climate efforts, aligning nationally determined contributions (NDCs) to combat climate change and its adverse effects.

The Paris Agreement commits signatories to; *'a global temperature rise this century well below 2 degrees Celsius*

above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius' (UNFCCC, 2016).

As outlined by the Tyndall Centre in their report for the city of Manchester²³ and Greater Manchester Combined Authority²⁴, a Paris Aligned carbon budget is significantly more challenging than the existing CCC budgets currently implied by the Climate Change Act.

Clean Growth Strategy (2018)



This strategy sets out the UK Government's proposals for decarbonising all sectors of the UK economy through the 2020s. It explains how the whole country can benefit from low carbon opportunities, while meeting national and international commitments to tackle climate change.²⁵

²² Committee on Climate Change. 2018. *UK Regulations: The Climate Change Act 2008*.

²³ Kuriakose J, Anderson K, Broderick J, McLachlan C. *Quantifying the implications of the Paris Agreement for the city of Manchester* [Internet]. Manchester: 2018

²⁴ Kuriakose J, Anderson K, Broderick J, McLachlan C. *Quantifying the implications of the Paris Agreement for Greater Manchester* [Internet]. Manchester: 2018

²⁵ UK Government. *Clean Growth Strategy*. 2017

Our Manchester (2016)



Manchester City Council's "Our Manchester" vision has 5 key themes²⁶:

- A thriving and sustainable city
- A highly skilled city
- A progressive and equitable city
- A liveable and low carbon city
- A connected city

The strategy sets out the vision for Manchester to 'be in the top flight of world-class cities by 2025' and commits the city to 'playing our full part in limiting the impacts of climate change'. The strategy is underpinned by the comments of residents, businesses and stakeholders who commented on the draft strategy, with around one-third stating that climate change action and environmental improvement needed to be

core parts of Manchester's further development.

Becoming a zero carbon city would have links beyond just the 'liveable and low carbon city' topic.

Greater Manchester Strategy: Our People, Our Place (2017)

our people our place

The Greater Manchester Strategy

The Greater Manchester Strategy outlines 10 key areas that have been identified as priorities for the future of the city region. 'A green city-region and a high-quality culture and leisure offer for all' is the priority most aligned with becoming a zero carbon city, however there are linkages to many of the other priority areas (e.g. healthy lives and quality care).

Greater Manchester Combined Authority state "We are working to reduce carbon emissions and pollution, use resources more sustainably, and make the most of our outstanding natural environment. We want to create community hubs and places which people can enjoy. Greater Manchester is a cultural hotspot, and we're investing to make it even better for visitors and residents. We're also continuing to invest in sport and leisure to encourage all of us to live healthy active lifestyles."²⁷

Greater Manchester Emissions Strategy (2016)



The Greater Manchester Climate Change and Low Emissions Implementation Plan²⁸, focuses on making the most of the region's energy and resources through reducing its carbon footprint.

Associated or relevant strategies/plans include:

- The Low-Emission Strategy (2016) which sets out a framework for policies and measures to help reduce air pollution, support the UK Government in meeting EU air quality thresholds; reduce Greater Manchester's carbon footprint; and encourage a low-emissions culture.

²⁶ [Manchester City Council, Our Manchester Strategy, 2016](#)

²⁷ [Greater Manchester Combined Authority, Our People, Our Place, 2017](#)

²⁸ [Greater Manchester Combined Authority, The Greater Manchester Climate Change and Low Emissions Implementation Plan, 2016](#)

- The Greater Manchester Air Quality Action Plan (2016) sets out measures which will reduce air pollution while supporting the sustainable economic growth of the region.
- The Greater Manchester Spatial Energy Plan (evidence base study) (2016) consolidates the significant data and existing evidence relating to the local energy system to provide a platform for future energy planning in the region and supports the development of suitable policies within the emerging spatial planning framework for Greater Manchester

Greater Manchester Springboard Report (2018)

**Greater Manchester's
Springboard to a Green
City Region**

**A carbon neutral, climate resilient
city-region with a thriving natural
environment and
circular, zero-waste economy**

Following the Greater Manchester Mayor's March 2018 Green Summit, a Springboard report has been prepared which sets out the city region's ambitious plans to make Greater Manchester one of the leading green city regions in the UK and Europe.



3. What does Manchester need to do?

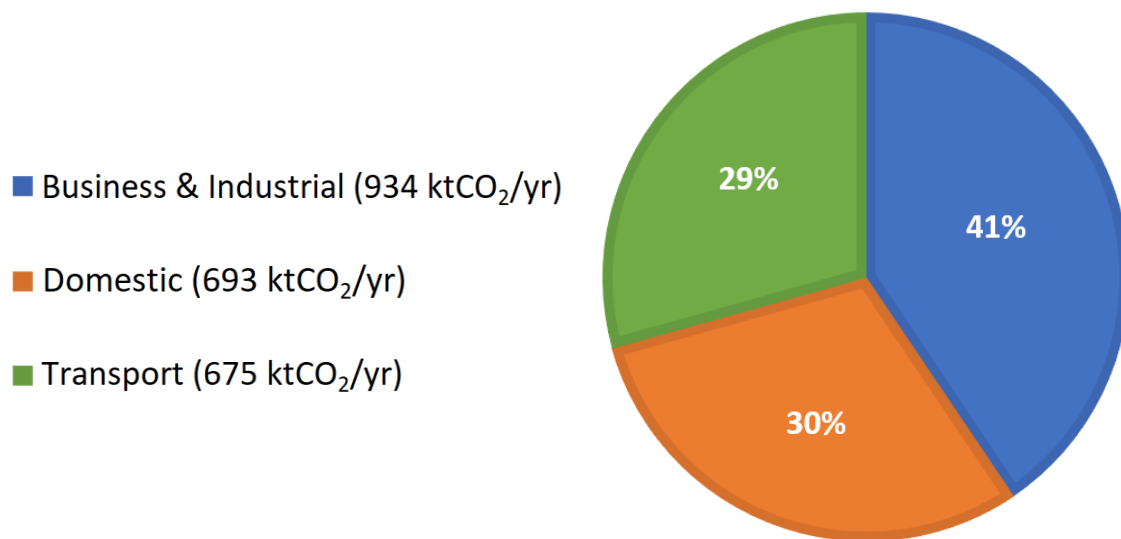


This section outlines the current city emissions profile, how zero carbon has been defined and how emissions have been accounted for in modelling performed to date.

Current citywide emissions

The City of Manchester accounts for approximately 18% of the Greater Manchester emissions. 2017 BEIS data indicates a total of 12,782 ktCO₂e is attributable to Greater Manchester. 2015 BEIS data, published 2 years in arrears in 2017, indicates a total of 2,302ktCO₂e of the Greater Manchester total of 12,782 ktCO₂e is attributable to the city.

The city emissions profile or ‘inventory’ has been broadly categorised as follows. This helps to understand where the material emissions sources are, and where action should be prioritised.



Defining zero carbon

To become a “zero carbon” city by 2038, it is assumed that **all** sectors will need to reduce emissions by **at least** 95% from current levels, with the residual 5% being reduced over the period 2038 to 2100. This is due to the difficulty in making further marginal reductions at these reduced levels. This is consistent with the definition of “Carbon Neutral” provided by the Tyndall Centre^{23&24}. For completeness, “net zero carbon”, commonly refers to the position achieved via carbon offsetting instruments, an approach that has not been assumed within either the carbon budget or intervention modelling. Further information on Carbon Offsets, please refer to page 6 of the Tyndall report for the Greater Manchester Combined Authority under the ‘Offsetting’ section.

Key sector stakeholders within the city are assumed to account for approximately 20% of the city’s Scope 1 and Scope 2 buildings emissions. This is further explored in Section 6 below.

Inventory accounting

Manchester has produced a GPC²⁹ inventory using the SCATTER³⁰ (Setting City Area Targets and Trajectories for Emissions Reduction) tool in order to align itself with a globally recognised and credible reporting standard. Unlike the BEIS data, this categorises the various emissions ‘scopes’.

While the emissions data presented in this report that are aligned with BEIS emission datasets, emission reductions set out can be easily transposed into the GPC inventory via the SCATTER tool, and more credibly tracked by emissions scope over time.

²⁹ [The World Resources Institute, Global Protocol for Community-Scale Greenhouse Gas Emission Inventories, 2014](https://www.wri.org/publications/2014/04/global-protocol-for-community-scale-greenhouse-gas-emission-inventories)
³⁰ <https://www.anthesisgroup.com/scatter-carbon-footprint-reduction-tool>

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary

Greater Manchester is required to submit a GPC inventory to the Global Covenant of Mayors (via CDP) as part of their commitment to this initiative. Ensuring consistency with this approach will enable Manchester to gain further recognition and greater access to knowledge sharing in these wider forums.

The GPC emissions inventory assumes a location-based approach (i.e. a city boundary is defined and emissions that occur within this boundary are the primary focus). It does not assume a

consumption based approach which can take account of the embodied energy of goods imported and consumed within Manchester, considering emissions associated with where they were produced, processed and transported from. These emissions would fall within the 'Scope 3' or 'Other Scope 3' categories. Manchester still has a significant role to reduce these emissions, and is assumed to fall within the scope of the pledge (within the "Playing Our Full Part" main document), however, these emissions are less easily measured and monitored.

Proposed citywide carbon budget

Leading scientific bodies have calculated limits or 'budgets' for the level of carbon dioxide that can be emitted globally, to keep within various ranges of temperature change compared to pre-industrial levels. The Tyndall Centre have transposed a global carbon budget that is "likely" (with 66% -100% confidence) to stay below 2°C temperature change, along with equity commitments as set by the Paris Agreement, into UK level budgets. A methodology has been designed and applied to scale down this 'carbon budget' to the UK city regions using a range of apportionment regimes that are ultimately responsible for defining the date by which carbon neutrality could be achieved. Based on this, the recommended carbon budget for the City of Manchester equates to 15MtCO₂. This report is available in full via the link above.²³

If emissions remained at current levels, there would be less than 7 years of budget remaining.

This type of budgeting approach is also referred to as a Science Based Target and is gaining traction with many corporate organisations at present, through the likes of CDP and the Science Based Target Initiative³¹. At present there are 20 other cities that are part of the Carbon Neutral Cities Alliance (London being the only UK city at present), which demonstrates that others are adopting similar approaches.

Potential citywide carbon reduction pathway / SCATTER

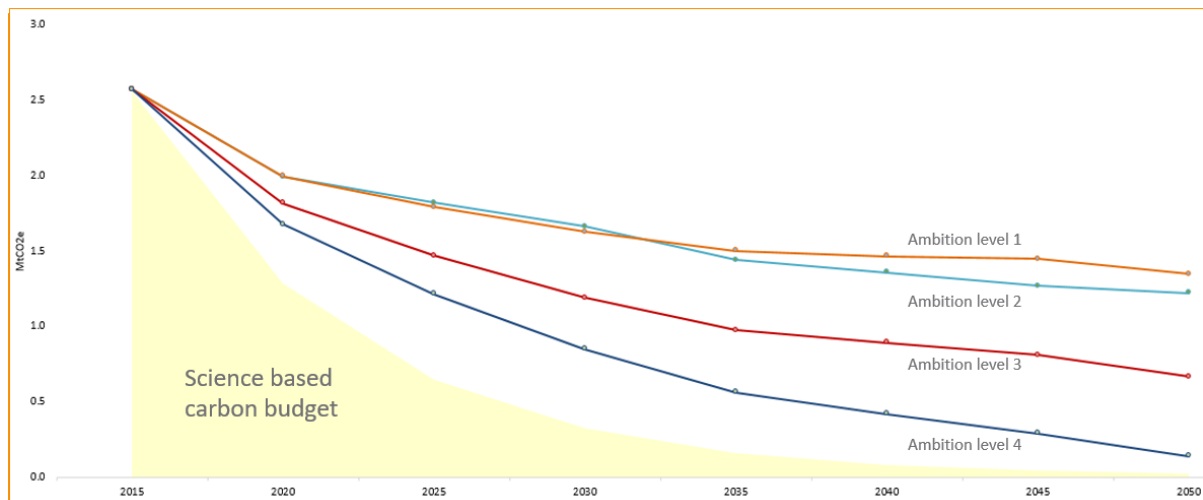
Technology and sector specific intervention modelling has been performed and overlaid against the carbon budget calculated by the Tyndall Centre. This has been processed using the SCATTER tool.

This BEIS-funded tool provides regions with the opportunity to standardise their greenhouse gas target setting aligned with UK and international reporting standards. Through the combination of multiple tools and data sources, SCATTER supports UK cities, regions and boroughs to set emission reduction budgets and define appropriate abatement pathways to achieve them. It was first developed and piloted for the Greater Manchester region and recently showcased at the inaugural 2018 Mayor's Green Summit. It has subsequently been applied to 5 further Core City regions in the UK.

The SCATTER tool is based on an updated and regionally scaled version of the DECC 2050 Carbon Calculator, whereby the user can define various intervention options and levels of ambition (across 4

³¹ <https://sciencebasedtargets.org/>

ambition levels). For Manchester, even when the maximum ambition level was assumed, there is still a gap with the budget. This gap can be seen to represent an opportunity for innovation, however doesn't change the fact that emissions need to be drastically reduced in the first 5 years, to avoid widening the budget deficit in later years.



'Carbon Offsetting' and negative emission technologies are not assumed within the SCATTER model for reasons outlined in the report published by Tyndall for Greater Manchester²³. We do however recognise that a new, innovative type of UK-based offset may still enable emissions reduction that can be attributed to Manchester, while providing economic and/or social benefits for the city. For example, city greening or a renewable energy generation project.

Natural sequestration over the period is assumed to take place by regeneration and intervention within Manchester's land, tree and natural assets (referred to as the Land Use, Land Use Change and Forestry (LULUCF) sector). Emissions from this sector are assumed to also be nil by 2038.

4. What can organisations and sectors do?



This section details, at a high level, the nature of actions that the city and it's stakeholders should consider.

City level actions

Non-city specific emissions reduction actions across generic city sectors were defined within the SCATTER tool. These provide sector stakeholders a feel for the nature and extent of actions, and serves as a reference point for actions they may then decide to make specific to their organisation.

The table below sets out what these actions mean, what SCATTER modelling assumptions were made, and provides some additional relevant Manchester related context.

SCATTER generated actions and modelling assumptions summary

Sector	Actions required	Current Context	Key SCATTER model assumptions (Level 4 scenario)
Energy supply	<ul style="list-style-type: none"> Significant increases in local renewable energy generation 	Only 2% of Greater Manchester's energy demand is provided via renewables sources, primarily landfill and sewerage gas. ³²	<ul style="list-style-type: none"> 100% of Greater Manchester's electricity supply comes from renewable sources by 2050 (with a view to maximise the proportion of renewables in-boundary or owned & controlled by the City) Solar PV on 50% of domestic properties plus over 100 football pitches' on commercial roof space and ground mounted sites 10x more biomass generation capacity 10x more onshore wind generation capacity
Domestic buildings	<ul style="list-style-type: none"> Large scale domestic retrofit and significantly more energy efficient new builds Energy demand reduction for heating lighting and appliances A shift away from natural gas as primary home heating source Smart temperature controls 	Approximately 95% of homes in Greater Manchester are heated via natural gas, over 25% of homes in are social housing stock. ³³	<ul style="list-style-type: none"> 75% reduction in thermal leakiness of 60% of all homes 80-100% of homes using electric (or zero carbon) heat source Average temperate (across the whole home) reducing to 16°C from 18°C via smart thermostats
Commercial buildings	<ul style="list-style-type: none"> Large scale commercial retrofit and more energy efficient new builds Significant energy demand reduction for heating, cooling and hot water, lighting and appliances A shift away from natural gas as primary heating source Smart temperature controls 	The 0-4 and 5-9 employment size bands accounts for 89,000 (89%) of enterprises within Greater Manchester. ³⁴	<ul style="list-style-type: none"> Space heating demand drops by 40% Hot water demand by 30% Cooling demand by 60%
Transport	<ul style="list-style-type: none"> 100% shift to zero emission passenger vehicles Significant reduction in distance travelled per passenger Passenger modal shifts from car to walking & cycling and increased public transport Freight modal shift from road to rail & water 	UK Electric Vehicle (EV) stock <5% of all vehicles. ³⁵	<ul style="list-style-type: none"> 100% zero emissions cars and buses by 2025 Complete railway electrification by 2035 25% reduction in passenger Km by 2035 Significant modal shifts in walking and cycling (+4%), bus and train (+15%) and reducing car travel (-19%)
Natural capital	<ul style="list-style-type: none"> Tree planting and peatland restoration 	City of Trees have planted c.330,000 trees to date. ³⁶	<ul style="list-style-type: none"> 3m trees planted by 2030, 5m by 2050 75% peatland restoration (across various bog and land types)
Waste & Industry	<ul style="list-style-type: none"> Electrification, energy efficiency improvements and Carbon Capture Usage and Storage Reductions in waste volumes and increases in recycling rates 	The UK's first CCUS demonstration plant opened in March 2018. ³⁷	<ul style="list-style-type: none"> Not included in the 'Scenario 4' pathway due to uncertainty of CCUS, however growth factors still applied Waste decreases by 20% and recycling hits 65% by 2035
Storage	<ul style="list-style-type: none"> Significant increases in storage capacities, specific technologies not specified 	Highview liquid air facility in Pilsworth, Bury, opened June 2018. ³⁸	<ul style="list-style-type: none"> 84MW of storage capacity within Manchester (equivalent of a 4kW battery in 10% of homes in Manchester)

³² [Greater Manchester Combined Authority, Spatial Energy Plan, 2017](#)

³³ [UK Government, Live tables on household projections, 2012](#)

³⁴ [ONS, Regional analysis of public and private sector enterprises by Broad Industry Group and employee size band, 2017](#)

³⁵ [PwC, Charging ahead! The need to upscale UK electric vehicle charging infrastructure, 2018](#)

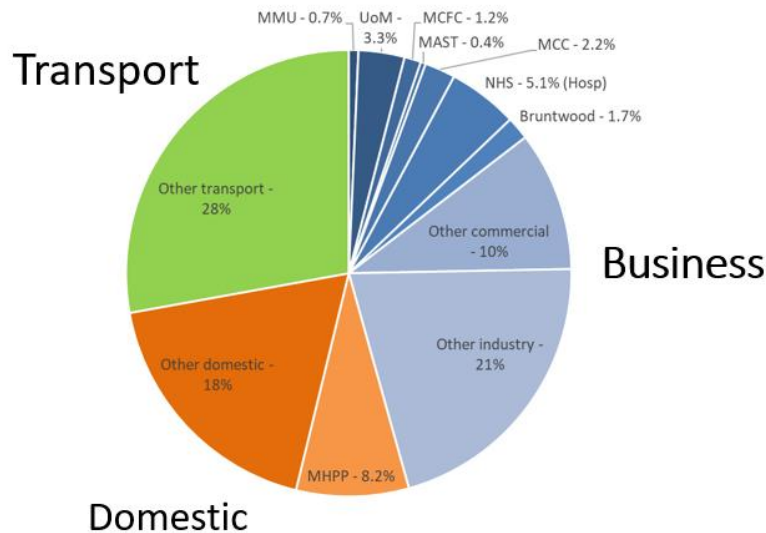
³⁶ [City of Trees, October 2018](#)

³⁷ [Eddie.net, EU-backed carbon capture utilisation plant opens in UK, 1 March 2018](#)

³⁸ [Energy Storage Report, Highview Power's Pilsworth liquid air energy storage project officially opens, 2018](#)

Sector and Stakeholder actions

Key sector stakeholders within the city have been identified in compiling this document. Based on direct ownership and control, these stakeholders account for approximately 20% of the city's footprint (predominantly relating to Scope 1 and 2 buildings emissions, based on publicly available data disclosed by each of the individual organisations).



Note that the above does not include organisation's indirect Scope 3 emissions (e.g. 3rd party supplier transport or employee commuting). While these are an organisation's Scope 3, it is likely to contribute to a significant proportion of the city's Scope 1. These wider emissions impacts have been explored for certain sectors and organisation's below. In a few cases, the organisation's Scope 3 impacts may be more relevant and pervasive to the city, than their more direct, Scopes 1 & 2.

1.1 Offices, landlords and their customers (ref. Bruntwood & Pro-Manchester)

The most relevant opportunity areas
<ul style="list-style-type: none"> • Buildings emissions - heating/cooling/tenant behaviour (Scope 1) • Energy generation - solar PV/thermal/district heat enabling (Scope 2) • Transport - EV infrastructure/tenant behaviour (Scope 3) • Construction materials & tenant waste (Scope 3 upstream & downstream impacts)
Possible actions
<ul style="list-style-type: none"> • Adoption of the 'Advancing Net Zero' commitment (via UK Green Building Council) • Designing and lobbying for a 'Manchester Standard', which, with support from planning policy, could generate higher carbon performance in new builds • A new higher standard equivalent of the Minimum Energy Efficiency Standard (MEES) requirements, imposed on existing landlords • More effective carbon performance measurement and monitoring • More transparent reporting of carbon performance to for tenants and landlords • More knowledge sharing on technology & efficiency gains • More knowledge sharing on what gains are feasible within capex and opex cycles of different owner and/or occupying businesses

Case studies



◀ Barangaroo - Sydney, Australia

Developed by Advancing Net Zero project sponsor Lendlease, Barangaroo is a truly pioneering high-density mixed-use development.³⁹



The Active Office, Swansea, UK ▶

the UK's first net energy-positive commercial building. Demonstrates the 'buildings as power stations' concept. Over an annual cycle the building is designed to generate more energy than it consumes.⁴⁰



1.2 Housing (ref. Strategic Housing Board & MHPP)

The most relevant opportunity areas

- Buildings emissions - heating/cooling/tenant behaviour (Scope 1)
- Energy generation - solar PV/thermal/district heat enabling (Scope 2)
- Transport - EV infrastructure/tenant behaviour (Scope 1)
- Construction materials & tenant waste - upstream & downstream impact (Scope 3)

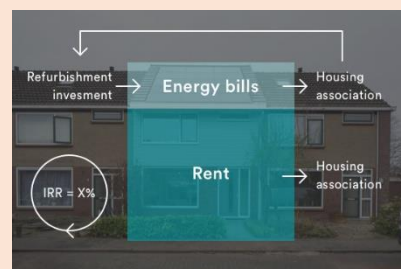
Possible actions

- Ensuring board-level zero carbon 'champions' are appointed
- Adopt a 2038 Carbon Neutral target
- Appoint a shared resource to disperse knowledge and implement measures
- Influence a more stringent planning policy
- Influence others in the wider sector through lobbying Greater Manchester and Manchester City Council and the Social Housing Regulator to adopt zero carbon standards for new build and retrofit

Case studies

Energiesprong⁴¹, Netherlands/ Nottingham ▶

Originating in the Netherlands, Energiesprong is an innovative financing model for whole-house social housing retrofit to zero energy standards, providing desirable, comfortable and affordable homes.



³⁹ [World Green Building Council -Advancing Net Zero Case Studies](#)

⁴⁰ [Specification Online](#)

⁴¹ <http://energiesprong.eu/>



◀ Ecospheric³ & RED Co-op⁴², Manchester

Two Retrofit experts based in Manchester with industry leading insight and approaches they are hoping to roll out at scale.



1.3 Developers (ref. MCC-Property sector joint-working)

The most relevant opportunity areas

- Buildings emissions - heating/cooling/tenant behaviour (Scope 1)
- Energy generation - solar PV/thermal/district heat enabling (Scope 2)

Possible actions

- TBD once sector working group has convened on this topic
- Adopt 2038 commitment
- Lobby for the enhancement of planning policy
- Pilot retrofit technologies & financing methods

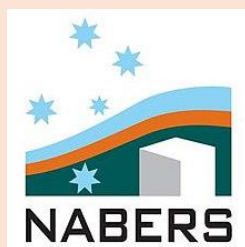
Case studies

Australia: Public Sector minimum energy efficiency standards⁴³

The Australian Government's energy efficiency measures are designed to make it easier for building owners and tenants to make informed choices about their energy use and invest in better buildings and equipment.



Australian Government
Department of the Environment and Energy



The National Australian Built Environment Rating System (NABERS)

Energy ratings for commercial buildings. The National Australian Built Environment Rating System (NABERS) rates buildings from zero to six stars, with six stars representing exceptional greenhouse performance and resource efficiency.

⁴² <http://red.coop/>

⁴³ <https://www.energy.gov.au/government-priorities/energy-productivity-and-energy-efficiency/commercial-buildings>

1.4 Universities (ref. Corridor)

The most relevant opportunity areas	
<ul style="list-style-type: none"> • Buildings emissions - estates management/ heating/ cooling/ appliances (Scope 1) • Energy generation & consumption - district heating enablers & renewables capacity on buildings (Scope 2) • Student behaviours - transport (how students commute to/from campus and accommodation) and student living (students energy consumption at home) (Scope 3) • Procurement (Scope 3) 	
Possible actions	
<ul style="list-style-type: none"> • TBD once sector working group has convened on this topic • Adopt 2038 commitment • Ensure strategy is in place • Engage with other partners on the Oxford Road Corridor to enable policy and/or financing opportunities • Raise awareness and make it easy for students to make more sustainable choices 	
Case studies	
<p>People and Planet 68 UK Universities have pledged to divest from fossil fuels. Local green investment may provide an alternative investment.⁴⁴</p>	

1.5 Health (ref. Manchester health structures)

The most relevant opportunity areas	
<ul style="list-style-type: none"> • Buildings emissions - estates management/ heating/ cooling/ appliances (Scope 1) • Energy generation & consumption - district heating enablers & renewables capacity on buildings (Scope 2) • Patient & staff transport (Scope 1) • Procurement – May represent approximately 60% of NHS emissions, pharmaceutical production alone accounts for 22%⁴⁵ (Scope 3) 	
Possible actions	
<ul style="list-style-type: none"> • TBD once sector working group has convened on this topic • Adopt 2038 commitment 	
Case studies	

⁴⁴ <https://peopleandplanet.org/fossil-free>

⁴⁵ https://www.sduhealth.org.uk/documents/resources/Carbon_Footprint_emissions_modelling_2009.pdf

New build hospitals Southmead, Bristol
Innovative lighting & ventilation design.



Existing hospital retrofit

Towards zero carbon Hospitals with Renewable Energy Systems (RES-Hospitals)⁴⁶ have various case studies/guidance documents. 50 pilot hospitals part of the initiative at present.⁴⁷

Klinikum Frankfurt Höchst, Germany
The 'world's first certified PassivHaus (Passive House) hospital'⁴⁸



1.6 Arts and culture (ref. Cultural Leaders P/ship & Mcr Arts Sustainability Team)

The most relevant opportunity areas

- Transport and other indirect emissions from attendees/ consumers/ participants (Scope 3)
- Buildings – Emissions from buildings directly used for events and productions (Scope 1/2)
- Procurement and emissions associated with procured goods for events and productions (Scope 3)

Possible actions

- Influencing attendees/consumers/participants of Arts & Culture in the city by raising awareness of the climate crisis
- Influencing and inspiring attendees/consumers/participants of Arts & Culture in the city to make meaningful changes (e.g. reduce transport emissions by changing mode of transport, saving energy at home or by low carbon consumption & purchases)
- Reducing the emissions of their own buildings, fleet and directly control purchases
- Ensuring procurement is as low carbon and sustainable as possible

Case studies

New York, USA ►
Climate change signage in the style of road work signage.⁴⁹



⁴⁶ <https://ec.europa.eu/energy/intelligent/projects/en/projects/res-hospitals>

⁴⁷ <http://www.hfs.scot.nhs.uk/downloads/1385380261-6D+JTaylor.pdf>

⁴⁸ <https://www.ft.com/content/e1758046-9599-11e8-95f8-8640db9060a7>

⁴⁹ <https://www.theguardian.com/artanddesign/2018/sep/04/climate-signals-climate-change-installation-new-york>

Datong, China ▼

Panda designed solar array.⁵⁰



▲ Home Theatre, First Street, Manchester
Low carbon building, policies and activities.⁵¹

1.7 Faith communities (ref. Greater Manchester Faith Leaders & Our Faith Our Planet)

The most relevant opportunity areas

- Members & attendee transport emissions and behaviours (Scope 3)
- Buildings (Scope 1 & 2)

Possible actions

- TBD once sector working group has convened on this topic
- Adopt 2038 commitment
- Educate participants/faith members
- Investment in energy efficiency measures & renewables

Case studies

St Michael's and All Angels Church, Gloucestershire, UK

The UK's first zero carbon church retrofit incorporating solar PV and biomass.⁵²



GreenFaith.org

Work with houses of worship, religious schools and people of all faiths to help them become better environmental stewards.⁵³


⁵⁰ <http://uk.businessinsider.com/china-panda-shaped-solar-energy-farms-project-2018-6>

⁵¹ <https://homemcr.org/about/policies/sustainability/>

⁵² <https://makewealthistory.org/2017/09/29/building-of-the-week-britains-first-zero-carbon-historic-church/>

⁵³ <http://www.greenfaith.org/>

1.8 Sports and leisure organisations (ref. MCFC)

The most relevant opportunity areas	
	<ul style="list-style-type: none">• Transport and other indirect emissions from attendees/ staff (Scope 3)• Facilities – Emissions from buildings directly used for events and activities (Scope 1 & Scope 2)• Procurement and emissions associated with procured goods for events and productions (Scope 3)
Possible actions	
	<ul style="list-style-type: none">• TBD once sector working group has convened on this topic• Adopt 2038 commitment• Influencing attendees/consumers/participants of sports and leisure organisations in the city by raising awareness of the climate crisis• Influencing and inspiring attendees/consumers/participants of sports and leisure organisations in the city to make meaningful changes (e.g. reduce transport emissions by changing mode of transport, saving energy at home or by low carbon consumption & purchases)• Reducing the emissions of their own buildings, fleet and directly control purchases• Ensuring procurement is as low carbon and sustainable as possible
Case studies	
<p>Forest Green Rovers, UK⁵⁴ 100% Powered by renewable energy, meat free menu for football fans.</p>	

1.9 Schools and colleges

The most relevant opportunity areas	
	<ul style="list-style-type: none">• Buildings emissions - heating/cooling/tenant behaviour (Scope 1)• Energy generation - solar PV/thermal/district heat enabling (Scope 2)• Transport – Student commuting (Scope 3)• Student behaviours – Linked to education & awareness on the climate crisis (Scope 3)
Possible actions	
	<ul style="list-style-type: none">• TBD once sector working group has convened on this topic• Adopt 2038 commitment

⁵⁴ <http://www.sustainabilityinsport.com/case-studies/forest-green-rovers>

Case studies

Droylsden Academy, Manchester

Powered by bioliquid generation on site.



Eco Schools Programme

Global charity raising awareness & driving more sustainable behaviours.⁵⁵

Stoneywood School, Aberdeen

The energy-efficient site contains 16 classrooms within the single-storey building, and features solar UV panels and low energy central heating.⁵⁶



1.10 Retail (ref. CityCo)

The most relevant opportunity areas

- Buildings emissions - heating/cooling/tenant behaviour (Scope 1)
- Energy generation - solar PV/thermal/district heat enabling (Scope 2)
- Upstream & downstream supply chains (Scope 3)

Possible actions

- TBD once sector working group has convened on this topic
- Adopt 2038 commitment

Case studies

Science Based Targets Initiative (SBTi)

The Science Based Targets initiative champions science-based target setting as a powerful way of boosting companies' competitive advantage in the transition to the low-carbon economy.⁵⁷



The SBTi's aim is that by 2020, science-based target setting will become standard business practice and corporations will play a major role in driving down global greenhouse gas emissions. Embedding science-based targets as a fundamental component of sustainability management practices is crucial in achieving this.

RE100

RE100 is a collaborative, global initiative uniting more than 100 influential businesses committed to 100% renewable electricity, working to massively increase demand for - and delivery of - renewable energy.⁵⁸




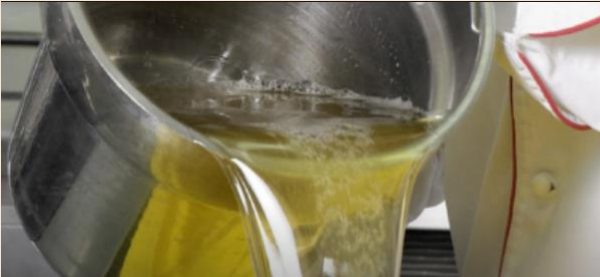
⁵⁵ <https://www.eco-schools.org.uk/>

⁵⁶ <https://www.scottishconstructionnow.com/29236/morgan-sindall-completes-13m-school-in-aberdeen/>

⁵⁷ <https://sciencebasedtargets.org/>

⁵⁸ <http://there100.org/>

1.11 Restaurants (ref. CityCo)

The most relevant opportunity areas	
<ul style="list-style-type: none"> • Buildings emissions - heating/appliance/cooking energy demand (Scope 1) • Energy generation - solar PV/thermal/district heat enabling (Scope 2) • Upstream & downstream supply chains (Scope 3) 	
Possible actions	
<ul style="list-style-type: none"> • TBD once sector working group has convened on this topic • Adopt 2038 commitment 	
Case studies	
<p>The Sustainable Restaurants Association⁵⁹</p> <p>The Sustainable Restaurants Association (SRA) is a community of foodservice businesses, suppliers and discerning diners working together to create a sustainable foodservice industry for people and planet.</p>	
	<p>Used cooking oil collections</p> <p>The used cooking oil (UCO) used in the food industry (restaurants, canteens, fast-foods etc.) is collected, cleaned and finally transformed into renewable and environmentally-friendly fuel.</p> <p>Note also that West Oxfordshire District Council are one of only a few local authorities in the country that accepts used cooking oil as part of their household recycling collection.⁶⁰</p>

1.12 Hotels (ref. Manchester Hoteliers Association)

The most relevant opportunity areas	
<ul style="list-style-type: none"> • Buildings emissions - heating/appliance/cooking energy demand (Scope 1) • Energy generation - solar PV/thermal/district heat enabling (Scope 2) • Upstream & downstream supply chains (Scope 3) • Guest behaviours (Scope 3) 	
Possible actions	
<ul style="list-style-type: none"> • TBD once sector working group has convened on this topic • Adopt 2038 commitment 	

⁵⁹ <https://thesra.org/>

⁶⁰ <https://www.westoxon.gov.uk/news/aug/waste-oil-recycling/>

Case studies

Green Hotelier⁶¹

A source of green hotel news, sustainable solutions for hotels, best practice eco hotel case studies and commentary on global environmental & responsible tourism practice.



1.13 SMEs (ref. FSB & Green Growth Programme)

The most relevant opportunity areas

- Various

Possible actions

- TBD once sector working group has convened on this topic
- Adopt 2038 commitment

Case studies

Business Growth Hub⁶²

Business Growth Hub supports businesses at all stages of their growth journey with our broad range of services. Resource efficiency and green technologies and services teams help businesses reduce operating costs and thrive in the green technologies and services sector.



Utilitri Ltd

- Renewables sector
- Low carbon sector support
- Improved marketing/sales strategy
- Three jobs created

1.14 Media & digital

The most relevant opportunity areas

- Influencing behaviours of others

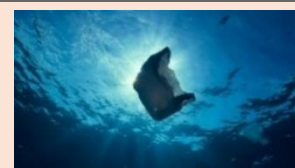
Possible actions

- TBD once sector working group has convened on this topic
- Adopt 2038 commitment

Case studies

BBC Blue Planet 2 (Plastics)⁶³

Inspiring individuals and businesses to take action on an unprecedented scale.

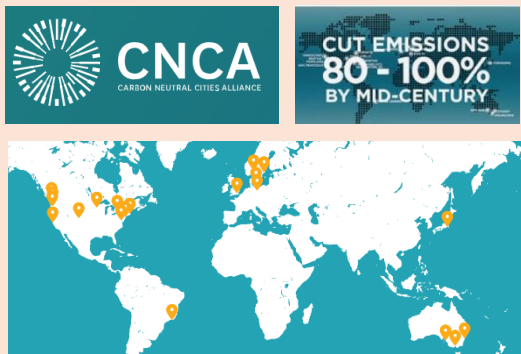


⁶¹ <http://www.greenhotelier.org/>

⁶² <https://www.green-growth.org.uk/article/greater-manchester-unveils-new-green-city-vision?platform=hootsuite>

⁶³ <https://www.youtube.com/watch?v=I4QNolP7Khc>

1.15 Manchester City Council

The most relevant opportunity areas	
<ul style="list-style-type: none">• Through policy & leadership, commercial & domestic buildings, transport and industry (Scope 3)• Council owned/controls buildings (Scope 1 & 2)• Council fleet (Scope 1)	
Possible actions	
<ul style="list-style-type: none">• TBD once council has convened on this topic• Adopt 2038 commitment• Policy intervention• Retrofit & upgrade of building stock & fleet	
Case studies	
<p>Carbon Neutral Cities Alliance⁶⁴ The Carbon Neutral Cities Alliance (CNCA) is a collaboration of leading global cities working to cut greenhouse gas emissions by 80-100% by 2050 or sooner — the most aggressive GHG reduction targets undertaken anywhere by any city.</p>	 <p>The image contains two logos at the top and a world map below. The left logo is the CNCA logo, featuring a stylized sunburst icon and the text 'CNCA CARBON NEUTRAL CITIES ALLIANCE'. The right logo is a graphic with the text 'CUT EMISSIONS 80 - 100% BY MID-CENTURY' over a world map background. Below these is a larger world map with several orange location pins indicating member cities across North America, Europe, and Asia.</p>

⁶⁴ <https://carbonneutralcities.org/>

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