

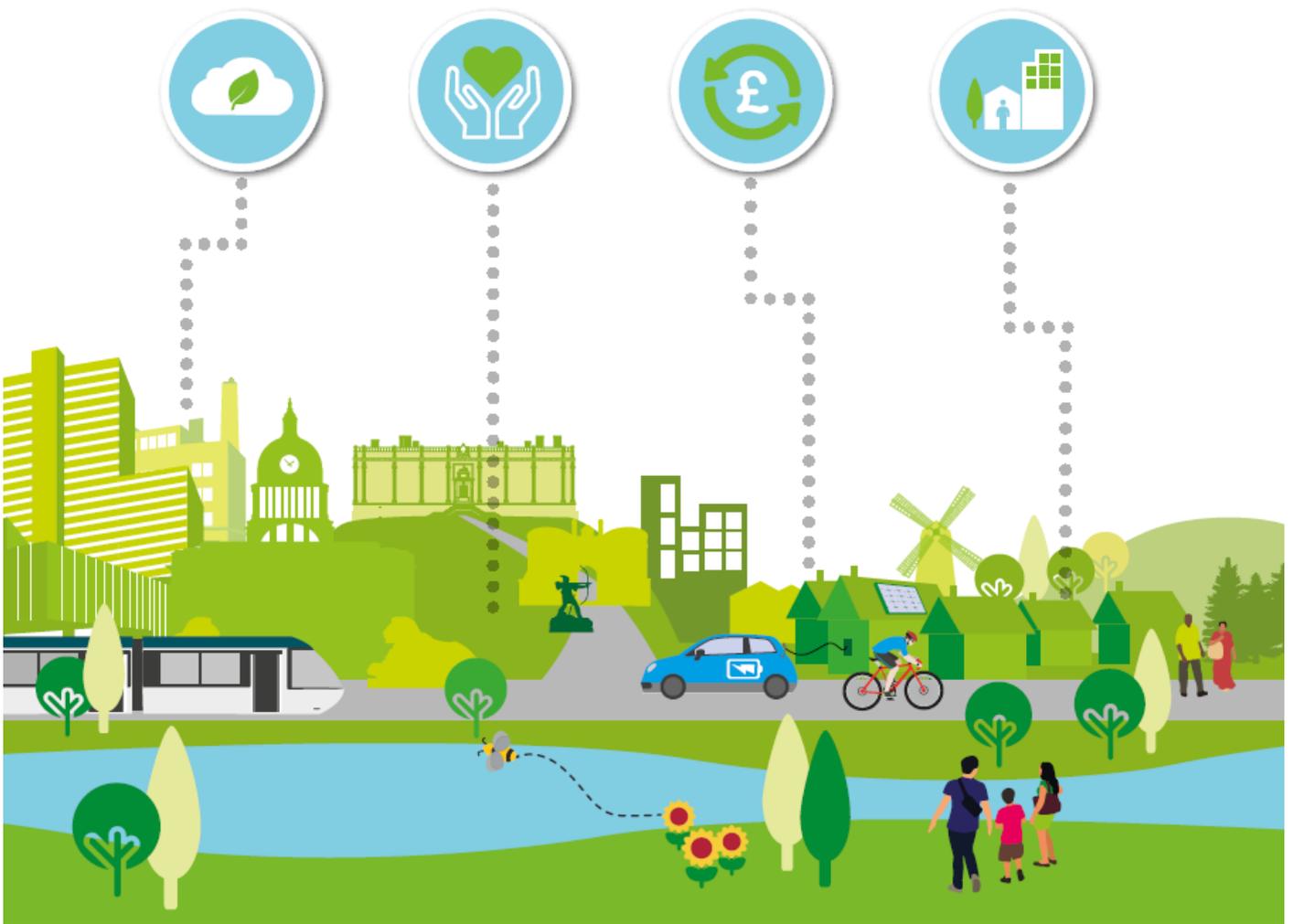
Nottingham

2028



Carbon Neutral Charter

A SUSTAINABLE APPROACH FOR A CARBON NEUTRAL NOTTINGHAM



brownejacobson^{L.P.}



Foreword

Nottingham City Council has responded to the climate and environmental crisis by setting an ambition to become the first carbon neutral city in the UK by 2028. In keeping with Nottingham's proud tradition of climate leadership, this Charter sets out a vision for sustainable carbon neutrality on behalf of the Council and the city's Green Partnership. At the heart of this shared vision is an approach that not only positively addresses wider environmental challenges, but improves quality of life and builds a new form of clean growth for our economy through a green industrial revolution.

The science is clear; we need to act urgently to reduce our carbon emissions to limit global temperature rise to below 1.5°C, and so prevent devastating impacts around the world and closer to home. It also shows we need to prepare for a changing climate. Climate Change is a long-lasting and universal problem that will affect everyone, particularly our most vulnerable citizens. It is also one that significantly impacts the young of today and for generations to come. We are the stewards for the world they will inherit, and it is an essential role of local authorities to protect the security and welfare of those citizens who depend upon us. We are continuing our work to create a prosperous, fair and resilient city for this and future generations.

We have been at the forefront of what local authorities can achieve. The Nottingham Climate Change Declarations and our current strategies for energy and climate change have driven forward our progress and inspired others to do so. The actions we have taken have made a real difference to people's homes, businesses, transport and to the way the Council operates. We've met our 2020 energy strategy emissions target early of reducing CO₂ emissions by 26% from 2005 levels. The most recent figures from 2017 show a reduction of 41% for the city and 49% per person.

We believe the approach we are taking will bring multiple benefits to the citizens, businesses and organisations of Nottingham. This Charter sets out the principles, priorities and definitions of this approach, building on our previous successes and state-of-the-art knowledge. This is one of the most important and complex challenges any society has faced, which is why the Council has taken it to the core of how it operates, and why it is so pleased to be working with Green Partnership members to provide a genuine city-wide response that can engage and support everyone in the city to take action. We all have a role to play in this, but we all have something to gain by finding more sustainable ways to live and work. Together with city partners, we will be creating new Climate Change and Energy plans for the next decade, to help set in motion this ambitious work and turn words into actions.

Whilst we rightly celebrate the success that Nottingham has had, we know this is only the beginning. Together this Council, our partners and citizens of this city can take forward the ambitions of a locally responsible global city. There is a way forward on this vital issue, and we believe that this Charter is something Nottingham can be proud of in ensuring we are on the right track.



Councillor Sally Longford, Deputy Leader of the Council and Portfolio Holder Energy, Environment and Democratic Services

“As Chair of the Nottingham Green Partnership I strongly support the city’s ambitions and so fully endorse this Charter and its unique vision for sustainable carbon neutrality. I am really pleased that Nottingham is continuing its strong record of work on Climate Change and will continue to be a leading city for sustainability. By bringing this vision to life as a partnership, we can help safeguard Nottingham’s environment, economy and quality of life. This is an issue that is of the utmost



importance, touching upon every part of our lives, and with a role for everyone. Through our partnership members, working together with citizens, organisations and businesses, I hope that the Green Partnership can ensure that this is very much a city-wide agenda and inspire action in our communities. The Charter puts forward a comprehensive set of principles through which the Green Partnership members can come together to make a difference in a way that is credible, ambitious and coordinated. I am looking forward to building upon this important milestone in Nottingham’s journey to being carbon neutral and positively addressing the environmental crisis we find ourselves in.”

Richard Barlow, Chair Nottingham Green Partnership

This Charter was written by Nottingham City Council on behalf of Nottingham’s Green Partnership, with the support of its members and a range of stakeholders across the city.

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Glossary of terms¹

1.5°C Temperature rise	This refers to the rise in the average global temperature above the pre-industrial period (pre-1750)
Adaptation	Actions to reduce vulnerability to climate change impacts, reducing its effects on social, economic and natural systems
Biodiversity	The variety of animal and plant life on Earth
Business as usual	Future emissions trend if the current state of affairs continue as they are today
Carbon budget	The maximum amount of carbon dioxide that can be emitted to be in line with keeping temperatures well below 2°C and pursue a 1.5°C limit to rising temperatures
Carbon dioxide (CO₂)	A key greenhouse gas with a long-lifetime in the atmosphere and both natural and human sources.
Carbon neutral	Having no net release of carbon dioxide into the atmosphere
Climate change	The long term change of climate, typically measured over decades or longer. This is different to weather, which is now.
Climate emergency	Climate change presents the greatest threat to life: on the economy, social well-being and the natural environment
CO₂e	Carbon dioxide equivalence; this includes all greenhouse gasses converted into the equivalent amount of carbon dioxide.
Ecosystem	Community of living organisms and the natural environment
Global warming	Increase in temperature of the Earth's atmosphere over long timescales, caused by increased levels of greenhouse gasses
Greenhouse gas (GHG)	The Earth can maintain a regular average temperature (about 15°C) despite heat leaving the planet's surface because a layer of gases in the atmosphere absorb and release heat – a process known as the greenhouse effect. Greenhouse gases are those that have this effect, each with differing lifetimes and abilities to capture heat (infrared radiation).
MtCO₂	Millions of tonnes of carbon dioxide
Planetary boundaries	The environmental limits of what the planet can sustain as result of human actions and other processes
Resilience	The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions
Sustainability	Meeting the needs of current generations, without compromising future generations or the natural environment

¹ https://archive.ipcc.ch/pdf/special-reports/srex/SREX-Annex_Glossary.pdf

Introduction

Climate change is a cause for concern across the world, following unprecedented increases in greenhouse gas concentrations, rising global temperatures and increasingly severe weather events. The year 2016 was the warmest year globally since records began in the mid-1800s, with the last four-year period the warmest on record². This has led to widespread protests and over 318 local councils declaring a state of Climate Emergency³, following growing international and local concern for the future of society and the natural world around us. In the UK this has been met with world leading emission reduction targets both locally and nationally, such as the City of Nottingham's ambition to be carbon neutral by 2028.

Preparations must be made for changes in our climate and its indirect effects; protecting our communities by becoming more adaptable, sustainable and resilient. This will involve actions at the personal, household, community and city level, for all people, organisations and services. Nottingham has decided to place its carbon neutral target firmly in the wider view of sustainability – you cannot achieve one without the other and it presents an opportunity for positive change. The City must act now, and prepare for a better, sustainable future. Our aim is to ensure Nottingham's Citizens will have a high quality of life and well-being which can be sustained for current and future generations.

Sustainability, economic growth, elevating poverty and tackling climate change are all complementary and interlinked. Nottingham must find new ways of doing things that can consider all these elements, as business-as-usual is no longer an option. This offers an opportunity to tackle key issues facing the city while simultaneously reducing the problems of inequality and maximising a range of benefits that improve people's quality of life. This would make Nottingham a fairer city and society for all. Actions to remedy the challenges faced must not unfairly disadvantage people; particularly those who are less able to pay or make changes themselves in order to maintain a good standard of wellbeing.

This document sets out a vision and outlines plans for tackling the complex task of making a sustainable and carbon neutral city together. The role of the council is to offer leadership, partnership, communication, planning/policy, signposting and provide skills that are all necessary to deliver the scale of action required. A clear and positive vision is important to encourage action and build enthusiasm for change; particularly when faced with challenges such as climate change. The city's Green Partnership⁴ has set out their vision for a future sustainable Nottingham:

This carbon neutral city is growing within the limits of what society, nature and the economy can sustain. All citizens will have access to clean air and water; fresh, affordable and nutritious food, and; quality blue and green spaces. Getting around the city is sociable and enjoyable; improving mental and physical health and connecting people with nature and each other. Through being more efficient and better managing its resources, the city is increasingly self-sufficient, making it more resilient and productive. Goods are created, re-used, repaired and recycled locally, boosting local enterprise. Citizens, research and enterprise are all involved in governing the city and looking to continually improve how it operates. It is a truly global city, leading on sustainability and recognised for its wellbeing and inclusiveness.

² <https://blog.metoffice.gov.uk>

³ <https://climateemergencydeclaration.org/climate-emergency-declarations-cover-15-million-citizens/>

⁴ http://www.onenottingham.org.uk/?page_id=4952

Nottingham's Climate Impacts and the Need for Action

The local effects of a changing climate are seen already. Individual extreme weather events have affected, and will continue to affect the city independently of climate change, but climate change will increase their likelihood. Nottingham has to prepare for what may come and to be resilient to it. It is expected that there will be an increased severity and frequency of extreme weather events in years to come, fuelled by climate change from the emissions already released to the atmosphere.

Urban areas, such as Nottingham, experience particular climate impacts and are more prone to events, such as heatwaves because of the 'urban heat island' effect. This is where heat is absorbed in surfaces like concrete during the day and slowly released at night⁵, leading to cities experiencing higher temperatures which can affect citizen wellbeing⁶, and increase water stress. In the future, there will be an increase in average daily temperatures, with warmer drier summers and warmer wetter winters. There will also likely be an increase in heatwaves, flood events, water shortages, food shortages, and a decrease in urban biodiversity.

Locally and regionally, flood events are the most frequent severe weather event. Nottingham has experienced a number of flood events in its history, with the River Trent and its tributaries being the key sources historically. There is also surface-water and groundwater flooding. Surface water arises when there is too much rainfall for systems to cope adequately, often because of large areas of concrete or hard material surfaces that do not let water through. It is important that the city can become more resilient to these events, adapt to a changing climate, and effectively manage how water moves around and is supplied in the city.

Regional records also indicate an increase in the frequency of heatwaves over the last decade. This summer saw record July temperatures across the UK approaching 40°C, with a new record in Nottingham of 36°C on Thursday 25th July⁷ (2019). Most recently a new record was set for the August Bank Holiday⁸. Overall, severe weather events have caused significant impacts, such as wide scale property and environmental damage, power cuts, impacts to human health, travel delays, lost working time, road closures and commercial losses.

The impacts of climate change are often felt most acutely by more vulnerable people in society. The role of the Council and its partners is critical in helping protecting the most vulnerable members of society from the worst impacts of climate change, and in designing measures to reduce carbon that don't worsen existing inequalities. This relationship with income and other characteristics creates a climate justice issue, particularly as those on lower incomes have historically emitted fewer carbon emissions.

For the Council, along with other parts of the public sector, severe weather events and a changing climate effect the delivery of services, wellbeing and safety of staff, costs and protection of key buildings and infrastructure and a range of other impacts, as well as creating new forms of demand upon council resources.

⁵ <https://www.nationalgeographic.org/encyclopedia/urban-heat-island/>

⁶ <https://rmets.onlinelibrary.wiley.com/doi/full/10.1002/asl.896>

⁷ <https://www.nottinghampost.com/news/local-news/updated-figures-show-record-high-3137707>

⁸ <https://www.theguardian.com/uk-news/2019/aug/26/uk-weather-temperature-record-set-late-august-bank-holiday-monday>

Nottingham's Approach to Sustainable Carbon Neutrality

Living within our Limits

Nottingham's approach is to put climate action at the heart of a wider sustainability vision that delivers for people and planet. Delivering carbon neutrality through a narrow carbon only perspective would create the risk of interventions and policies that at best missed out on opportunities to deliver other city objectives, and at worst, had negative impacts upon certain groups of people, the economy and the wider environment. Climate change is linked to many other sustainability issues connected to food, water, land-use, energy for homes and transport, consumption and production.

Collective action should allow society to develop sustainably through meeting the needs of people, delivering internationally agreed Sustainable Development Goals and remaining within what the planet can provide to us. This includes safeguarding the Earth's life-supporting systems on which we depend. Many of these systems are already stressed, reaching limits known as planetary boundaries. Climate change is one of these, and the most pressing concern of the 21st Century. Pushing these boundaries beyond their natural limit puts pressure on the safe space for humanity to thrive.

There is a need to balance our environmental sustainability with providing what people need for a good quality of life, in an affordable and just manner. Linking the two is the requirement for societies to be 'better prepared for the consequences of environmental breakdown'⁹. This means creating a more resilient Nottingham that prevents the worst of the impacts that are likely to come, directly and indirectly, from issues like climate change, as well as being adaptable to continue to thrive in new conditions. This balancing act, to create a safe space for society to operate, has been represented by the 'Doughnut' model of environmental economics described by the economist Kate Raworth (Figure.1). This is why Nottingham has chosen to measure its progress with the UN's Sustainable Development Goals - described in more detail later in the document.

Sustainable development is the logical, as well as responsible approach, for any city to provide a good quality of life and opportunity for its citizens and organisations for current and future generations. The aim is to create an approach where the future of Nottingham places equal importance across people, the environment and the economy, while at the same time supporting Nottingham's ambition to be carbon neutral by 2028.

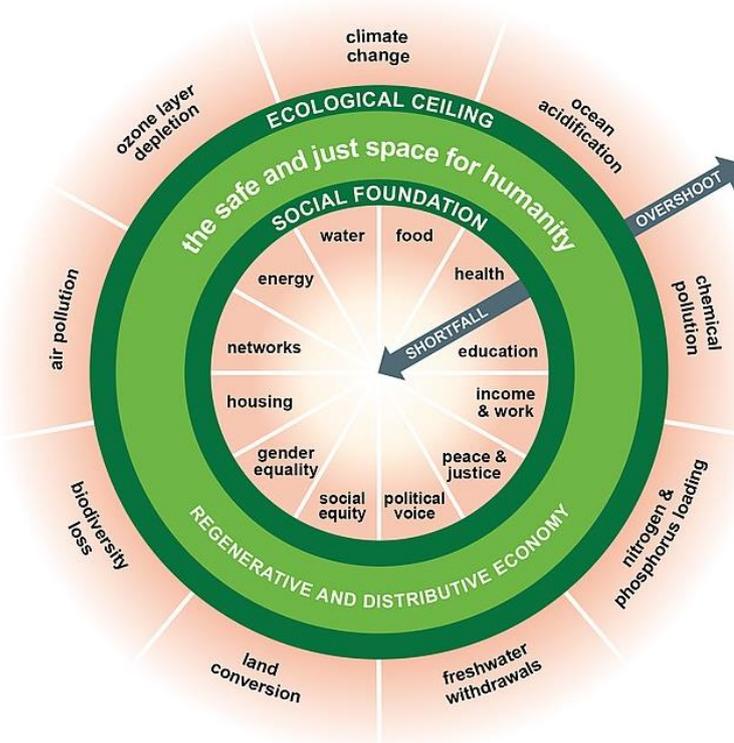


Figure 1. Doughnut economics model <https://www.kateraworth.com/doughnut/>

⁹ <https://www.ippr.org/research/publications/rethinking-economics-for-the-age-of-environmental-breakdown>

Strategic Plan

The process shown below enacts the strategic approach and the development and refinement of the Energy and Climate Change strategies. A continuous cycle will involve many different stakeholders in the development and delivery of the plans. The carbon budget helps put the city's performance into context along with the inventory of the emissions.

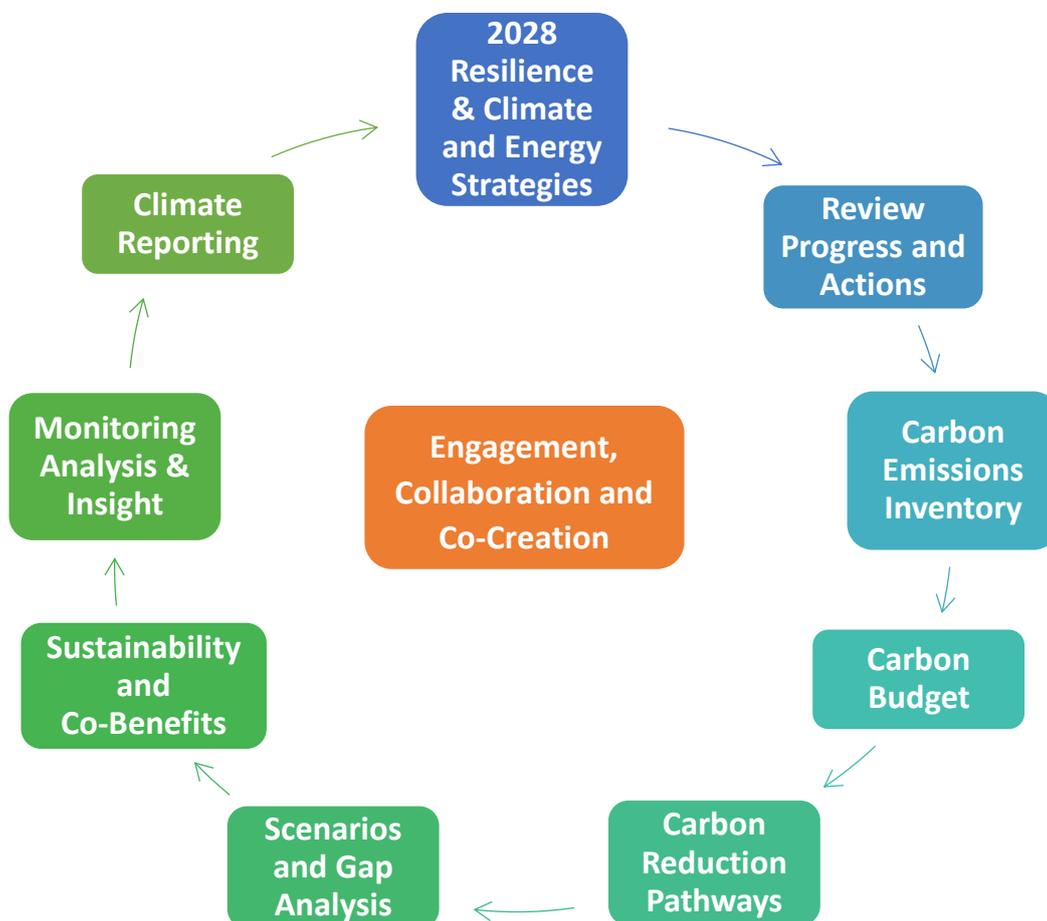


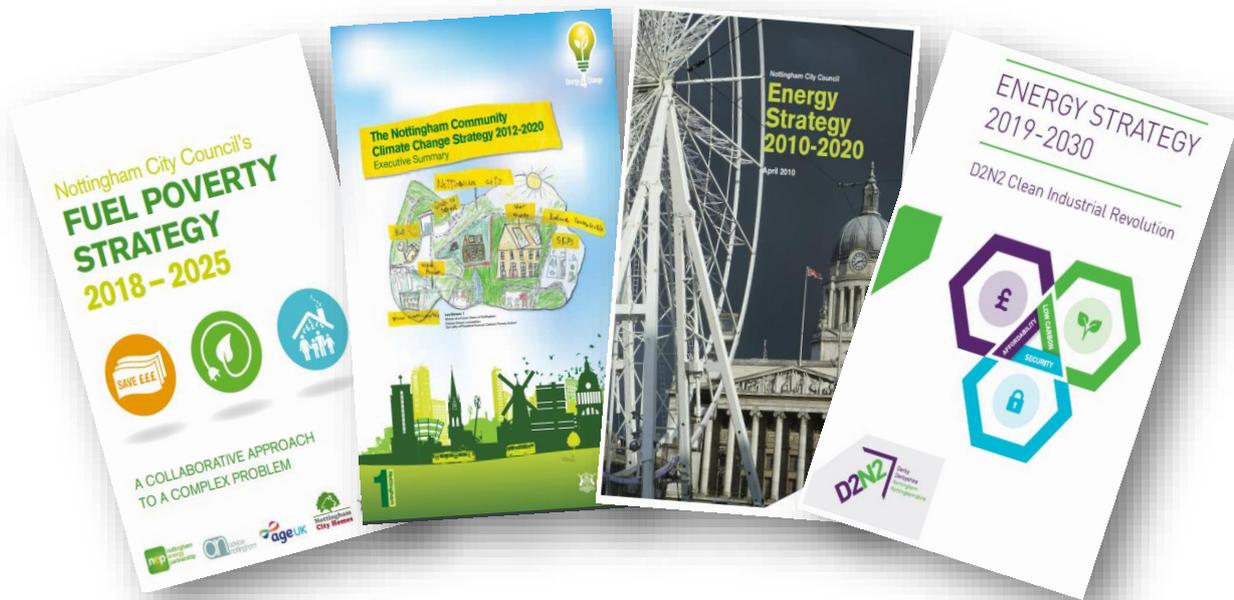
Figure 2. Nottingham's approach to developing new strategies for sustainable carbon reduction

The next step is the refinement of the pathways to carbon reduction, understanding where and how emissions need reducing. This allows the creation of scenarios of different types of intervention and an analysis of where there are gaps. From here the interventions identified in the scenarios will be considered using a co-benefits approach to bring more value to the city and to ensure the sustainability agenda is delivered. Finally, the interventions and delivery are monitored and analysed. The resulting insight is given and shared, helping refine the plans before the cycle repeats. The city will be disclosing its reporting through international frameworks to be transparent and benefit from the additional insight that this can bring. Engagement, collaboration and co-creation sits at the heart of this process, playing a vital role throughout. The city faces a unique challenge, one that requires a unique response.

Making Nottingham the UK's First Carbon Neutral City

Nottingham City Council has taken the ambitious aim of becoming the first UK carbon neutral City, setting itself the target to achieve this by 2028. The Council has been a leader amongst local authorities for action on climate change, in sustainability and innovation in energy work.

Progress and Past Actions



For the last 19 years, since the Nottingham Climate Change Declaration¹⁰ onwards, the city has showed a proactive approach and commitment to climate change, alongside the development of key strategies for Climate Change, Energy, Transport and Fuel Poverty. These have been key drivers of Nottingham's success in reducing emissions, acting on climate change and enhancing the city's resilience.

Nottingham has already made significant progress towards cutting its carbon emissions (Figure.3) by surpassing its 2020 target of reducing CO₂ emissions by 26% by 2020¹¹ (compared to 2005). In 2017, Nottingham had managed to reduce total CO₂ emissions by 41% (49% reduction in per person emissions) from 2005. This was achieved, through considerable emission reduction actions across industrial/commercial, transport and domestic sectors.

Nottingham's recent figures for carbon dioxide are shown in Figure 3. They show that the city's emissions have been falling steadily, with most of the reduction taking place in industry and commerce (down 56%), followed by the domestic sector (down 38%) since 2005. The total CO₂ emissions for Nottingham in 2017 from government figures¹² were 1,171,364 tonnes, which equates to 6 billion miles driven by the average new car in the UK¹³.

¹⁰ <https://webarchive.nationalarchives.gov.uk/20081201055944/http://www.energysavingtrust.org.uk/nottingham/Nottingham-Declaration/Why-Sign/About-the-Nottingham-Declaration>

¹¹ Nottingham Energy strategy (2010 to 2020) <https://www.nottinghaminsight.org.uk/research-areas/nottingham-key-strategies/>

¹² <https://data.gov.uk/dataset/723c243d-2f1a-4d27-8b61-cdb93e5b10ff/emissions-of-carbon-dioxide-for-local-authority-areas>

¹³ <https://www.theguardian.com/business/2018/feb/27/co2-emissions-from-average-uk-new-car-rise-for-first-time-since-2000>

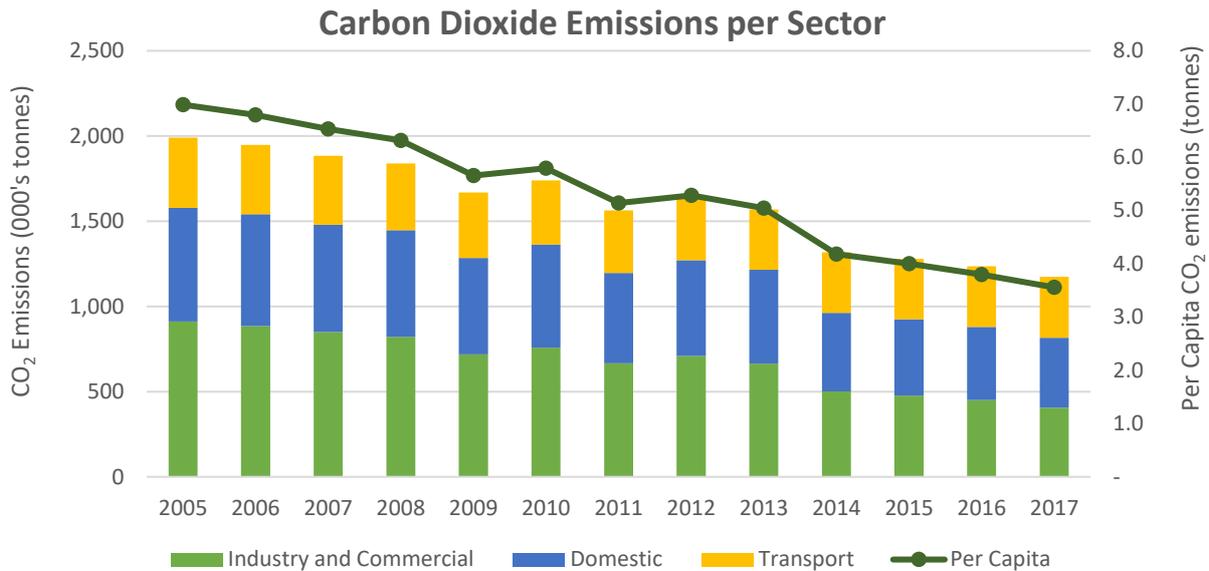


Figure 3. Nottingham city area CO₂ emissions breakdown (Source: BEIS 2019)

Key Actions:

- Our low-carbon District Heat Network now supplies heat to over 5000 homes and businesses
- Carried out over 40,000 energy efficiency improvements to local homes
- Established a 100% renewable not-for-profit energy company Robin Hood Energy
- Introduced one of the UK's largest electric bus fleets and the world's largest biogas bus fleet, alongside our 20-mile electric tram network. This was supported by the introduction of the Work Parking Levy, which discourages driving to work where possible, and has helped finance more sustainable transport options.

These actions have not only contributed to the success of Nottingham's emission reductions but have helped to alleviate fuel poverty, improve air quality, improve human wellbeing and quality of life, whilst developing a green, clean sustainable economy and community.

The city is also on track to meet the target of generating 20% of the City's energy demand through low and zero carbon sources by 2020¹⁴. This success stems from the successful implementation of key strategies and through our partnerships with local businesses, universities and other local authorities, enabling many forward-thinking carbon reduction actions to take place.

Annual progress in emission reductions is not always smooth on a year-by-year basis due to seasonal differences between years. For instance, in cooler periods there is an increase in demand for heating which increases the total emissions for that year. Warmer winters however, mean there is less heating demand and coincide with the years where there is the largest reduction in emissions, meaning despite actions to reduce emissions we will always be affected by variations in the natural climate.

¹⁴ Nottingham Energy strategy (2010 to 2020)

https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&ved=2ahUKewjf_trT45PkAhWGLFAKHeAcC50QFjAAegQIABAC&url=http%3A%2F%2Fdocuments.nottinghamcity.gov.uk%2Fdownload%2F3497&usg=AOvVaw0e_b-PQzK2-YyMUIJD3BD8

Carbon Emissions Inventory

Carbon dioxide and other greenhouse gas emissions come from a variety of sources. Some are naturally occurring processes, and others from activities in our homes, transport and businesses. Carbon emissions, especially those that we can measure, generally come from the use of energy for heating, vehicles, motors, machinery and appliances. Some of these, like traditional cars or gas boilers, have direct emissions from the burning of fossil fuels. Others have them through the use of electricity from the grid.

Government data shows what kind of energy is consumed in Nottingham - principally gas (47%), petrol products (28%) and electricity (24%)¹⁵. Each energy source will have a different carbon intensity and footprint, meaning the emissions from some sources, such as coal, are worse than others. The true picture of carbon and greenhouse gas emissions in any city is wider than the description above. There are emissions involved in the lifecycle of products, and the infrastructure that delivers energy and products to us.

Nottingham's Greenhouse Gas Emissions					
(tonnes CO ₂ e)	Scope 1	Scope 2	Scope 3		
Stationary Energy ¹	467,203	432,286	146,982	Net Total	Per Capita
Transport (City) ¹	309,029		889		
Waste ¹	46,906				
Aviation ¹			172,934		
Imported Consumption ²			1,756,384		
Total	823,138	432,286	2,077,189	3,332,613	10.1

¹ Emissions are from the SCATTER inventory tool and reported as CO₂ equivalences www.scattercities.com
² Imported consumption emissions have been calculated based on a per capita allocation of data from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/794557/Consumption_emissions_April19.pdf

Scope 1 emissions are from direct actions of a city, Scope 2 emissions relate to purchased electricity and heating/cooling used in the city but purchased from outside the city, whilst Scope 3 emissions are all other indirect emissions from activities and their lifecycles, such as procurement, waste disposal and investments

Detailed information about the key emissions from the main sources are shown in the table above and pie chart (Figure.4). These emissions include imported consumption emissions, which is the carbon locked into the goods, food and services we consume from around this country and the world. These are very hard to measure locally, but we can make an estimate for Nottingham from UK figures. It shows that these often hidden emissions make up around half of our emissions footprint overall, followed by industrial/commercial and residential building emissions.

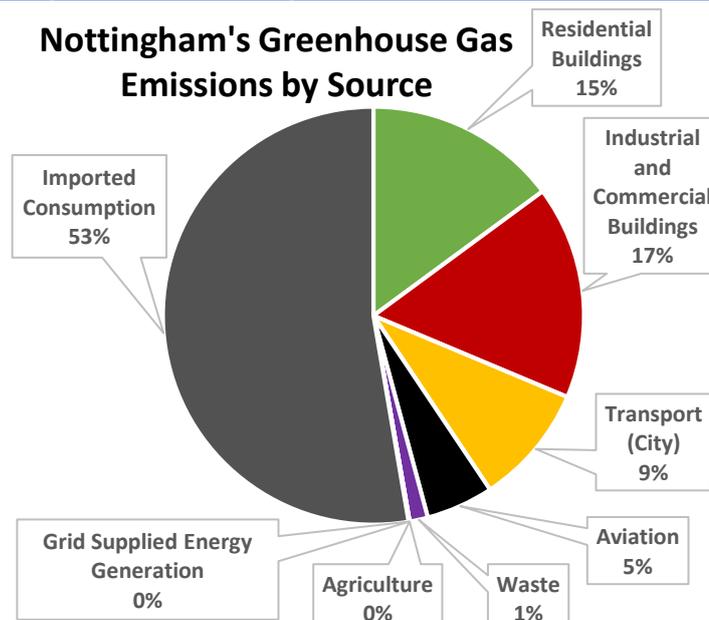


Figure 4. Scope 1 to 3 greenhouse gas emissions for Nottingham, split by source

¹⁵ <https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level>

At the local level, in 2016, Nottingham City Council's operational CO₂ emissions¹⁶ were mainly from electricity (38%) and gas (24%) use in buildings, street lighting (18%), and fleet (13%), of which emissions from diesel vehicles account for 89%. These are all classed as Scope 1 or 2 emissions (direct emissions). The Council's operational emissions account for 2.7% of the city's carbon emissions. This is likely to be a lower limit, due to not including emissions from waste produced by council buildings and operations, or emissions from employee commuting.

The Council has always played its part in reducing its own emissions as part of the wider city emissions targets. In 2016, Nottingham City Council had seen a 29.5% reduction in its own emissions compared to 2007. The greatest progress has come from significant emission reductions in street lighting (40%), gas (34%) and electricity (19%), and from the complete removal of coal and oil consumption, whilst subsequently increasing our connections to our low-carbon District Heat Network. Further to this, emissions from business travel have reduced by 70% since 2007/8, highlighting the Council's ambition to reduce emissions across all scopes and sectors. In reducing the council's carbon emissions, we have also saved money, generated income and delivered on our climate and sustainability objectives.

Nottingham's Carbon Neutrality

Nottingham has chosen to focus its ambition on Carbon Dioxide (CO₂), which is the primary driver of long-term global warming¹⁷. Other greenhouse gasses (e.g. methane) are acknowledged, which under Committee on Climate Change guidance should be at least stabilised alongside reducing CO₂ to net-zero. Setting a 2028 target not only prioritises that Nottingham stays well below its carbon budget to pursue a 1.5°C limit to warming but it also sets the standard for other cities as they consider their own pledges, making Nottingham a leading city in climate action. Through instigating concerted action sooner, it provides the best chance for the city of making this challenging transformation.

Nottingham is aiming to become a carbon neutral city by 2028, meeting this target by reducing all carbon dioxide emission from direct and indirect energy use to net-zero.

The target covers direct and indirect energy related CO₂ emissions, referred to as Scope 1 and 2. It does not cover Scope 3 or imported emissions. This is for several reasons, including:

- Ability to monitor and measure effectively
- Alignment with the local carbon budget model embedded
- Ability to influence and shape sources of emissions directly

The City Council is also very much part of the city target, but the Council will address wider greenhouse gases in the form of a CO₂e target for scope 1 and 2 (and scope 3 where possible) emissions for our estate, consumption, travel and services. Some of these emissions may occur outside of the city boundary. As with the city target, the Council will consider wider embodied emissions in its internal policy to affect those emissions outside of the main target.

¹⁶ NCC operational emissions include energy and water in all owned and managed buildings and local authority controlled schools, street lighting energy consumption, council vehicle fleet and business travel

¹⁷ <https://www.ipcc.ch/sr15/>

Carbon Budgets

A carbon budget provides an indication of the maximum cumulative amount of carbon dioxide that can be emitted to the atmosphere through human actions, between 2020 and 2100, to be in line with keeping global temperature rise well below 2°C and pursuing efforts to limit to 1.5°C rise by the end of the century¹⁸. A carbon budget of this type is not a financial scheme or a limit or cap given to individual persons or organisations.

Carbon budgets can be explained using a bathtub analogy¹⁹ (Figure.5), where everything contained within the tub represents the amount of CO₂ in the atmosphere, the tap feeding into the bath is the amount of CO₂ added to the atmosphere by human activity and the taps draining the bathtub represent actions that remove CO₂ from the atmosphere. The carbon budget is the level to which the bath can hold these emissions, if more is added than removed the level in the bath would rise and then it would overflow. If this happened in the atmosphere, there would be enough CO₂ in the atmosphere to cause an increased risk of global temperatures reaching dangerous levels.

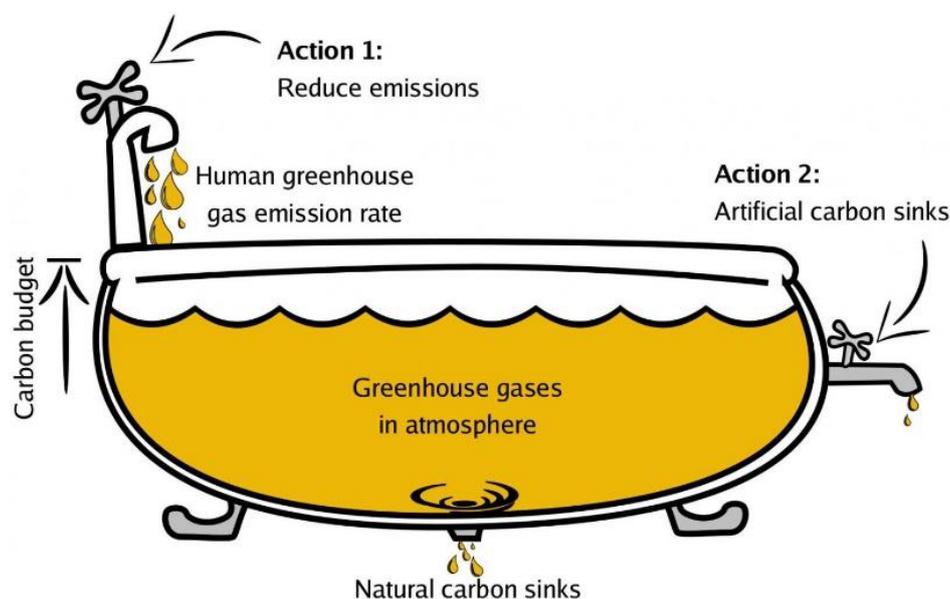


Figure 5. Explanation of carbon budgets using a bathtub analogy¹⁹

A carbon budget is needed to ensure that global CO₂ emissions do not collectively go beyond the level that would increase the risk of global temperatures reaching dangerous levels. Large-scale global action is needed to achieve this, right down to local level. This means Nottingham must abide by this budget and ensure that its emissions fall below its appropriate share of this global carbon budget. This is part of a sustainable approach to carbon neutrality, one where there is a fair and just share of responsibility.

The carbon budget shapes the rate at which we need to decrease emissions each year. Analysis of the national picture has suggested that if nationally we were to plot a straight line pathway to zero from today, the target date would have to be 2025 to avoid exceeding the available carbon budget²⁰. This stresses the importance of acting to cut emissions deeper and sooner to give the best possible chance of avoiding dangerous levels of climate change.

¹⁸ <https://carbonbudget.manchester.ac.uk/reports/E06000018/>

¹⁹ <https://wattsupwiththat.com/2019/01/18/climate-change-how-could-artificial-photosynthesis-contribute-to-limiting-global-warming/>
Credit: M. May/HZB <https://www.eurekalert.org/multimedia/pub/190395.php>

²⁰ <https://www.cusp.ac.uk/themes/aetw/zero-carbon-sooner/>

Nottingham's Carbon Budget

Through working with a tool designed to give a localised carbon budget, an **illustrative** carbon budget for the city of Nottingham suggests we have an allowance of:

7.7 million tonnes of carbon dioxide (MtCO₂) for the period 2020 to 2100.

If Nottingham were to continue as it has done so over the last 12 years, with an annual emissions reduction trend of 4.16%, this budget would be completely exhausted during 2028.

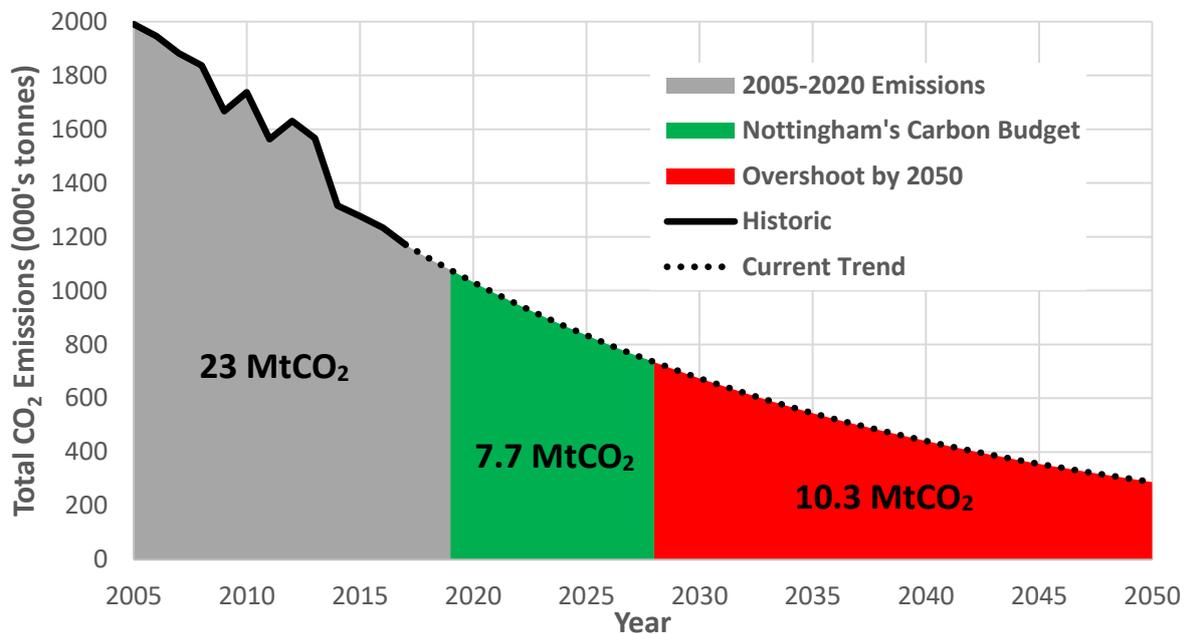


Figure 6. Nottingham's historic cumulative emission period, allocated carbon budget and overshoot of emissions 2005 to 2050

Already, by the end of 2019, Nottingham will have cumulatively emitted three times this remaining carbon budget (since 2005) and if we continue on this trend, by 2050 we would have added 2.3 of our allocated carbon budgets to the atmosphere (2020 to 2050).

This demonstrates the urgent need to reduce carbon emissions due to the small window of opportunity before the carbon budget is exceeded, contributing to an increased risk of dangerous warming. The sooner we act, the longer this carbon budget will last and the more CO₂ prevented from entering the atmosphere. Reduction of every tonne of CO₂ counts, no matter where it is emitted.

Carbon Reduction Pathways

Nottingham's future carbon budget demonstrates the importance of pursuing our commitment to become a carbon neutral city by 2028.

The graph below outlines illustrative scenarios which would meet the City's ambition, in comparison to the trend in emissions if Nottingham was to continue as it has done so over the last 12 years.

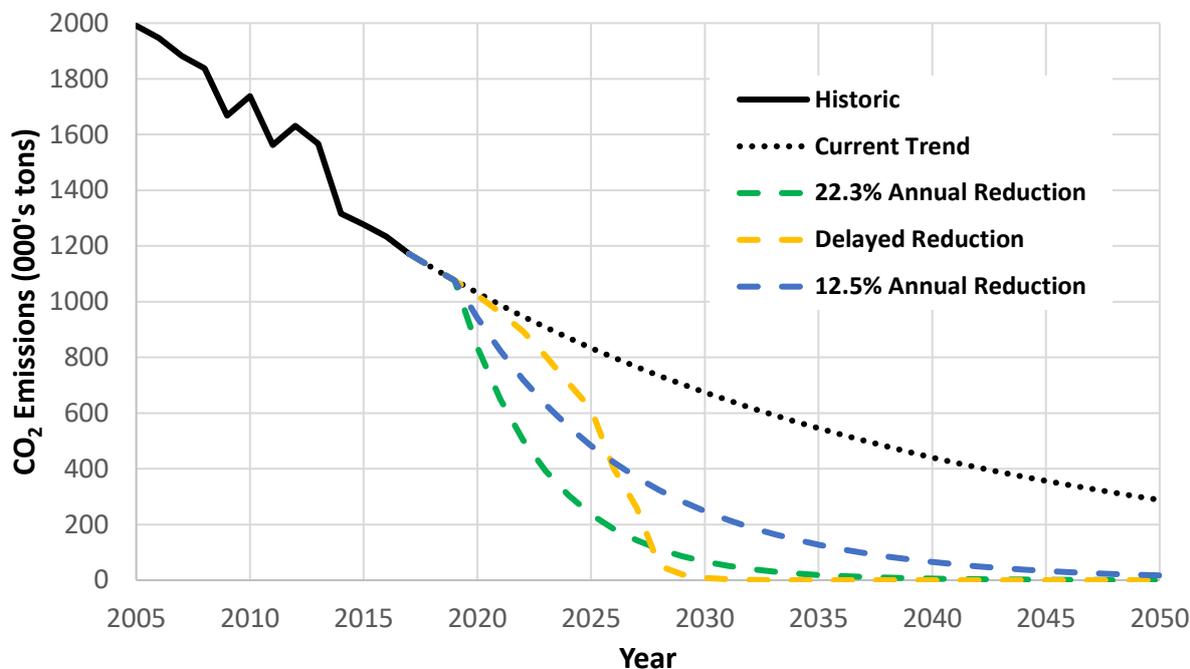


Figure 7. Illustrative emission reduction pathways to meet the 2028 commitment

A delayed reaction to emissions reduction would mean emissions continue along the business as usual path, slowly increasing in scale of emission reductions year on year, becoming more rapid as we get closer to 2028. This would allow time for a more gradual implementation of emission reduction actions. However, this method puts pressure on later years and has a greater risk of overshooting the 2028 commitment by allowing more time for inaction and may even risk surpassing Nottingham's carbon budget.

Instead, Nottingham will place a greater emphasis on reducing emissions as quickly as possible to increase the chance of staying within our carbon budget and meeting the 2028 carbon neutral ambition. To do this, emission reduction rates would have to be in excess of 22.3% per year. This is the rate of emissions reduction required each year to reduce emissions to the point when cumulative emissions up to 2100 remain below 5% of Nottingham's carbon budget, and acknowledges the technical challenges behind removing all emissions.

Negative emissions technologies and offsetting could be used to neutralise remaining emissions. However, Nottingham should aim to reduce emission beyond 22.3% annually to be in with the best chance of meeting the 2028 commitment.

The below graph (Figure.8) demonstrates that under Nottingham’s current emission reduction trend, cumulative CO₂ emissions to 2100 would be in excess of 24 MtCO₂, which is over three times Nottingham’s carbon budget.

The minimum annual emission reduction (22.3%) Nottingham must meet in order to be on track to carbon neutrality in 2028 would limit these cumulative emissions to below 3.7 MtCO₂. This would require a reduction of 240,000 tonnes of CO₂ in 2020, equivalent to almost all direct emissions from residential buildings in Nottingham.

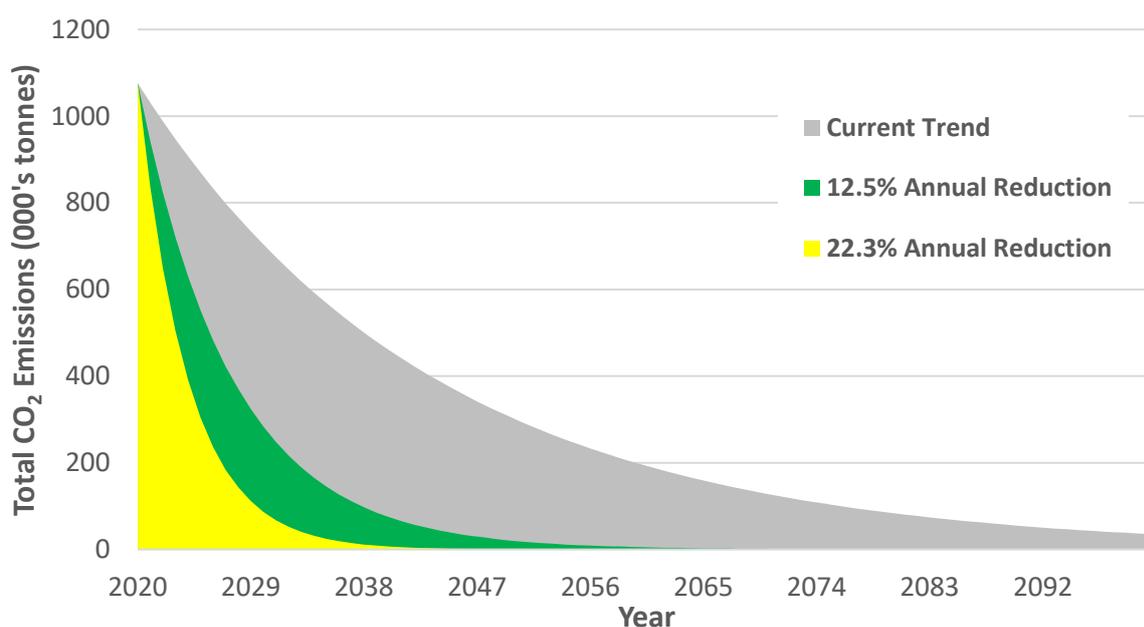


Figure 8. Illustrative CO₂ emission footprint of pathways

If Nottingham was not to meet its 2028 carbon neutral commitment the chance to limit its share of emissions in line with pursuing a 1.5°C future will not have passed. The minimum required CO₂ reduction rate to stay below Nottingham’s carbon budget, through until the end of the century, is 12.5% each year, from 2020 onwards. This would require a reduction of 135,000 tonnes of CO₂ in 2020, equivalent to half of the residential building direct CO₂ emissions.

The importance here is the urgency in the need to act to reduce Nottingham’s emissions. Delaying action by just one year means the minimum 12.5% annual reduction to remain below Nottingham’s carbon budget becomes 13.5% and the 22.3% annual reduction to achieve the commitment becomes 24.3%. This highlights that the time to act is now, the longer we delay the greater the effort needed in the following years.

A more refined set of scenarios and modelling will appear in the forthcoming Energy and Resilience and Climate Change Strategies.

Scenarios and Gap Analysis

This Charter has reviewed the current progress in carbon reduction and past actions/strategies that have contributed to Nottingham's success, as well as provided an analysis of Nottingham's carbon inventory, fair and just carbon budget, and illustrative carbon reduction interventions. The next step for Nottingham is to work towards developing in-depth scenarios of how the 2028 carbon neutral commitment could be achieved, through creating a detailed and well informed action plan. This will enable easy wins and key gaps to be identified, which will require widespread stakeholder engagement and consultation, which will contribute to the new Energy and Climate Change Strategies.

Carbon Sequestration and Offsetting

Nottingham's carbon budget currently assumes that we won't be using technologies to remove CO₂ from the atmosphere or using large scale carbon offsetting. Theoretically, if these technologies were to become widely available and used, Nottingham's carbon budget would become bigger. However, it is important that Nottingham does not assume this and use a bigger budget before these technologies are proven, otherwise we risk contributing to a warmer world.

Localised carbon offsetting can be implemented. For example, it is recommended that Nottingham increase the capture of CO₂, in a process called sequestration, through tree planting, forestry yield improvement and management²¹. This would allow Nottingham to offset emissions elsewhere in the city, helping to achieve our carbon neutral commitment.

Carbon Rebound

It is important to acknowledge the rebound effect that may occur when acting to reduce carbon emissions as it will have an impact on Nottingham's progress of reducing emissions and energy demand both directly and indirectly. We must take into account the time lag that exists between implementing actions, such as energy efficiency measures, and the time it then takes for a rebound to take effect. For example, an action to improve energy efficiency could increase energy use elsewhere through additional activities as a result in an increased disposable income, due to cheaper utility bills. This will be monitored throughout the delivery of the 2028 target.

Priorities Areas for Carbon Emissions Reduction

The technologies and approaches to deliver a net-zero world are believed to be available already, and with strong leadership could be implemented at a cost effective level (1-2% UK GDP)²². Not only would this help tackle climate change, citizens will see an improvement in their everyday lives with their health, diets, cleaner air and new economic opportunities from clean, green growth.

Using tools, such as SCATTER²³ which the Council is helping to develop, the depth and breadth of carbon reduction interventions required to get to carbon neutral will be identified. This will provide examples of the scale of action needed to become carbon neutral and how much carbon can be saved by interventions if they were to be rolled out across the city.

Ultimately, for the city to meet the carbon neutral aspiration, there needs to be clean energy sources, better energy behaviours, more efficient products and buildings, alongside an overall reduction in the demand for energy.

More details on priority interventions will be set out in the forthcoming Energy and Climate Change Strategies for Nottingham, including plans for those emissions that are not part of the carbon target.

²¹ Tyndall Carbon Budget Tool <https://carbonbudget.manchester.ac.uk/reports/E06000018/>

²² <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>

²³ www.scattercities.com

Set out below are the key areas for action towards the targets that need to start being addressed in plans and policies:

Decarbonising Electricity

Since 2010, the UK electricity national grid CO₂e conversion figures have decreased by 47%²⁴. These are expected to continue to decrease as the mix of electricity sources nationally become lower carbon, with increased generation from renewable sources such as wind and solar. Nottingham has been active in helping to decarbonise electricity; the best estimate of the percentage ratio of the available local energy generation from low-carbon sources provided to local domestic and non-domestic demand, covering heat and electricity, is 21%²⁵. By March 2019, over 6,200 solar PV installations had been deployed across the city, covering 4.5% of domestic properties, with an installed capacity of 21MW. Moving forward, Nottingham should continue to increase its local renewable generation, with a particular focus on small-scale solar PV combined with energy storage. The city will continue to participate and lead on innovative solutions to energy generation and look to have a range of sources in place including energy from waste, wind, sewage, water, land and movement.

Decarbonising Transport

To achieve the 2028 carbon neutrality ambition, it will be necessary to almost entirely replace existing fossil-fuel based Internal Combustion Engine (ICE) vehicles with what are termed Ultra-Low Emissions Vehicles (ULEVs). The majority of these ULEVs will need to be electric vehicles, with the remainder likely to be fuel-cells or other variants. This would immediately benefit the city's carbon target. Considering the wider emissions not included in the main target, there have been concerns around the impact of the total lifetime footprint of new electric vehicles due to manufacturing, particularly of their batteries. However, recent research suggests that the lifetime carbon emissions of ULEVs are half those of a conventional vehicle, with more efficient electric vehicles saving on the carbon produced in the batteries in just two or three years²⁶. Out of the 108,000 vehicles registered in Nottingham, there are only 458 ULEVs, less than 0.5% of the total²⁷. Whilst there won't be the same number of ULEVs required as today's current number of vehicles, the scale of this change is still enormous.

In addition to the electrification of privately owned cars, a large shift away from the use of single occupancy car trips towards public transport will be required. Nottingham City Council has historically pursued policies that encourage the use of public transport together with walking and cycling. Policies such as the introduction of the Workplace Parking Levy has enabled the construction of a tram network in the city as well as investment in a high quality, high frequency bus network. These policies have resulted in a rising number of people using public transport and despite a rising population, traffic volumes in Nottingham have remained static for several years.

²⁴ <https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting>

²⁵ This uses a range of BEIS data released in 2019 for 2017 Consumption, and 2018 datasets were available for renewable generation.

<https://www.gov.uk/government/publications/sub-national-electricity-and-gas-consumption-statistics-analysis-tool>,

<https://www.gov.uk/government/statistics/regional-renewable-statistics>

²⁶ https://www.drax.com/press_release/ev-battery-emissions-offset-by-lower-carbon-electricity-system/

²⁷ <https://www.gov.uk/government/statistical-data-sets/all-vehicles-veh01>

Department of Transport statistics from the National Road Traffic Survey estimates annual mileage driven on Nottingham’s roads has increased by 4.3% since 2012 to 0.97 billion miles in 2018²⁸. This represents 0.3% of the total vehicle miles driven on Great Britain’s roads in 2018²⁹.

Nottingham	2011/12	2017/18		% Increase
Population	309,000	331,100	people	7.2%
Bus passenger journeys	49.6	47.7	million journeys	-3.8%
Tram passenger journeys	9.0	17.8	million journeys	97.8%
Road vehicle miles	0.93	0.97	billion miles	4.3%

During this time, Nottingham’s population has increased by 7.2%³⁰, and the number of bus passenger journeys has decreased by 3.8%³¹, however tram passenger journeys has increased by 97.8%³². Overall, the number of public transport passenger journeys have increased over the last five years. Based on the historic trend, a projected 4.15% population growth between 2020 and 2028³³, could result in an increase of 2.5% in road vehicle miles. To help achieve the 2028 commitment, Nottingham must continue to shift towards an increased use of public transport but reduce road vehicle miles, alongside an increased use of low carbon modes of transport.

Decarbonising Heating and Cooling

Space heating is the largest contributor to domestic CO₂ emissions, currently 294,000 tonnes of CO₂ for domestic space heating and hot water is emitted by domestic properties in Nottingham. This accounts for 25% of Nottingham’s 2017 CO₂ emissions and demonstrates that there will have to be a shift in the way we heat our homes, away from the 84% of households currently heated by gas, towards low carbon electric, heat networks and heat pumps.

Reducing and changing Consumption and Waste

In 2018-19, 113,000 tonnes of household waste was produced by Nottingham, of which 26.5% was re-used, recycled or composted, 64.5% was sent for energy recovery; and 7.0% was sent for landfill. Since 2016-17, the mass of household waste re-used, recycled or composted has decreased by 10.6%, waste sent to landfill over the same time period has decreased by 19%, whilst waste sent for energy recovery has increased by 9%. Meanwhile, the overall total amount of household waste collected between 2016/17 and 2018/19 has remained broadly consistent. As Nottingham transitions to a more sustainable society, the recycling rate will have to increase and landfill decrease even further, alongside a reduction in the total amount of household waste. This will require changes to processes and physical infrastructure, as well as city wide behavioral changes to disposal, sharing, shopping and dietary habits. Food and drink has a big impact on wider and imported emissions. Areas for reducing emissions include reducing meat and dairy and increasing plant-based meals; reducing food miles, and; sourcing from less energy intensive forms of farming and production.

²⁸ <https://roadtraffic.dft.gov.uk/local-authorities/188>

²⁹ <https://roadtraffic.dft.gov.uk/summary>

³⁰ <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/bulletins/subnationalpopulationprojectionsforengland/2014-05-29>

³¹ <https://www.gov.uk/government/statistical-data-sets/bus01-local-bus-passenger-journeys>

³² <https://www.gov.uk/government/statistical-data-sets/light-rail-and-tram-statistics-lrt>

³³ <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/localauthoritiesinenglandtable2>

Reducing Demand for Energy

From 2005 to 2016, energy demand in the city has decreased by 26% to 5042 GWh³⁴. This is due to industry and commercial energy demand decreasing 35.5%, domestic by 26.3% and transport energy demand by 8.9%. Overall, gas demand has decreased by 35% and electricity demand has decreased by 22%. However, in 2016, gas consumption still accounts for 47% or 2347 GWh of total energy demand (61% for domestic use and 39% for industrial and commercial use). Though industry/commercial and domestic sector energy demand is decreasing, their gas use accounts for almost half of total energy consumption in Nottingham. In the coming decade, Nottingham will have to reduce gas consumption, and replace its usage with lower carbon alternatives, as well as improve the efficiency of products, buildings and vehicles to reduce the demand for energy.

Improving the Energy Efficiency of Housing and Commercial Buildings

Nottingham's current housing stock poses a key challenge to tackle in our approach to sustainable carbon neutrality. There are 135,000 homes in Nottingham, many of which were built pre-1980 and over 58.2% are below an EPC rating of C³⁵, which is the national target for homes to be at by 2030.

Domestic Housing Stock EPCs							
EPC	A	B	C	D	E	F	G
Percentage of Stock	0.4%	8.1%	33.4%	38.7%	16.1%	3.0%	0.4%

Moving forward, significant improvements must be made to Nottingham's housing stock, which will require a sustained level of household retrofits. In addition, there will be an estimated 9,400 new build homes by 2028, which should be built to the highest possible standards and be climate smart in their design. Nottingham's non-domestic property stock also poses a challenge, which currently consists of 8480 properties³⁶. Over 69% are below an EPC rating of C and currently 47% of non-domestic properties are heated by natural gas³⁶. These are on average 2.6 times the size of properties heated by grid-supplied electricity³⁶. Significant new development is expected to take place at the Boots site, Southside and Eastside Regenerations Zones, and the Eastcroft area of the Waterside Regeneration Zone, which should also be climate smart and done to a high energy efficiency and carbon standard.

Non-Domestic Building EPCs								
EPC	A+	A	B	C	D	E	F	G
Percentage of Stock	0.76%	0.02%	6.67%	24.00%	32.77%	20.76%	7.68%	7.34%

Within Nottingham City Council

It is essential the Council prioritises reducing emissions from electricity and gas use in buildings, street lighting and fleet. The Council will be creating its own internal plan in 2020 to meet its own targets through its award winning Energy Services. This plan will put in place new monitoring to ensure the Council prioritises programmes based upon emission data. Current programmes of work around invest-to-save energy efficiency projects will be continued, using the Buildings Charter and behaviour change to support physical and system changes. The Council will also continue to roll-out renewable energy generation to ensure the Council consumes and provides clean energy. The Council already has a nationally leading approach to its fleet vehicles, and this work will continue to make the fleet increasingly electric, also improving air quality. Other priorities include tackling the wider scope of emissions through better procurement, changes to catering, and the Council's single-use plastics free pledge. It is vital that the Council's non-Nottingham emissions are also addressed, for example flights.

³⁴ <https://www.gov.uk/government/statistical-data-sets/total-final-energy-consumption-at-regional-and-local-authority-level>

³⁵ <https://epc.opendatacommunities.org/>

³⁶ <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/ukbusinessactivitysizeandlocation>

The Council's own housing provider, Nottingham City Homes, has a significant role to play, but has already made huge strides with a nationally recognised approach to whole-house retrofit and innovation to benefit residents and environment alike.

Key Challenges

The city is expecting population growth in the region of 13,000-14,000 citizens between 2020 and 2028³⁷. Existing plans for the city have already suggested an increase in homes for this period of over 9,000 dwellings. With every new home and each new citizen in the city, there are further requirements for transport, infrastructure and services. The City is also planning to grow its economy, which pushes up demand for resources and energy. Nottingham's carbon reduction target and sustainability aspirations must consider and address the impact of these challenges. For an absolute reduction in carbon emissions the rate per person must decrease at a faster rate as population increases. The same applies to a growing economy. This effectively increases the total decarbonisation requirements for the city.

There is the additional challenge of creating a new relationship between wellbeing and consumption. There is currently a correlation, to a certain point, of wellbeing increasing with affluence and consumption. After that point, it fails to rise further, known as the Wellbeing-Consumption Paradox³⁸. Alongside this, research has found that there tends to be a decline in life satisfaction in countries where there is no growth in incomes or carbon footprint³⁸, which should be acknowledged in the forthcoming strategies. Additional challenges to achieving the required level of carbon reduction include achieving wide scale behavioural change across the city, investment in new technologies and processes, alongside overcoming significant technological hurdles.

Clean Growth and a Sharing, Efficient economy

Nottingham's economy will change; existing businesses will become more sustainable and low carbon, and a growing new sector will appear to meet the demand for the products and services to assist with this transformation. Nottingham is looking to position itself to be able to build its capacity to deliver the demand to transform the city. This will mean thousands of new jobs, retraining of countless more, investing in skills and offering young people new types of high-quality careers. This Clean Growth Economy offers one of the best ways for the city to benefit from its sustainability ambitions, as being able to deliver what is needed here, will allow the city to export its strategies nationally and further afield as areas tackle the challenge of a carbon neutral future. The Committee on Climate Change have suggested the low carbon economy could grow 11% per year through to 2030, five times the rate projected for the rest of the economy³⁹, highlighting the significant opportunity to grow Nottingham's economy.

It is essential that the city explore new business models to transform the way enterprise operates to decouple carbon intensity from economic output and growth, whilst remaining competitive in wider markets. This requires a long view on investment, working across traditional sector boundaries and using new techniques in green financing. Businesses are already taking steps towards sustainability, and there are a range of support programmes that are helping businesses to improve their efficiency profitability and productivity and reduce carbon, resources and costs.

³⁷<https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationprojections/datasets/localauthoritiesinenglandtable2>

³⁸ <https://goodlife.leeds.ac.uk/paradox/>

³⁹ <https://www.greenpeace.org.uk/wp-content/uploads/2019/08/Government-Investment-for-a-greener-and-fairer-economy-FINAL-DESIGNED-28.08.19.pdf>

Cities have a history of sharing and are hubs for so many types of exchange⁴⁰, many of which are informal and more communal. In line with the rise of the platform economy, these have been increasingly supported by apps and websites, allowing people to share food that would be wasted, swap or give away items, and share tools and other items that are expensive to buy and used infrequently. Energy cooperatives and communities are emerging across the UK and across the world, providing citizens with the chance to participate in and benefit from a clean energy system.

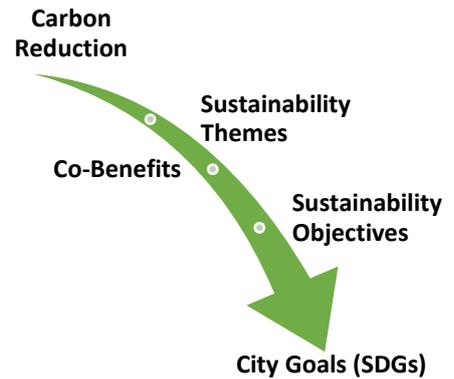
These sorts of initiatives have many benefits; particularly reducing the need for consumption, and through that, reducing costs and greenhouse gas emissions. It will simply not be enough to substitute all forms of current consumption with a more sustainable alternative; wider scale changes are required. This will be vital for the city to reduce the imported emissions in the goods we buy, whilst ensuring that people have access to the things they need. Citizens can also share time and knowledge, learning new skills and doing more by working together. Such approaches can bring people together and help reduce isolation.

⁴⁰ <https://liveablecities.org.uk/outcomes/little-book-sharing-city>

Integrating Sustainability and Co-Benefits

Nottingham’s approach to sustainable carbon neutrality will integrate carbon reduction with sustainability and an ambition to identify and realise what are termed co-benefits. Co-benefits are deliberate or incidental positive outcomes across a range of other areas in addition to the central aim of an intervention. For example, moving towards more active travel to tackle air-quality also has benefits for health from exercise and mental wellbeing, and reducing carbon emissions.

Building on work through the city’s Green Partnership, the wider sustainability agenda has four key objectives (outlined below). Integrating these with the city’s carbon neutral target highlights the holistic and joined up approach needed to deliver carbon reduction and the benefits this can bring to life in Nottingham. A holistic approach is required, as these objectives, along with the six additional themes, cannot be considered in isolation without potential unintended consequences on other areas; this plan aims to reduce one-sided approaches to carbon reduction and sustainability to increase alignment and integration with other strategies and policies in the city.



Improve air quality



Poor air quality affects childhood development, respiratory conditions in all ages and has a variety of long-term health impacts. Carbon reduction initiatives such as improvements in public transport will greatly improve Nottingham’s air quality and vice-versa. Sustainability interventions such as urban greening can simultaneously deliver improved air quality, carbon reduction and many other co-benefits.

Improve the built environment to enable sustainable communities



Thoughtful enhancements to the built environment of Nottingham can simultaneously deliver a reduction in emissions and enhance the natural environment whilst promoting safe and sustainable urban development, helping to reduce crime, improving the sense of community and enabling more sustainable living.

Enable a sustainable economy



Nottingham is aiming to develop a resilient, carbon neutral and sustainable economy. This will see continued growth in local value and a net-positive effect on natural capital whilst decoupling the carbon and resource intensity of its output. Growth in the economy will be achieved through use of innovation, embracing circular economy principles, investing in skills and embedding smarter infrastructure.

Improving quality of life and human wellbeing

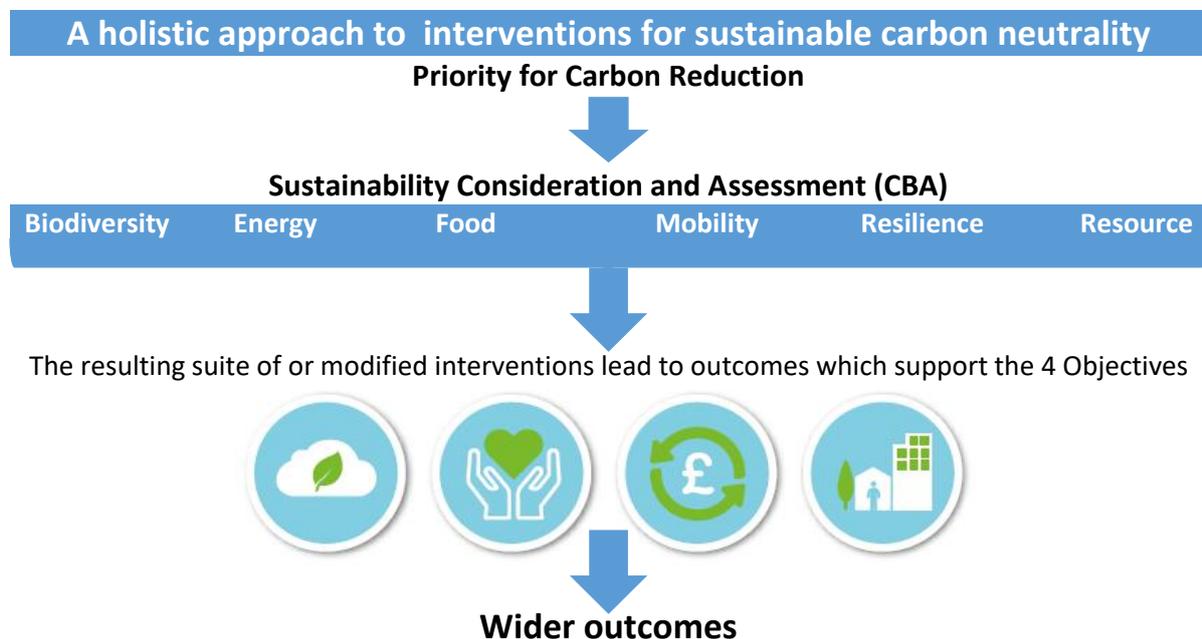


Quality of life is at the heart of sustainable and attractive cities. It is essential that carbon and environmental interventions not only don’t worsen quality of life, but can improve wellbeing and other social factors. The city will develop actions that help to improve health inequality, promote healthier lifestyles, improve life chances and positively impact wellbeing.

A Holistic Approach

The Council is proposing a new approach, integrating carbon reduction interventions in one sustainable holistic approach. This will help to achieve multiple sustainability objectives and themes simultaneously, alongside following a more efficient and robust process. It can also help avoid unintended consequences, whereby addressing carbon reduction might worsen another environmental or social concern adversely. There has to be a balance struck in this consideration. By considering a holistic approach, rather than several single interventions, the combined cost can be reduced, whilst the benefits increase. For example, undertaking all interventions at once would reduce upfront costs and inconvenience to citizens, rather than closing a road once for retrofitting a house, then again later to install solar panels or fit Electric Vehicle charging points.

Once outputs of the investment are determined, the combined benefits of a holistic approach can be mapped to outcomes (e.g. carbon savings, energy savings, improved air quality, comfort effects), and the benefits modelled across three different areas of public value: fiscal value, economic value, and social value.



A Cost Benefit Analysis (CBA) methodology will be used to ensure a well-rounded approach to help identify and build the case for suitable interventions that deliver more value to the city and its citizens. This is a leading national approach to articulating the fiscal, economic and social value of interventions and was adopted as supplementary guidance to HM Treasury's Green Book (2014).

The CBA Approach is a process to assess, evaluate and compare different interventions. In contrast to traditional approaches, the CBA approach enables the wider public value to be articulated, quantifying economic benefits that individuals and businesses realise, and social benefits in terms of improved health and wellbeing. This approach can consider the value for money offered by different interventions that may otherwise not be easily compared. The toolkit allows for both a high-level approach, prior to any local bespoke modelling, as well as later detailed modelling. This CBA approach also considers the 'business as usual' case – what would have happened anyway, and what is actually happening as a result of the investment. It also considers who experiences these benefits beyond just those who have input investment. The CBA approach can be used at each stage of a project: Predictive stage; Project delivery; Project completion, assisting with business cases, evaluation and monitoring.

The Benefits of Nottingham's Approach

Actions that reduce carbon emissions and alleviate sustainability issues can offer many additional cross-cutting benefits. See below how the six themes and four objectives, which will be used in Nottingham's approach to carbon neutrality, will provide these benefits.

	Objectives			
	Improving Air Quality	Improving quality of life and human wellbeing	Enable a sustainable economy	Improve the built environment and sustainable communities
				
Biodiversity and Natural Capital	Raised awareness of the positive impact of biodiversity, which in turn leads to greater protection for species and habitats	Raise awareness of the positive impact of biodiversity when considering human health	Improve existing urban areas through open space and habitat creation, street tree planting and provision of allotments and community gardens.	Ensure development takes into account local ecology and maximises its diversity by maintaining/introducing 'green' routes/connections between development sites.
Energy	Reduce carbon emissions and cost for business	Improve housing stock to bring down energy demand and tackle fuel poverty	More energy efficient businesses, creating a leaner economy. Growth in energy services jobs.	Reduced energy needs/net energy production significantly reduces citizens at risk of fuel poverty and associated adverse impacts on health and educational outcomes.
Food	Local food production reducing food miles and air pollution	Tackling food poverty, diet related ill health and access to affordable healthy food	Promote a vibrant and diverse sustainable food economy; build community food knowledge, skills and resources, and reduce food waste	Wherever practicable ensure domestic properties have sufficient space and suitable orientation to grow plants / vegetables for enjoyment / consumption, also adding to local biodiversity
Mobility	Convert users to Ultra Low Emissions Vehicles e.g. public sector fleet to electric Mass public transport usage Active travel	Boosting walking and cycling to increase physical activity, mental health and improve air quality	Capturing opportunities of green technologies and sustainable business to boost local skills, training and employment	Reduce the need for privately owned vehicles and facilitate the use of Autonomous Electric Vehicle (EV) and 'Mobility As A Service' (MAAS) solutions. Better connectivity via pavements, footpaths and cycleways.
Resource	Reduction in emissions towards zero chimney. Reduced emission from waste	Provide education to promote recycling and responsible disposal of waste and re-use of Resources	Job creation through rearranging of supply chains moving towards a circular economy	Ensure developments include sufficient space for (highly segregated) waste storage whilst awaiting collection.
Resilience	Better air quality and reduced urban heat due to greening of the urban area	Assets that enhance the visual quality of the urban environment in between floods. Schemes designed using blue and green infrastructure to improve health and wellbeing	Better value for money from whole-life costs over the lifetime of the scheme. Attractive spaces for recreation and enjoyment in all areas including development zone	Examine the role of water for sustainable urban planning and design adaptive communities that are resilient to future changes in rainfall, flood risk, temperature and water availability

Monitoring, Analysis and Insight

It is essential that robust, transparent and timely measurement and monitoring is embedded in the city to understand the progress towards the 2028 target, and to understand the broader sustainability performance. Without monitoring and measurement, there can be no management of the challenges.

There is a need to build a better picture of the relationship between actions and their impacts, and to understand the links between different sustainability areas/planetary boundaries, between interventions and co-benefits, and, between carbon and other sustainability metrics.

The UN Sustainable Development Goals (SDGs) offer a common language and overarching framework to enable increased responsibility, connection and delivery of sustainability. Many of the goals may overlap with the aims of this Charter, demonstrating that sustainable development is wide reaching, affecting every area of business, environment and society. The aim is to encourage wider cross cutting collaboration using this internationally recognised approach and focusing on five key goals.



Nottingham can take advantage of new smarter systems and applications. Communications infrastructure and services are transforming the way we live and work. Innovative applications can enhance data collection and monitoring across the city. Smart city approaches change the way we interact with and use such data, allowing for a more accurate, timely, frequent and widespread view of what is happening. This builds the analytical and insight capabilities to better inform the forthcoming action plans and programmes of work. The knowledge gained can affect behaviour change, and, identify and resolve issues at an earlier stage in an agenda that is time critical. The Council is already adopting new insight approaches and making use of the latest innovations in data visualisation, mapping and open-data.

The Council will work with partners to understand Nottingham’s own contribution to planetary boundaries, and the relationships in turn to Sustainable Development Goals from these boundaries and the aims and objectives in this charter, to understand how we get to a more sustainable good quality of life for all citizens.

Climate Reporting

As part of Nottingham City Council’s desire to be a leader on sustainability and climate change, the City Council will renew and update its commitments to the Global Covenant of Mayors for Climate and Energy⁴¹ and transparently disclose the city and Council performance and plans through the international climate and resource reporting platform run by CDP⁴². This will be aided by the Council’s work on the SCATTER project, which helps cities and local authorities disclose their data more efficiently to common reporting frameworks. Through working openly as part of a larger international group of cities, Nottingham will benefit from additional insight, opportunities and be seen as a place trusted by investors and other organisations to deliver this agenda.

⁴¹ <https://www.globalcovenantofmayors.org/cities/nottingham/>

⁴² <https://www.cdp.net/en/cities>

Strategies and Delivery

A systemic shift is needed in the way we produce, distribute, share, store and use energy, in addition to how we manage resources and travel across the city to mitigate climate change and reduce fuel poverty and air quality. The council is ambitious to do more within the next ten years and beyond. Well-designed policy can deliver strong results in tackling climate change. A number of new strategies, policies and plans will be required to deliver the objectives of a sustainable decarbonisation of the city. These include the new citywide Energy, Transport and Climate Change strategies, along with a range of other documents that support and align sustainability

The City's carbon neutral ambition is not isolated within future plans of the council. Many other plans and pledges from the City Council Plan 2019-2023 will help deliver the 2028 commitment, whilst many of the carbon reduction interventions will in return help to deliver new plans, highlighting that Nottingham's approach to sustainable carbon neutrality is mutually beneficial. Examples below demonstrate how Nottingham becoming a carbon neutral city by 2028 aligns with the Council's strategic aims:

- Ensure all planning and development decisions within the city consider the environment and sustainability
- Expand the tram and cycle network, giving people access to cleaner modes of transport and a better way of life
- Protect 1000 more homes from the increased risk of flood events, working with the Environment Agency
- Work experience and student placement schemes within NCC services helping to implement carbon reduction initiatives, whilst aiming to retain more graduates within the city.
- Double the number of Nottingham residents who are Robin Hood Energy customers, which provides a 100% renewable electricity
- Create suitable habitats for a bee friendly city
- Reduce plastic across the city with provision of water refill stations, alongside making the Councils single use plastic free by 2023
- Plant at least 10,000 trees and work with local communities, to help expand and protect Nottingham's Green Flag parks
- Secure investment in Nottingham to develop the city as a centre of excellence for sustainable/eco/renewable sector.
- Create 15,000 new jobs many opportunities will emerge in the clean, green low carbon economy.
- Improve the sense of community and bring people together to improve their neighbourhoods

The overall carbon and sustainability vision will be enacted through a suite of policies and strategies across directorates, as detailed at the outset of this document. Work has already begun in the City Council to set out and take forward in detail the strategic direction for the city's transport and energy systems, and the overarching climate change agenda. The new strategies are key to success in reducing greenhouse gas emissions and delivering on the sustainability objectives for Nottingham.

The Council is looking to develop these strategies, and their action plans, with key partners and representation from citizens, communities, business and research. This is will be using engagement, consultation and a process called co-creation. This co-creative process will be developed through the Living Lab aspiration for the city to implement and deliver the strategies as it takes on key sustainability and carbon challenges.

Resilience and Climate Change Strategy

To fulfil our ambition to become a just, sustainable and carbon neutral city, Nottingham must consider how its citizens, community, buildings, transport, environment, infrastructure and businesses will adapt and become resilient to unavoidable impacts of climate change. Many of these impacts are already being experienced, such as the record breaking July heatwave in 2019. These events will likely increase in size and frequency, particularly in the city, due to increasing population and the urban heat island effect, even if temperatures are limited to a 1.5°C rise. The risks to individuals depends on their exposure to events and environmental characteristics of where they live (exposure), social and institutional context (ability to adapt) and their personal situation (sensitivity)⁴³.

Adaptation and resilience will feature as a key element of the new Energy Strategy and Resilience and Climate Change Strategy. A vulnerability assessment will be carried out to assess the City's sensitivity to current and potential future impacts, its adaptive capacity, and required adaptive measures. By addressing climate change using a risk management process, the Council and the City can embed adaptation approaches strategically and ensure business continuity.

This strategy will set out in more detail the overall climate change agenda. This includes:

- A detailed picture of city emissions and relationships to actions
- Modelling of scenarios for our carbon reduction trajectory and interventions
- Understanding of climate vulnerability in the city, using UKCP18 climate projections
- Adaptation and resilience plans
- Refined co-benefits estimation
- Reporting requirements

Energy Strategy

Energy is vital to livelihoods, transport and our economy. The energy system is also crucial to reducing emissions and improving air quality in the city. Delivering energy has three key strands; security, carbon reduction and cost. These must be balanced and effectively addressed.

The way in which we generate, use and move energy around is changing rapidly with technological advances and the ability for more citizens and organisations to be producers and consumers of clean energy. The grid is evolving from a network to a dynamic system. This creates complexity and challenges for ensuring there is energy when and where we need it. So too, there is a real need to ensure that the benefits of new systems and their opportunities are shared equally, and the costs are not borne by the most vulnerable. Fuel poverty, despite enormous efforts, remains a problem in Nottingham due to the high costs of energy, large number of houses with poor energy efficiency and lower the average levels of disposable income in households.

The new Energy Strategy will be addressing all of these factors, in particular:

- Modelling different energy system models
- Modelling potential renewable energy generation and energy storage opportunities in the city
- Forecasting energy demand scenarios

Local Transport Plan

Nottingham City Council has a proud tradition of investing in public transport, cycling and walking. This longstanding policy has helped NCC to develop a tram network integrated to rail and buses together with a high quality, high frequency bus network. As a result, Nottingham is now one of the

⁴³ <https://www.climatejust.org.uk/who-vulnerable>

few UK cities to have a growing public transport patronage. This policy has also been supported by the UK's first and only Work Place Parking Levy. The revenue from which is invested in sustainable forms of transport including public transport cycling and walking.

Nottingham City Council are currently in the process of developing its latest Local Transport Plan (LTP4). The plan will build on the success of the LTP3 which had at its heart the development of a world class sustainable transport system as well as encouraging the use of Ultra Low Emission vehicles and behaviour change.

The new plan will go further and aim to ensure that the City Council makes use of new technology to make substantial reductions in carbon emissions from transport. We know that the majority of carbon emissions from transport in Nottingham come from road transport and of those emissions the vast majority come from cars. Encouraging the use of alternative modes of transport will again be central to the plan as well as reducing the need to travel.

The Way Forward: A Citywide Agenda for All

Ultimately, the aspiration of sustainable carbon neutrality by 2028 is one that is for, and on behalf of, the whole city. The success of the city in rising to the challenge depends upon the involvement of all citizens, business, the public sector and our educational establishments. The Council, or any one organisation, cannot achieve this goal alone. The Council will play its role in providing leadership and coordination but everyone has a part to play and something to contribute. It is recognised that new forms of partnership, collaboration and engagement are needed to deliver this ambitious but necessary agenda.

A new form of engagement is planned that brings together more people and partners to identify what sustainable and carbon neutral means to citizens of the city, and how to develop the new policies and strategies to take the city there. Citizens have a huge role in shaping the success of the city's efforts to become sustainable and carbon neutral. This is a role for everyone, and whilst there may be changes to behaviour and consumption, there will be many benefits. It is not just people acting alone, but it is also about how people can act together: with their neighbours, streets, communities and colleagues. As a city with a large education sector, it is imperative that there is engagement with students all of ages and in all forms of learning. The two Universities and their students have a significant role and voice in shaping the sustainability of the city, and on the wider national and international stages.

The graphic to the right shows what Nottingham citizens felt were the most important factors in becoming a more sustainable city. The city's Green Partnership has previously created two online public consultations which aimed to gather information resulting to central sustainability themes of the strategy. The results found a strong support for the vision principles and objectives.



The City Council is creating a suite of engagement and communication activities for 2020 onwards to:

- Increase carbon and sustainability literacy amongst citizens and across all organisations and staff
- Increase action at the individual level
- Create wider action through pledges for citizens and organisations
- Identify aspirations, opportunities and challenges to inform plans

Engagement is required for a mandate, to inform the choices people wish to take understand the barriers to action and to instigate wider action to:

- Create new ways of working across sectors to co-create solutions to key city sustainability challenges.
- Engage people with the development of the new Energy Strategy and Resilience and Climate Strategy, and their accompanying action plans.
- Create new discussions about what a sustainable carbon neutral future means to different people in their lives, creating a shared sense of Nottingham's future.

Partnerships to Inform and Govern

The city has great partnerships locally, nationally and internationally. These will play a vital role in learning, sharing information and collaborating with other cities and authorities.

As part of its leadership to deliver its own internal carbon neutral target, the City Council recently launched a new Energy and Sustainability Board that brings together key officers and decision makers from across its service areas to coordinate work.

Nottingham Green Partnership, which consists of partners from public, private and voluntary organisations, are working towards reducing the city's environmental impact and improving the quality of life for citizens. The Partnership is addressing the challenge by taking on a new structure that involves citizens, businesses, researchers and city officials in each of its working group areas that cover the six key themes of this document. This is building towards a wider sustainability Living Laboratory for Nottingham.

The City is not alone in its efforts to tackle these immense challenges. Nottingham is working with Core Cities, Local Enterprise Partnership (D2N2) and Derbyshire and Nottingham Local Authorities Energy Partnership, amongst other national and international networks.

Appendix 1. The Climate and Environmental Crisis

There is a growing awareness of the local and global impacts of climate change. Over the past 250 years, the Earth has already experienced more than a 1°C rise in average global temperatures, as a result of human activity⁴⁴; mainly through the burning of ‘fossil fuels’ such as coal, oil and gas. These actions have resulted in increased carbon dioxide (CO₂) concentrations within the atmosphere; a long-lived gas that is directly linked to rising global temperatures. The graph below (Figure.9) shows how the levels of carbon in our atmosphere have increased to the highest recorded level for hundreds of thousands of years⁴⁵.

Alongside a growing awareness of the impacts of climate change, there is a greater acknowledgment that the way we live is not sustainable. Evidence has shown that overall, it is not healthy for us, or for the wider natural world to continue as we are. Population health impacts of not delivering UK emission reductions could cost £5.3 billion a year by 2030⁴⁶. Our consumption of the planet’s resources is threatening the wellbeing of future generations and the natural resources we depend upon. This has been described as a ‘human and natural’ emergency⁴⁷. The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) states: “Nature is declining globally at rates unprecedented in human history — and the rate of species extinctions is accelerating, with grave impacts on people around the world now likely⁴⁸”

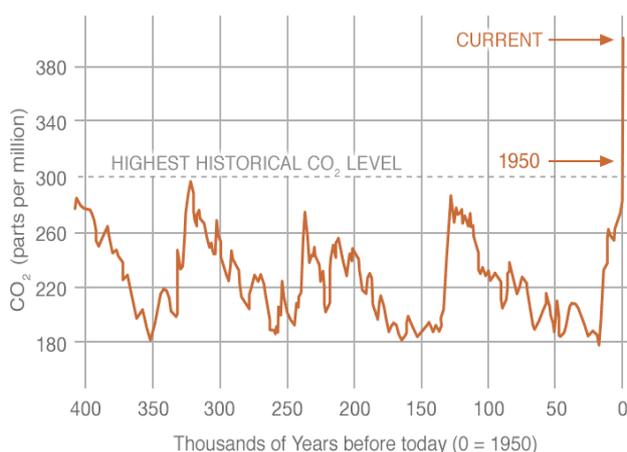


Figure 9. NASA/NOAA proxy (Indirect) measurements of CO₂ using reconstruction from ice-cores.
<https://climate.nasa.gov/vital-signs/carbon-dioxide/>

While carbon dioxide gets the focus because of its impact and the link to the burning of fossil fuels, there are a range of gases, known as greenhouse gases, warming our atmosphere. These include methane (which is strongly linked to farming and land-use), ozone, water vapour, CFCs and nitrous oxide. These are collectively referred to as CO₂e, or carbon dioxide equivalent, when used in data.

The rise in the global average temperature is seen more strongly in some areas than others; for example in the northernmost areas of the world. It is not only the average temperature that matters. A warming atmosphere has more

energy and can hold more water. It is also creating more extremes of weather and making certain events more likely to happen as well as gradual changes in the climate and seasons.

Some of these effects are increased droughts and heatwaves; more intense rainfall and storms; and sea level rise⁴⁹. The impact this has in turn causes events like flooding, wildfires, crop and livestock losses, migration or extinction of animal species, water shortages, damages to infrastructure and property, changes in the reach and spread of diseases, forced migration of people and loss of livelihoods. In 2018, global economic costs of extreme weather events rose above £172billion, making

⁴⁴ <https://www.ipcc.ch/sr15/>

⁴⁵ average of 407.4 parts per million for 2018 <https://www.ncei.noaa.gov/news/reporting-state-climate-2018>.

⁴⁶ BEIS Green Finance Strategy

⁴⁷ <https://www.bbc.co.uk/news/science-environment-48059043>

⁴⁸ IPBES 2019 - <https://www.ipbes.net/news/Media-Release-Global-Assessment>

⁴⁹ <https://climate.nasa.gov/effects/>

the last two years the costliest on record⁵⁰. The potential increase in magnitude of this damage is very large.

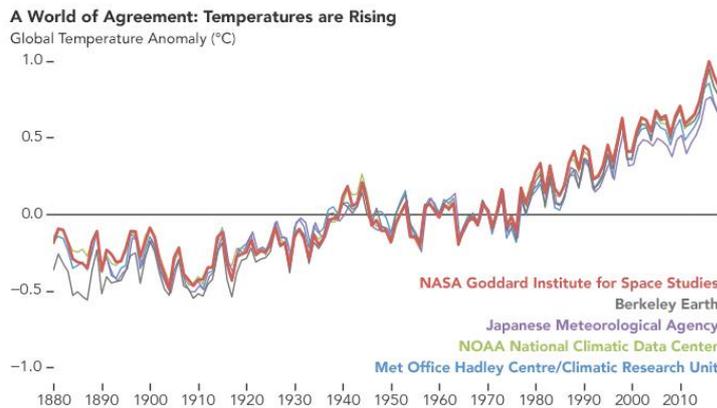


Figure 10. NASA global temperature trend using 5 different organisational methodologies <https://climate.nasa.gov/scientific-consensus/>

Across the UK, society, the environment and the economy are all at long-term risk from higher temperatures, droughts, floods, wild fires and rising sea levels⁵¹. Where the cost on inaction would be far greater than the cost of action.

However, even now there are areas in the UK, such as along the coastline, where the current effects of climate change are irreversible, which will lead to climate migration

nationally as well as internationally. Many of these climate effects and impacts interact and some, like the melting of ice in the polar regions, can create what are known as 'positive feedbacks' - which means accelerating climate change.

Avoiding the potential for runaway climate change is one of the most pressing challenges ahead⁵². Delaying our response to climate change is dangerous⁵³. As a result, there is an urgent call for wide-scale change to reduce our greenhouse gas emissions to net zero as quickly as possible to prevent additional dangerous warming in the decades to come⁵⁴. There is a clear scientific consensus about both the science of climate change and that the heating of the climate, seen in the past 50 years or so, is very likely (>95% chance) to have been caused by human activity – as shown in Figure 10 below⁵⁵.

If a response to this is delayed, the level of effort and action required in years to come will be significantly higher and will mean an even warmer world. Even just a 2°C rise will lead to extreme weather events happening more often and more severely compared to a 1.5°C rise⁵². The UN is already reporting that climate-related disasters at all scales are happening at a rate of one per week⁵⁶. Local commitments are in place to help tackle climate change and we must now act to deliver these ambitions. The increasingly frequent and severe impacts of climate change acts as another stress upon the natural systems and species around us - including those that play a critical role in our wellbeing and sustainability (sometimes referred to as Natural Capital).

The increase in carbon dioxide has also led to our oceans and seas becoming more acidic⁵⁷ and warmer- affecting marine life and the risk of major impacts upon vital fish stocks. Already, global biodiversity loss is at unprecedented levels with a million more species at risk from extinction in the

⁵⁰ Aon Insurance Estimate <https://www.businessgreen.com/bg/news-analysis/3069713/extreme-weather-cost-global-economy-usd215bn-in-2018-aon-estimates>

⁵¹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/693158/25-year-environment-plan.pdf

⁵² <https://www.stockholmresilience.org/research/research-news/2018-08-06-planet-at-risk-of-heading-towards-hothouse-earth-state.html>

⁵³ Stern Report

⁵⁴ <https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/>

⁵⁵ <https://www.ipcc.ch/sr15/>

⁵⁶ <https://www.theguardian.com/environment/2019/jul/07/one-climate-crisis-disaster-happening-every-week-un-warns>

⁵⁷ <https://oceanservice.noaa.gov/facts/acidification.html>

near future⁵⁸. Human activities, such as fossil fuel extraction and converting forests, wetlands and grasslands for agricultural practices, has put stress on the natural environment. Crop fertilization has altered soil composition, impacting nutrient levels and polluting water systems. Whilst, chemical pollution, such as emissions of heavy metal compounds, has caused irreversible impacts to environmental processes and the climate⁵⁹.

All these actions have put pressure on the planet's boundaries in which we live. Current data shows that our total environmental footprint is greater than what the planet can sustain, with countries such as the UK taking 'as much from nature than our planet can renew in the whole year' by mid-May – our 'overshoot day': for the rest of the year we are depleting the planet's natural capital⁶⁰. Nottingham must aim to live within sustainable boundaries in order to protect the wellbeing of future generations.

⁵⁸ <https://www.chathamhouse.org/expert/comment/biodiversity-loss-big-crisis-climate-change#>

⁵⁹ <https://www.stockholmresilience.org/research/planetary-boundaries/planetary-boundaries/about-the-research/the-nine-planetary-boundaries.html>

⁶⁰ https://www.footprintnetwork.org/content/uploads/2019/05/WWF_GFN_EU_Overshoot_Day_report.pdf