

Carbon Neutral Hull



An Environment and Climate Change Strategy for 2020 - 2030

Carbon Neutral Hull Framework

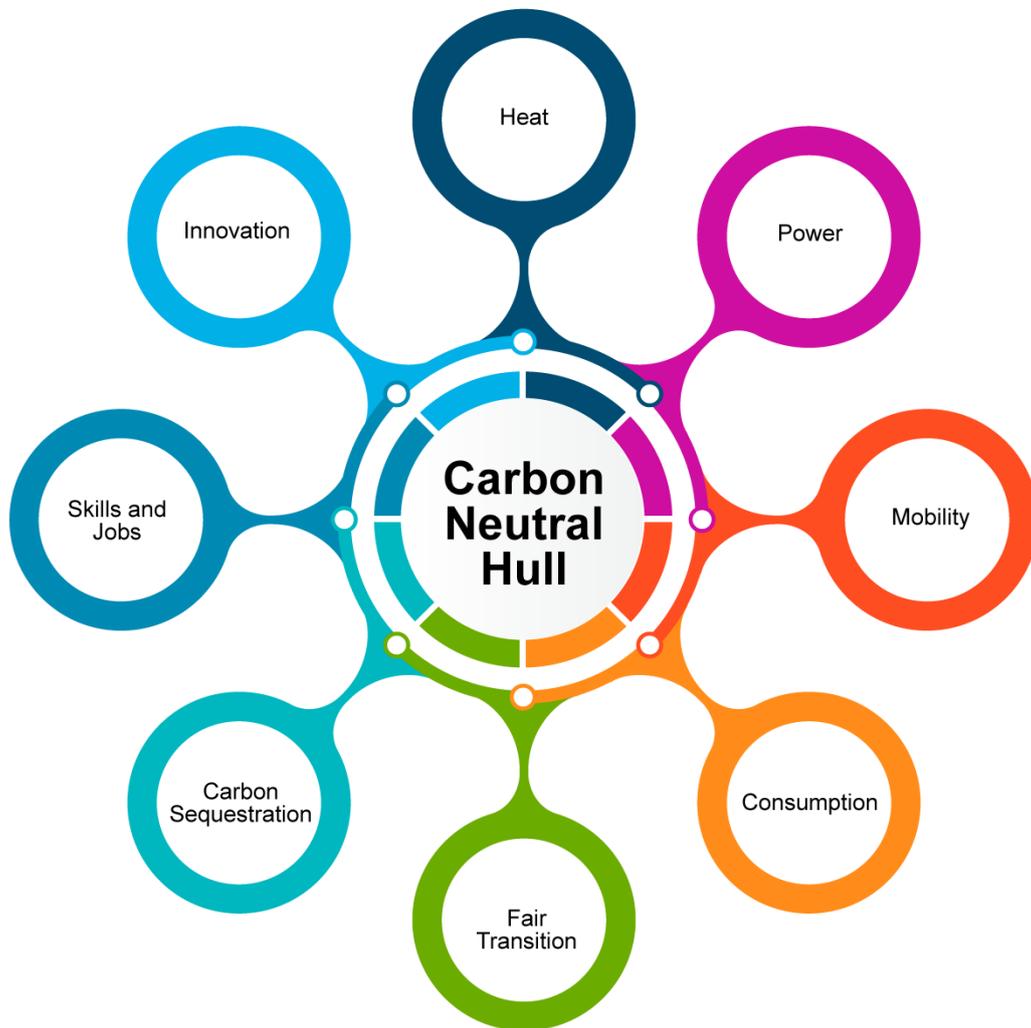


Chart 1: Carbon Neutral Hull Framework

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Executive Summary

The decision by the Council to declare a climate emergency in March 2019 is a significant point in the history and is the point at which Hull made its commitment to carbon neutrality which will be the key force shaping its future over the next ten years and beyond.

A Hull Peoples Panel survey in June 2019 found that 68% of residents agree that there is a climate emergency and 77% of residents think that climate change is a threat. Addressing climate change is therefore a key issue for our residents.

Our vision is for Hull to become a leading carbon neutral city within the United Kingdom (UK) by 2030, to have taken all possible action, under its control, to reduce emissions so that Hull becomes fully carbon neutral by 2030.

The achievement of carbon neutrality by Hull for 2030 is a big challenge, and one that requires significant policy and funding change that can only be delivered by Government. Therefore, based upon the national net zero target for 2050, established within the Climate Change Act, and the current policy and funding landscape, Hull will aim for a minimum carbon reduction of 77% by 2030 from its 2005 carbon emissions¹. As Hull's target is to achieve carbon neutrality by 2030, 20 years earlier than the national 2050 target, the Council, together with partners, will campaign for national policy changes and additional funding to ensure Hull's carbon neutrality is delivered by 2030.

The strategy is based around eight interlinking themes setting out 34 challenges which provide the points of focus for Hull activity over the next ten years to become carbon neutral by 2030. The themes are interdependent and it is only by seeing these in the round and working across them, that we can address the challenges. Some of the activity that needs to take place will require changes in Government policy and increased levels of investment. These have been identified in the themes below and the Council with partners across the city will press for the changes required to ensure that Hull is able to make the changes required.

The eight themes represent the core challenge areas for the city and the areas where activity needs to be focused, to deliver the changes in the economy as well as the co-dependent social and environmental themes, all of which need to be woven together to successfully deliver a carbon neutral Hull that is inclusive and creates a better future for current and future generations.

The actions identified in each theme represent ambitious activity for the city and require a pace and scale of change that we have not experienced before. It will require bold leadership and commitment across all sectors in the city and fundamental changes in how we currently invest and do businesses. Organisations in the public, voluntary, education and private sectors in Hull, have a critical role to

¹ Gouldson, A. Sudmant, A. Duncan, A. (2019). "A summary carbon roadmap for Hull City Council". Place-based Climate Action Network, <https://pcancities.org.uk/>

play (Chart 2) , not only in developing carbon neutral solutions for their organisations but also in educating their workforces in the changes required in day to day business operations and also when away from work in their homes and communities.

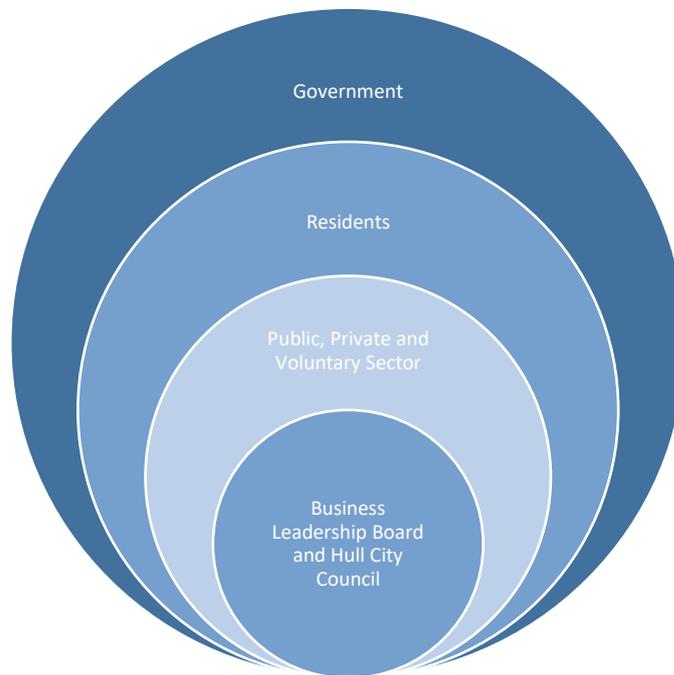


Chart 2: Leadership Structure for 2030

The strategy requires the mobilisation of ideas within the city and an open mind to the technological changes that will be required and will emerge over the next ten years. This document represents a first step in what needs to be achieved in this time and will be reviewed annually to capture changes in Government policy and funding as well as innovation and ideas generated in Hull.

The strategy though does not sit in isolation from other strategies and plans for Hull (Chart 3). The Council will ensure that its key strategies and plans align with the 2030 ambition and support the transition. The Council will work with others in Hull to help align activity with the vision.

The strategy will begin the conversation in our city of how together we can deliver on the commitment to become one of the leading carbon neutral cities in the UK by 2030. Over the next 12 months we will undertake consultation with businesses and organisation across Hull on the vision, challenges and actions to further refine them, identify new ones and bring together the resources and talent in Hull to address the climate emergency.

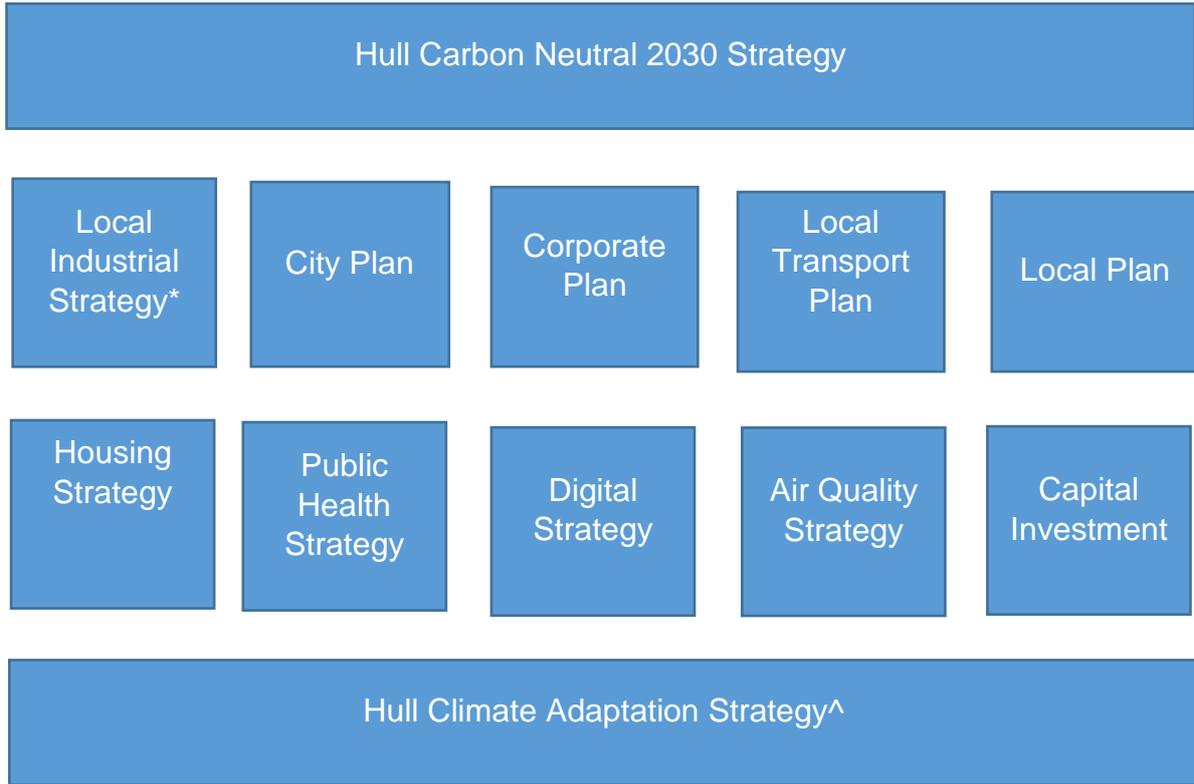


Chart 3: Strategic plan relationship (*awaiting publication in spring 2020; ^ to be produced by September 2021)

Leadership

The embedding of carbon neutral thinking and approaches within Hull requires strong, clear, decisive and insightful leadership within all major stakeholders in the City in the public, private and voluntary sectors.

The achievement of our collective ambition, of Hull becoming the leading carbon neutral city, will help to secure the economic and social benefits derived from the future global carbon neutral economy and enable our city to grow and prosper.

This will be achieved through a change in the culture within organisations and the city, and governance processes. The aim to become carbon neutral by 2030 provides the defining lens through which all investment decisions need to be viewed.

It is at the heart of this transition, for our city, that collectively we do not embark on decisions that will create known problems for future generations of Hull residents. Delivering a carbon neutral city requires an understanding of the long term impacts of decisions, before they are agreed, so that unintended negative consequences are avoided and time and resources are not wasted undoing or resolving problems that could have been identified and avoided by viewing through a carbon neutral lens.

The delivery of carbon neutrality provides Hull with the opportunity to forge a reputation as a leading authority in this necessary and essential transitioning just as its approach to flood management has enabled the city to gain a reputation as a leading flood adapted city.

Carbon neutral leadership will bring confidence to investors and provide certainty in the city's journey and enable its ambitions to maximise the benefits from early adoption of carbon neutral approaches.

The Council has a strong role in establishing the strategy in key areas alongside partners. Collectively, all organisations in Hull will need to lobby Government to take its leadership role to enable change at a local level.

All of Hull's organisations also have a role, in preparing current and future employees for the impacts and opportunities of making Hull a carbon neutral city through training, support and the future design of employment.

Leadership for a Carbon Neutral Hull
Communications
<ul style="list-style-type: none">• Develop training programme for all staff to raise the profile of 2030 target and staff engagement in energy and waste reduction• Understand staff attitudes and awareness of challenges for business and service area around carbon neutral economy and society• Identify opportunities for communicating/ raising awareness of target and decarbonisation, through internal event programmes• Continue to use the Hull Peoples Panel to explore attitudes to transition and views on approaches

Shaping the Future

- Establish a Climate Commission working across the Business Leadership Board, Health and Well-Being and Placed Based Strategy Boards
- Identify and lobby for national policy changes and local funding to enable delivery of the carbon neutral target for 2030
- Produce Carbon Budget Roadmaps for the city covering mobility, energy, buildings, industry, land-use, land-use change and forestry
- Understand the future cost / implication of non-optimum decarbonisation solutions and investments
- Zero emission transport infrastructure strategy
- Citizens Inquiry: Provide wider civil society input into 2030 target actions
- Ensure that climate proofing is undertaken of all major investment in the city to align with the recommendations of the National Infrastructure Commission
- Develop Circular Economy strategy for the city

Place

Hull is home to 260,000 residents covering an area of 71.5 square kilometres and serves a travel to work community of over 515,000². It is the location for circa 8,000 businesses with some of the largest global brands including SiemensGamesa, P&O, RB and Smith and Nephew choosing to make Hull a key part of their business. Hull has a national centre for digital industries in C4Di, a world class University and KCOM which has made Hull the leading ultrafast fibre broadband city in the UK with almost 100% coverage, enabling Hull to be at the forefront of the SMART economy. The Council has invested in a smart city platform to enable the revolution in smart technology and create an Intelligent City. As the UK City of Culture Hull has one of the most thriving arts communities in the north of England. The city has seen over £3billion of investment since 2013 that has seen GVA increase, employment and visitor numbers grow.

Through its port complex Hull is a gateway to Europe and provides a vital trade and visitor link to our near continent ports in Holland and Belgium as well as those in the Hanseatic ports in Scandinavia, the Baltic countries and northern Europe. Hull provides a link to the rest of the world for the UK and one of the key entry points to the country.

Hull is the most exposed city in the UK, after London, to the impacts of flooding, which makes the city acutely aware of how climate change impacts residents, businesses and infrastructure.

However, we are not a city without its challenges and the effects of previous economic shocks and downturns still exhibits its influence on the communities of Hull. As with many other cities there are challenges throughout our housing stock from the legacy of homes built in the 1960's and 1970's to the grandeur of Victorian and Edwardian homes, and whilst there have been great strides made over the last decades in addressing the housing legacy from programmes aimed at the owner occupied and private rented sectors to the large scale residential and community schemes to address market failure in Gipsyville and Preston Road for example, there is much that still remains to be done. Shaping our housing future in the existing stock as well as new build in Kingswood and the city centre is helping to further develop Hull as a place to live and create a carbon neutral residential sector.

Continuing to reshape housing in Hull in the context of climate change provides a significant challenge and opportunity to address the built domestic legacy through a rapid and extensive expansion in energy efficiency and developing low carbon and low cost heating solutions.

As a port city Hull has a set of unique factors that shape us beyond the maritime connectivity. These result from the movement of freight into and out of the port by road, rail and ship and the impact this has on the infrastructure of the city and that of

² ONS TTWA Mid-Year population Estimates 2016

port decarbonisation is primarily seen within a national and international context. Therefore, influencing the role and shape of how carbon neutral ports develop and operate is a key element of our future.

Hull is rightly proud of its maritime history, stretching back 800 years and which helped build the city through trade, fishing and later the importation of coal and timber. However, it is creating a new maritime history based on the key economic prize of the 21st Century the decarbonisation of the economy. The SiemensGamesa offshore wind turbine manufacturing plant has shown how Hull can transform itself for a new industry and the investments by KCOM, RB, Smith and Nephew and C4Di for example demonstrates our leading role in research and innovation. The expertise in the caravan industry and construction provide the building blocks for development and innovation in modern methods of construction for housing development.

The city centre has seen the public realm along prime shopping streets completely refreshed with new water features and innovative lighting to valued buildings and spaces. Major residential development is moving forward and new connections are being made to the Marina and the Humber Estuary waterfront with a new footbridge across the A63. The Old Town has become a focus for new leisure uses, while the Fruit Market area hosts the city's growing tech cluster.

While Hull is a tightly bounded city with the Humber Estuary to the South and measuring sixteen kilometres by eight kilometres, it makes a compact and human scale city. The city has all the benefits that an urban area can offer with housing, clustering of industry and business with great transport connections to London and across the Pennines to Manchester as well as the connections to Europe. Hull is surrounded by a rural and maritime hinterland that provides recreational health benefits with access to a rich natural environment that plays a key role in the biodiversity of the wider Humber Estuary and the UK.

Hull, like the rest of the UK and the world, is at a cross roads in the journey from a place built on a fossil fuel economy to one built on renewable energy and production circularity. Our city has already chosen its direction through recent inward investment and its 2030 carbon neutral target to instigate the transition to a place able to take full advantage of the opportunities and productivity benefits derived from carbon neutral based place-making.

Hull is playing a vital role in leading the carbon neutral change in the Humber as its key city, and within the north of England. We are already leading in the offshore wind industry powering the UK renewable energy transition, our businesses are generating renewable power themselves (e.g. Croda and Aunt Bessies) and providing power through Energyworks for the UK. Hull has developed, with partners, demonstrable leadership in flood management through the Living with Water partnership which recognises the key geographic challenges Hull faces in addressing water abundance and in future periods of water shortage.

Hull will also play an important role in the emerging need for greater and more innovative ways to capture carbon. This will be through natural systems to sequester emissions that cannot be avoided as well as being a key place for carbon capture

usage and storage (CCUS) technology for energy intensive industry, and the emerging hydrogen economy.

Hull is place-making for a low carbon future that will shape our city for the rest of the century and beyond.

The Approach

This strategy sets out the challenges for Hull, and the pace of change required, to deliver future growth and prosperity whilst at the same time becoming carbon neutral by 2030.

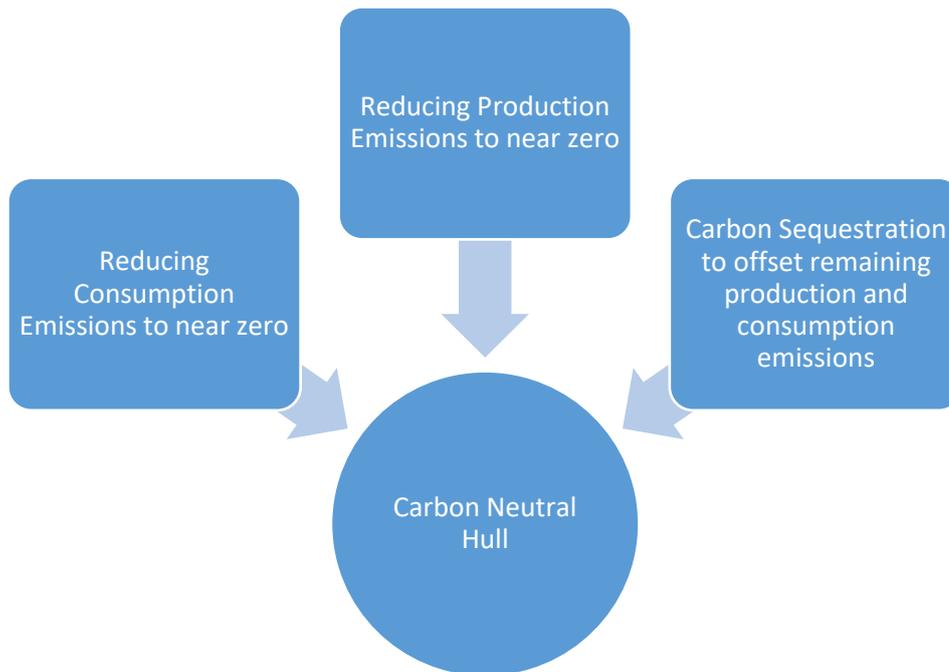


Chart 4: Three actions for Hull Carbon neutrality

The strategy is built on eight key themes that Hull will need to address. Each of these themes sets out the main challenges, targets and how these can be addressed before summarising the programmes of work that could be taken to enable Hull to become a global carbon neutral leader.

The strategy is brought together in a summary of the actions that will be taken over the next four years to begin our journey to being carbon neutral by 2030. The action plan does not set out all that is required over the next ten years but indicates the first steps, which will be complemented by sector specific roadmaps that will be developed.

The strategy and action plan mark the beginning of a consultation process that will be undertaken during 2020/21. This will help to define the actions we need to take including increasing our understanding of the challenges, pace and scale of change in key sectors and establishing clear roadmaps to make Hull a global leader as a carbon neutral city.

One key and linked element running alongside this strategy is the need to develop a comprehensive Climate Adaptation Strategy. The Adaptation Strategy will build upon the adaptation work the city has already undertaken around flooding and the ongoing

work in the Living with Water Partnership but will also look to the future impacts of heatwaves, extreme weather events, and climate impact assessments across key sectors, and to opportunities for innovation in adaptive technologies and services. Climate change is happening and needs to be responded to not just by delivering carbon neutrality but also through adaptation to a changed climate.

The Challenge Ahead

In March 2019, Hull City Council declared a climate emergency and established a target for Hull to become a carbon neutral economy for both production and consumption of emissions by 2030, joining a global movement of local authorities as one of over 230 within the UK.

The UK Government has committed the country to become net zero, for production emissions by 2050 and the Committee on Climate Change has set out, for Government, the pace and scale of change required within the UK if we are to meet the 2050 date. The achievement of a net zero economy by 2050 is considered credible and viable with existing known technology and for an annual cost of 1%-2% of GDP³. Further, the United Nations Inter-Governmental Panel on Climate Change has said that for the world to meet the aims within the Paris Agreement of keeping global warming “well below 2°C by 2050” that global emissions need to at least half from where they are now in the next ten years.

The Committee on Climate Change has identified that the transition to a carbon neutral economy would deliver significant economic benefits through;

- Reduction in costs of climate impacts: both at home (e.g. flooding), and abroad (e.g. supply chain disruption or migration). Acting is cheaper overall than inaction
- Industrial and economic competitiveness: growth in low carbon industries has been faster than average economic growth in the UK for some years and this is predicted to accelerate. By becoming an early mover in products and services related to low carbon electricity production, low emission vehicles and low carbon financial services, the UK can benefit when these are needed by other countries
- Improved impact on human health: for example, through the uptake of active travel, healthier diets, and air quality improvements
- Non-monetised benefits include comfortable homes (e.g. reduced risk of heat and cold related deaths), the recreational and biodiversity benefits of increased woodland and hedgerow coverage, and reduced flood risk and water quality improvements from the restoration of peatlands

These provide key areas where Hull can increase the co-benefits⁴ of becoming carbon neutral through improvements to health and well-being of its residents, creating jobs and increasing productivity.

Climate change, and the response of delivering carbon neutrality, represents the greatest challenge of our time. Delivery of carbon neutrality in Hull is not only

³ <https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>

⁴ United Nations Sustainable Development Goals
<https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

dependent on actions taken locally, but also the actions of government, supply-chains and decisions taken internationally. An integral role of the strategy is to undertake, with partners, effective lobbying of Government and other key influencers to ensure that the policy and funding models are in place to deliver the changes required. A carbon neutral city will require a fundamental change to ensure that the children of our city today have a place fit for their children and grandchildren.

What changes do we need to see?

To deliver the level of decarbonisation required over the next ten years will require Hull to generate much of its electricity from renewable energy sources locally, making use of our roofs and land inside and outside the city. The way we move in and around the city will be significantly different as we walk and cycle more and use public transport as we create the infrastructure to make this the easiest and first choice. The public transport (buses and trains), cars, freight trains, lorries, boats and ships will be powered by electricity and hydrogen. Our homes and offices will be more energy efficient and we will use electricity and/or hydrogen to heat and cook with.

The Committee on Climate Change says cutting greenhouse gas emissions to zero by 2050 will require these seven changes;

Petrol and diesel cars banned from sale ideally by 2030 and 2035 at the latest.

Quadrupling clean electricity production from wind, solar and perhaps nuclear, plus batteries to store it and connections to Europe to share the load.

Connection of new homes to the gas grid ending in 2025, with boilers using clean hydrogen or replaced by electric powered heat pumps. Plus, all homes and appliances being highly efficient.

Beef, lamb and dairy consumption falling by 20%, though this is far lower than other studies recommend and a bigger shift to plant-based diets would make meeting the zero target easier.

A fifth of all farmland – 15% of the UK – being converted to tree planting and growing biofuel crops and restoration of peat bogs. This is vital to take CO₂ out of the air to balance unavoidable emissions from cattle and planes.

1.5bn new trees will be needed, meaning more than 150 football pitches a day of new forests from now to 2050.

Flying would not be banned, but the number of flights will depend on how much airlines can cut emissions with electric planes or biofuels.

We will need to increase energy efficiency in the way we manufacture goods, reusing heat from processes so we get the most value from it. Develop a circular

economy approach to the design, manufacture and reuse of products and resources so we get the most value from them. Switch to different fuels for processes and where we need to use carbon based fuels and include carbon capture solutions.

Hull will have the opportunity to create new products and services required in a decarbonised world that opens the door for innovation for the future and make the most of the skills and talent of the people of Hull and those who will come and live here in the future. Hull will need to ensure that residents currently employed in carbon intensive jobs can retain their employment as we transition to carbon neutrality and that we reskill them for the new jobs and services required.

One of the biggest changes though lies within each of us as we will need to change our behaviour in the choices we make in how we travel, food we consume, use energy within our homes and workplaces, and what we choose to spend our money on. All of the decisions we make have an impact on the environment of our great city and through our choices we will shape its future.

All organisations in the city whether public or private sector, will need to use their skills and talent to deliver the transition to carbon neutrality. Larger organisations will be able to use their buying power to support the transition across the wider economy, enabling smaller and medium enterprises that make up the majority of employers in our city to build on the benefits.

Despite significant economic growth in Hull over the last decade there is still a large proportion of the population of the city that are distanced from a positive experience of work and wider life chances. A carbon neutral Hull needs to address this issue of fairness and ensure that experiences such as fuel poverty are effectively redressed.

Analysis undertaken for Hull by the University of Leeds has identified some of the steps that are both cost effective and technically viable that can be taken that will be the most carbon effective (Chart 5) and cost effective (Chart 6) in delivering carbon reduction.

Carbon Effectiveness	Cumulative carbon savings over next decade	Measure	Sector
Highly effective	1 to 5 Mt CO ₂	Heating (<i>boilers, heat pumps, controls</i>)	Domestic
		Insulation (<i>cost-effective insulation: cavity, loft and floor</i>)	Domestic
		Cooling in retail buildings	Commercial
		Boilers and Steam Piping (<i>cost-effective measures</i>)	Industrial
		Demand reduction (<i>minor; heating, lighting and appliances</i>)	Domestic
Very effective	500 to 1000 kt CO ₂	Insulation (<i>cost-effective fabric improvements</i>)	Commercial
		Appliances (<i>refrigeration, cookers, TVs, washing machines</i>)	Domestic
		Lighting (<i>low energy</i>)	Domestic
		Pumps (<i>cost-effective measures</i>)	Industrial
Effective	100 to 500 ktCO ₂	Electric vehicles (<i>cars, goods vehicles and buses</i>)	Transport
		Compressed Air Systems (<i>cost-effective measures</i>)	Industrial

Chart 5: Most Carbon Effective carbon reduction actions

Cost Effectiveness	Total area cost savings over next decade	Measure	Sector
Highly effective	£500 to £1000 million	Cooling in retail buildings	Commercial
		Hybrid cars (diesel and petrol)	Transport
		Insulation (<i>cost-effective insulation: cavity, loft and floor</i>)	Domestic
Very effective	£100 to £500 million	Appliances (<i>refrigeration, cookers, TVs, washing machines</i>)	Domestic
		Demand reduction (<i>minor; heating, lighting and appliances</i>)	Domestic
		Heating (<i>boilers, heat pumps, controls</i>)	Domestic
		Lighting (<i>low energy</i>)	Domestic
Effective	£50 to £100 million	Pumps (<i>cost-effective measures</i>)	Industrial
		Compressed Air Systems (<i>cost-effective measures</i>)	Industrial
		Fans (<i>cost-effective measures</i>)	Industrial
		Boilers and Steam Piping (<i>cost-effective measures</i>)	Industrial

Chart 5: Most Cost Effective carbon reduction actions

Change on this scale will require Hull to deliver, over the next ten years, a pace of carbon reduction that it has not been achieved to date.

What is carbon neutral and what is the difference between production and consumption emissions?

Being carbon neutral, also referred to as “net zero”, means that as a society and economy we need to transition to a future without fossil fuels, reduce the emissions produced by burning and using fossil fuels to almost zero. To achieve these, changes will need to be made to how we travel, heat and power our homes and work places, and how manufactured goods and food grown do not release avoidable carbon dioxide, and other greenhouse gases, into the atmosphere that are at the heart of man-made climate change.

The 2030 carbon neutral target covers both the production and consumption of carbon emissions (Chart 7).

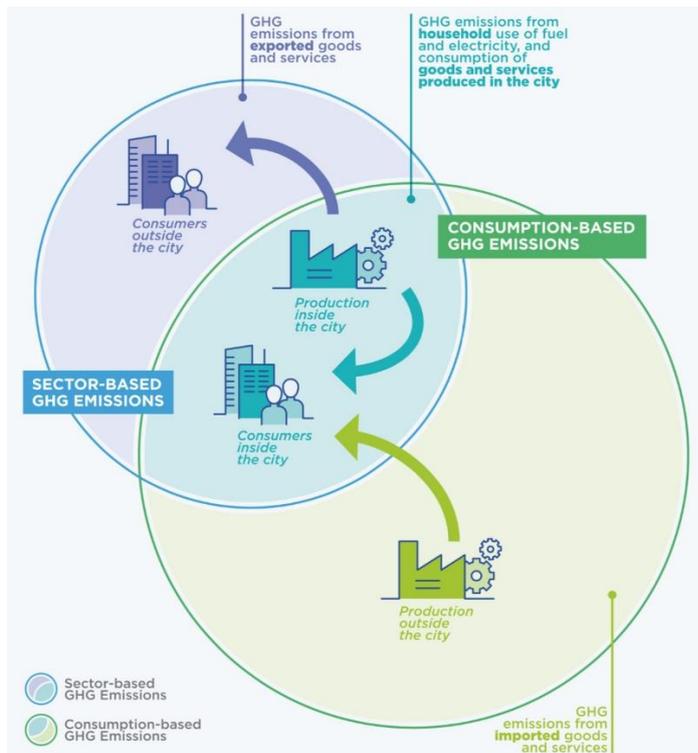


Chart 7: Production and Consumption emissions⁵

Production: emissions produced from products and services we use in the city

Consumption: emissions created in the manufacture and creation of goods and services, also sometimes referred to as embedded emissions

Production emissions are always created within the city, but as consumption emissions are often created outside of the city they are more difficult to identify and control without focussed attention on supply chains and national, or international, government policy decisions.

Reducing emissions by improving home insulation will reduce the amount of production emissions as we need to burn gas to keep warm in our homes. However, the emissions created when the insulation material is manufactured may increase consumption emissions. Ending the use of fossil fuels such as oil, gas, petrol and diesel and significant reduction of the products we use that are made from oil such as plastics and fertilizers as well as dietary changes, will reduce both production and consumption emissions.

However, it is not possible to completely stop the use of fossil fuels as these will still be a requirement for some industrial processes or specialist products. Therefore, once we have reduced and limited the release of carbon dioxide and other greenhouse gas emissions with renewable energy, battery storage and bio-based

⁵ <https://www.vox.com/energy-and-environment/2019/7/1/18743992/climate-change-cities-food-cars-emissions>

plastics and natural fertilizer growing systems, there will still be some emissions remaining.

The final step to carbon neutrality will be through carbon sequestration either through natural solutions such as tree planting and habitat creation for wildlife and plants and technical solutions like carbon capture and storage.

What have we achieved so far?

Production

Analysis undertaken by the University of Leeds⁶ covering Scope 1 and 2⁷ emissions only shows that Hull's baseline (scope 1 and 2) emissions have fallen by 44% since 2005⁸, due to a combination of increasingly decarbonised electricity supply, structural change in the economy, and the gradual adoption of more efficient buildings, vehicles and businesses (Chart 8).

With full decarbonisation of UK electricity by 2045, and taking into account economic growth (assumed at 2.5% p.a.), population growth (assumed at 0.1% p.a.) and on-going improvements in energy and fuel efficiency (assumed at 1% p.a), the analysis projects that Hull's baseline (scope 1 and 2) emissions will fall by a further 26% by 2050, or by a total of 58% between 2005 and 2050.

Scope 3 emissions or consumption based emissions, discussed below, are those associated with the goods and services that are produced elsewhere but imported and consumed within the area, after taking into account the carbon footprint of any goods and services produced in the area, but that are exported and consumed elsewhere.

⁶ Gouldson, A. Sudmant, A. Duncan, A. (2019). "A summary carbon roadmap for Hull City Council". Place-based Climate Action Network, <https://pcancities.org.uk/>

⁷ Scope 1 covers emissions from fuel (e.g. petrol, diesel or gas) directly used within an area and from other sources such as landfill sites or industry within the area. Scope 2 covers emissions from electricity that is used within the area, even if it is generated somewhere else.

⁸ 2005: 2,156 kilotons of carbon emissions

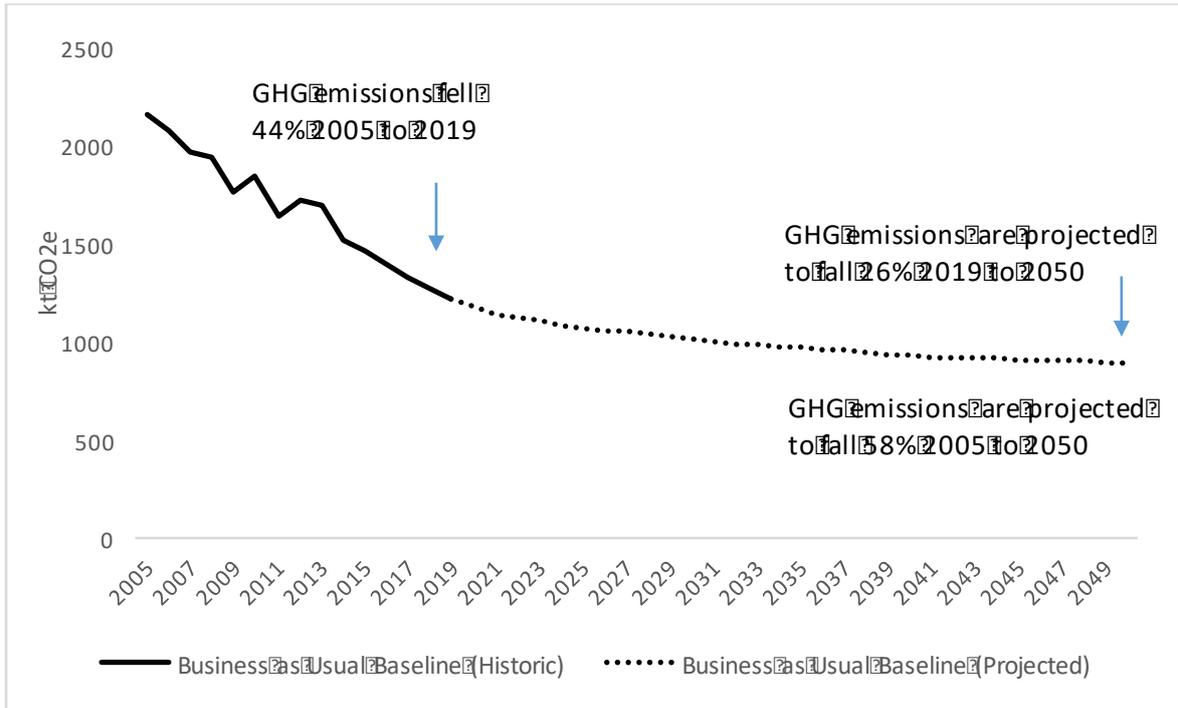


Chart 8: Scope 1 and 2 GHG emissions 2005 to 2050 for Hull

Currently, 22% of Hull's emissions come from the transport sector, with housing then responsible for 28% of emissions, public and commercial buildings for 29% and industry 21%. By 2050, the analysis projects emissions from transport and housing will increase with a small decrease in the proportion of emissions from public/commercial buildings and industry (Chart 9).

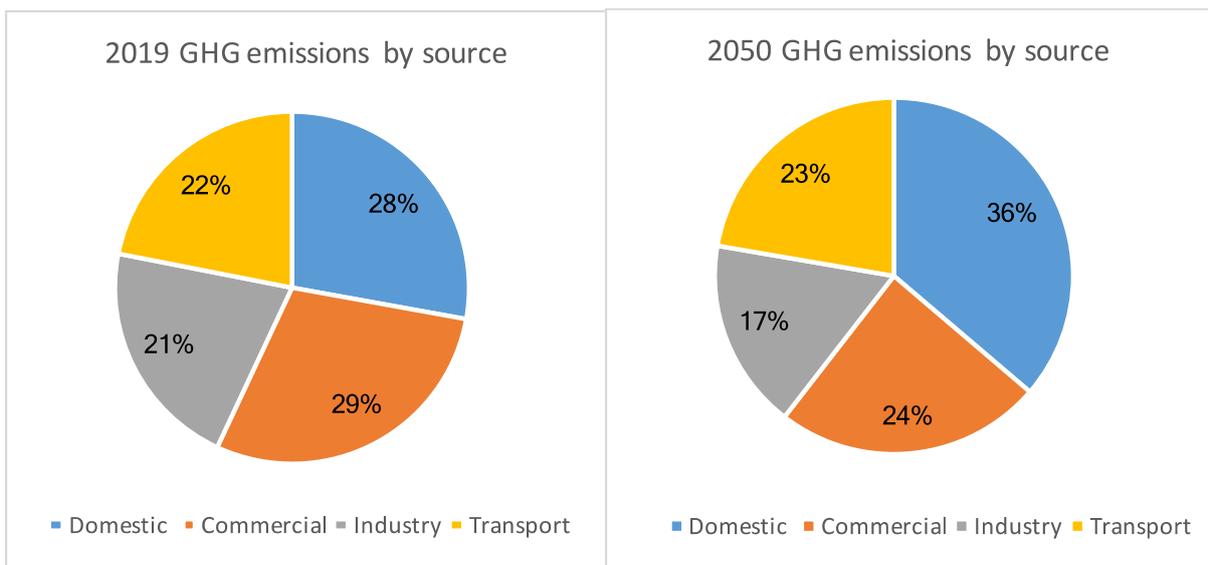


Chart 9: Emissions by sector

Nationally the sources of carbon emissions, Chart 10, show that there has been a clear difference in how sectors within the economy have either started to decarbonise or have seen emissions grow. Emissions for Hull reflect this national progress and demonstrates that some of the issues will require national policy intervention and investment to deliver change.

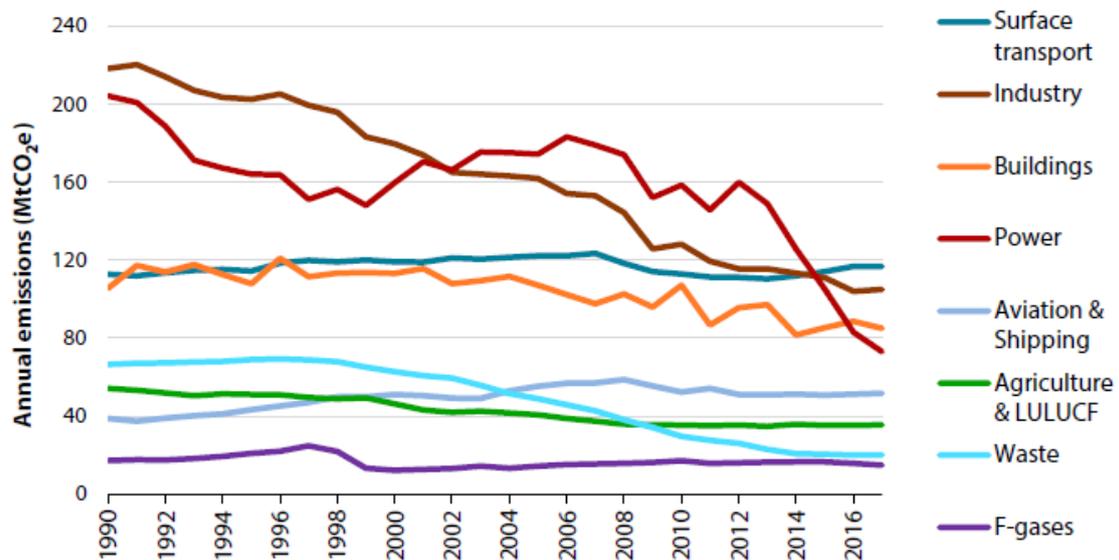


Chart 10: Progress reduction emissions has been imbalanced in the UK⁹

Consumption

Consumption emissions are more difficult to calculate and Hull has not looked at this area of emissions previously. New research has been commissioned to establish the baseline position which will enable measurement up to 2030. The research, undertaken by Anthesis, has identified that Hull’s consumption emissions generate 1.8 times more than the cities production emissions and emanate primarily from six sectors, Chart 11.

⁹ BEIS (2019) Final UK greenhouse gas emissions national statistics 1990-2017; CCC analysis. LULUCF = land use, land use change and forestry.

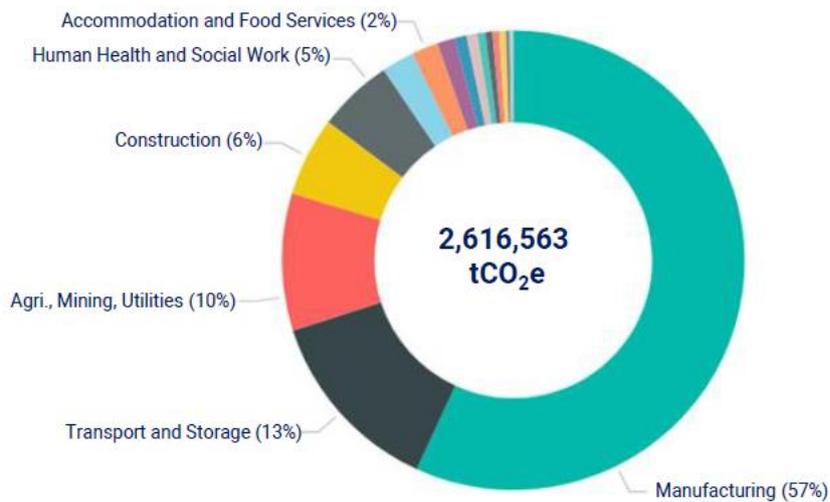


Chart 11: Hull Consumption Emissions by Sector

The inclusion of consumption emission within the carbon neutral target for Hull presents a new set of challenges and opportunities. Over the next two years further assessment will need to be undertaken into consumption emission to enable the development of appropriate methods for recording these emissions more frequently and developing consumption carbon emission reduction actions.

Sequestration

Work is required over the coming year to understand the current carbon sequestration benefit offered by the existing trees and habitats in Hull and therefore understand the requirements to ensure that these are maintained in a carbon sequestration and biodiversity enrichment way.

Analysis for the Humber Local Enterprise Partnership (LEP) identified that the Humber four authority land areas have a current established sequestration benefit of 600ktCO₂e/yr¹⁰, excluding the net emissions from agriculture of around 2,900ktCO₂e with a total sequestration potential of 2,000ktCO₂e/yr using 21% of the current land available.

The trees planted in the current tree planting season are estimated to offer a sequestration benefit of circa 656 tonnes of carbon sequestered over their 45 year life¹¹.

Further work will need to be undertaken to accurately assess the annual natural sequestration requirements for Hull to meet the 2030 target and to offset the annual future emissions post 2030 in perpetuity of approximately 5% of 2005 emissions.

¹⁰ Humber and the net zero carbon ambition- ARUP 2019 unpublished paper

¹¹ Growing trees to sequester carbon in the UK: answers to some common questions M.G.R. Cannell Institute of Terrestrial Ecology Penicuik Scotland. Based on figures for a wild cherry tree

Becoming Carbon Neutral by 2030

The Inter-governmental Panel on Climate Change (IPCC) has argued that from 2020, keeping within a global carbon budget of 344,000,000kt of Greenhouse Gas (GHG) emissions would provide the world with a 66% chance of limiting average warming to 1.5 degrees and therefore avoiding dangerous levels of climate change. Dividing the global figure up on an equal basis by population, will give Hull a total carbon budget of 10,400kt from 2020 for the period through to 2050 and then for emissions to be zero hereafter.

Therefore, using the national 2050 net zero target date, which is the date that current Government policy and funding is focused upon achieving, at current rates of carbon emissions, Hull would use up its 10,400kt budget in just over 9 years. However, Hull could stay within this carbon budget by reducing emissions by 7.7% year on year to become carbon neutral by 2050. This would mean that Hull commits to transition from the current position where emissions are 44% lower than 2005 levels to a pathway where Hulls emissions are 66% lower than 2005 levels by 2025, 77% by 2030, 85% by 2035, 90% by 2040, 93% by 2045 and 95% by 2050. Such a trajectory would mean that the majority of all carbon cuts need to be delivered in the next ten years (Chart 12).

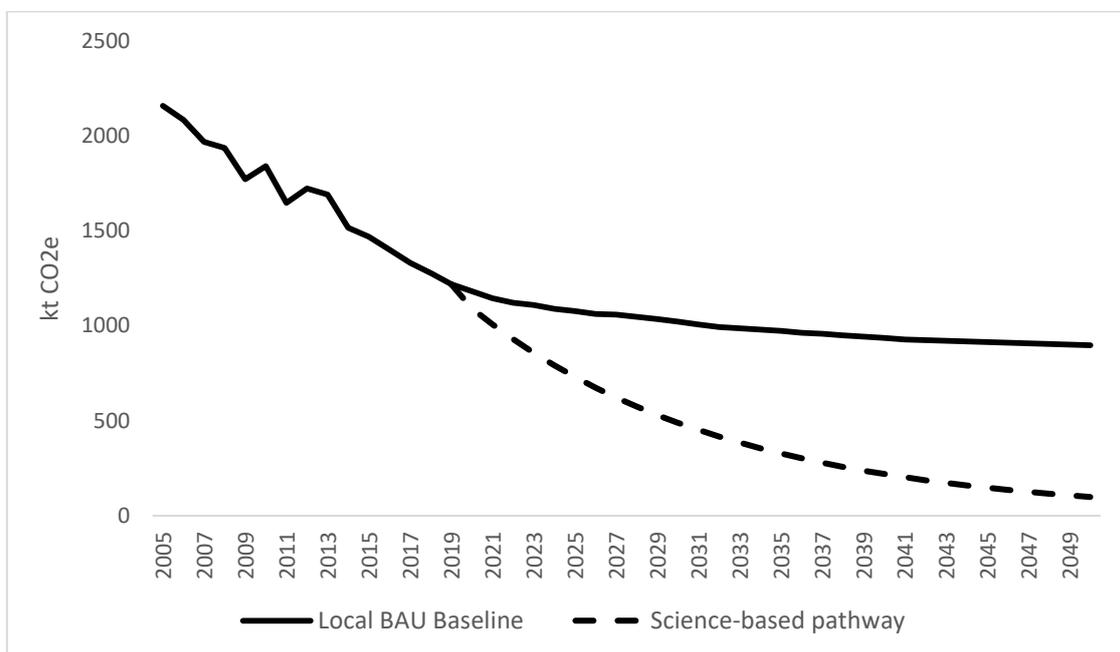


Chart 12: BAU and science-based emissions pathways

Therefore to meet the target for Hull to become carbon neutral by 2030, 95% of carbon emissions cut with 5% offset through natural sequestration by 2030, will require an annual reduction of over 10% per year.

Carbon budgets establish the amount of carbon reduction required to achieve neutrality by making use of the best scientific knowledge and technologies. A carbon budget approach looks at the total amount of carbon “available” to a place that can be emitted to ensure it makes its proportionate contribution to national carbon emissions.

The Climate Change Act established the use of carbon budgets as the primary method of calculating cumulative carbon emissions that affect the climate rather than a target linked to a specific date which could lead to larger amounts of carbon being emitted over the longer term.

In order to adopt a carbon budget approach, centred on carbon neutrality by 2030, more detailed analysis will be required to help understand the different work needed in each sector so that clear carbon neutral roadmaps are able to be produced for Hull to stay within the carbon budgets for production emissions.

The use of carbon budgets is not incompatible with the 2030 carbon neutral target, and the roadmap work will include an assessment of the carbon budget to meet the 2030 carbon neutral target for production emissions. A budget for consumption emissions will be a lot harder to create as the embedded emissions, often generated outside of the UK, will be subject to decarbonisation plans and progress outside of the control of the Council and UK Government.

The chapters below, which look at the key decarbonisation areas and issues, identifies not only the activity that will need to be undertaken by the public and business sectors but also the areas where Hull will lobby Government for policy and funding clarity. These lobbying areas are in line with most of the recommendations made by the Committee on Climate Change in their Net Zero Report¹².

The Opportunity

Achieving carbon neutrality requires commitment and joint working across Hull by its public, private and voluntary sectors, residents, visitors and inward investors. This needs to be supported by a clear policy direction and funding by Government in areas where the City requires national infrastructure changes, for example in heat decarbonisation and the growth of electricity and hydrogen in the transport sectors. Hull can only progress so far towards being carbon neutral by 2030 before key national structural economic changes are in place.

Considering the carbon reduction gap, Chart 12, between the businesses as usual emissions and achieving an earlier carbon neutral target there are three areas of carbon reduction. Activities which are cost effective and therefore pay for themselves in the short term, technical potential options which are available today but may not pay for themselves directly but provide wider social benefits. The final category are those actions which can be defined as innovative which include low

¹² <https://www.theccc.org.uk/wp-content/uploads/2019/05/Net-Zero-The-UKs-contribution-to-stopping-global-warming.pdf>

carbon solutions which are currently not adopted widely or require further technical or deployment assessment.

The analysis by the University of Leeds predicts that the gap between Hull's business as usual emissions in 2050 and a 2050 net zero target could be closed by 32% through the adoption of cost-effective options and 53% through the adoption of both the cost-effective and technically viable options. Therefore, there would still a need to identify innovative options that could deliver the last 47% of the gap between the businesses as usual scenario and 2050 net zero (Chart 13).

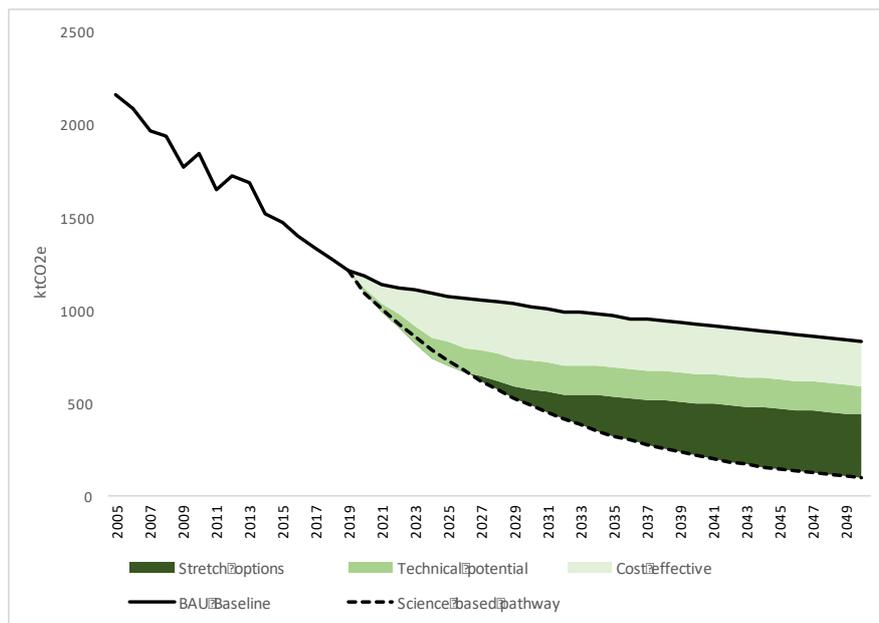


Chart 13: Baseline with the contributions of cost-effective, technical potential and stretch options

The analysis has identified that undertaking the only the costs effective options would require investment of £535 million, and that once adopted these could reduce Hull's total energy bill by £78 million p.a. and create 1,149 years of employment.

The challenge ahead, therefore, presents a major opportunity for Hull to position its businesses; commercial, manufacturing and service, to be at the forefront of a decarbonised future and increase productivity, innovation and growth. Hull has the ability to support the creation of skills and training opportunities for residents to take advantage of the future nature of work and the areas of growth and ensure that an effective transition takes place economically and socially.

Hull has demonstrated over the last five years that it has the skills and inward investment infrastructure to meet the future challenges. The development of the SiemensGamesa wind turbine factory has shown that our residents have the qualities to meet fully the challenges of a new industry that is key to the City and the UK decarbonising. Local businesses and the Council have demonstrated that they are able to reduce energy use and innovate in manufacturing and services to increase resource efficiency and deliver growth.

Nationally, the Committee on Climate Change set out the carbon reduction measures across a set of core and ambitious areas. Core measures include no new homes heated by natural gas from 2025, significant roll out of low carbon power and electric vehicles, increased diversion of waste from landfill, a massive increase in tree planting, the roll out of low carbon heating and carbon capture and storage.

Ambitious areas of work cover the establishment of a hydrogen economy providing heating, peak power and fuel for trains, HGV's and shipping, increased expansion of carbon capture and use, reduction in meat consumption of 20% and even greater reforestation. These actions, it is predicted, would deliver a 96% carbon reduction by 2050.

The challenge before us though requires change that goes further and deeper than we have achieved to date and requires greater levels of partnership working, innovation and skills acquisition. More so than before, we are setting the infrastructure economically, socially and environmentally that will determine the future for Hull.

The chapters that follow set out the detail of the changes required in key areas and the contribution that can be made by the public sector, businesses and residents together these will enable Hull to be in the right position to meet its target.

Wider benefits of decarbonisation

Becoming carbon neutral over the next ten years has the potential to deliver significant co-benefits for the city that will address many of the other challenges we face. Delivering carbon neutrality, particularly in the transport sector, will have a significant impact on air quality for Hull, a known cause of ill health and reduced life expectancy, with children being particularly vulnerable. The increased provision and attractiveness of more sustainable travel choices has the potential to increase active travel and lifestyles which again is known to reduce years of ill health and increase years of active health. Rapid progression to carbon neutrality will make a significant contribution to the impacts of climate change and the severity and frequency of extreme weather events.

Energy: Heat

Challenge

- Increase all home energy performance to a minimum of EPC C rating
- Decarbonise space heating in buildings across all sectors
- Decarbonise heat for industrial processes
- Capture and reuse waste heat
- Ensuring all biodegradable waste is used for anaerobic digestion

The decarbonisation of heat in the domestic and industrial process areas presents the greatest challenge in the city's ambition to become carbon neutral by 2030. The scale of the challenge is stark with domestic gas consumption of 1,340GWh and 1,012GWh in the non-domestic sector in 2017 the majority of which was used for heating and industrial processes.

The decarbonisation of heat will require key national infrastructure decisions and investment to stimulate and enable private sector investment and significant changes to how we heat our homes and buildings and undertake industrial processes. Hull cannot deliver this change without Government intervention. While the Government is proposing to require all new homes built after 2025 will not be connected to the gas network, and new homes energy efficiency will meet the Future Homes Standard, this does not affect the 95% of homes that will be around in 2050 that have already been built.

The decarbonisation of heat also represents a key area where the fair transition to a carbon neutral future, discussed further below, needs to be considered so that fuel poverty and business stability is addressed.

Hull through its compact scale and its digital platform allows for the intelligent control of resources through smart home technology building upon current heating applications as Nest and Tado.

Hull is well placed to deliver one of the key elements of heat decarbonisation and that is to reduce heat loss and waste heat. The most effective way to decarbonise heat is through large scale energy efficiency improvements to all homes across the city so that they all meet an EPC¹³ C rating or higher and an equivalent DEC¹⁴ rating for non-domestic premises. The Council, businesses and other organisations have been undertaking this work for a long time and delivering significant improvements in people's lives as a result and the 2030 carbon neutral target now requires that the pace and scale of this work needs to increase significantly.

¹³ Energy Performance Certificate

¹⁴ Display Energy Certificate

The required increase in property energy efficiency requires significant additional investment and support from Government to enable the Council, private landlords, Housing Associations and individuals to increase the current pace of improvement.

Housing ESWI case study

The Housing service has undertaken significant work to improve the thermal efficiency of homes in the private and public sectors that are hard to treat through traditional cavity wall insulation through the use of external solid wall insulation. In total over 1,000 private homes and 1,600 council own homes have been improved, with future planned schemes improving another 117 private and 546 council homes with an investment in excess of £18m.

Reducing the need for heating through insulation directly impacts the need for new infrastructure required for low carbon heating.

Within the industrial process area there is also the opportunity to increase the reuse of waste heat as a by-product of a process either within the business itself or through the transfer of the heat to adjacent potential users either as direct heat or as hot water. The Hull district heating network currently in the detailed design phase aims to deliver low carbon heating to Hull's city centre, initially, with the aim to use waste heat, and in the future hydrogen, to provide heating and hot water.

Hull will need to move away from the use of natural gas as the primary fuel for heating and cooking in homes and for industrial processes. In the domestic, retail and office sectors this will need to be replaced through either electric or hydrogen heating. A full electric conversion will require a significant increase in the generation of renewable energy and the installation of new infrastructure in the city to homes and businesses as well as replacing existing gas radiators with modern electric systems such as air source heat pumps or low temperature radiators in existing homes and underfloor heating systems in new homes. This will also require a significant increase in home fabric thermal performance and energy efficiency

Hydrogen, currently being developed through projects such as H21¹⁵ and HyDeploy¹⁶, which the Council is involved in, envisages hydrogen replacing natural gas in homes and offices for heating and hot water, with either hydrogen or electricity used for cooking.

A number of industrial processes in Hull use natural gas to enable the manufacture of products and the use of hydrogen provides the only realistic alternative. To generate enough hydrogen to meet our heating and industrial needs would require an increase to the production of 8 million tonnes a year from the current 0.74 million tonnes¹⁷.

¹⁵ H21 is a collaboration between Hull and Leeds Councils, Teeside, Northern Gas Networks to assess the development of a hydrogen infrastructure to homes and businesses.

¹⁶ HyDeploy is a collaboration between Cadent, Northern Gas Network's, ITM Power, Keele University and Progressive Energy to assess the use of hydrogen for heating and cooking within the home

¹⁷ <https://www.newscientist.com/article/2206546-uk-could-use-hydrogen-instead-of-natural-gas-if-it-can-make-enough/> 14th June 2019

The production of hydrogen either through the process of removing it from natural gas or steam methane reforming generates significant amounts of carbon dioxide. Therefore, the development of hydrogen as a viable carbon neutral heating solution requires the use of CCUS. CCUS processes capture the carbon at the point of the production and transports it through underground pipeline for storage in empty oil and gas wells in the southern North Sea, under current proposals¹⁸. The development of the hydrogen economy, with the right national policy framework and funding, would be in a position to commence conversion of homes and businesses in the late 2020's with current modelling indicating that Hull alongside other northern cities, could be converted to hydrogen in the mid to late 2030's¹⁹.

As we move forward there is the opportunity to generate blue hydrogen generated from the use of renewable energy to create hydrogen from electrolysis. The Gigastack²⁰ Project between Orsted, ITM Power, Phillips 66 and Element Energy is aiming to scale up blue hydrogen capability to reach 20MW electrolysis systems that are scalable in the near future. This would avoid or significantly reduce the need for CCUS over the century.

There are also opportunities to derive heat through water and ground source heat as well as solar water heating systems and developing new community renewable energy systems and these need to be explored further over the next few years.

The decarbonisation of heat will require reskilling of existing business in the natural gas sector as well as opportunities for growth in the insulation and heat efficiency sector and opportunities, to generate new products and services and innovation.

Carbon Neutral Heat Pathway Summary	
Council	<ul style="list-style-type: none"> • Build low carbon Maritime Project new visitor centre • Undertake Local Energy Area Energy Assessment for domestic heat decarbonisation • Develop community based sustainable heat solutions • Take a leading role in the development of a hydrogen economy • Operational district heating network covering the city centre and regeneration sites
Public Sector	<ul style="list-style-type: none"> • Take steps to insulate buildings and reduce heat loss • Support heat efficiency through procurement contracts • Provide support to supply chain to reduce heat loss. • Understand heat decarbonisation implications for sites
Business	<ul style="list-style-type: none"> • Take steps to increase the energy efficiency of your property through advice from the Energy Savings Trust business pages • Understand how heat decarbonisation will affect your business • Identify opportunities for new products and services you could develop
Government Support Required	<ul style="list-style-type: none"> • Increase funding and mechanisms for energy efficiency work in all homes

¹⁸ <https://www.h21.green/>

¹⁹ <https://www.h21.green/>

²⁰ <https://www.gigastack.co.uk>

- Provide clear policy direction and funding for heat decarbonisation including the future of Renewable Heat Incentive
- Provide funding for local authorities to undertake Local Energy Planning
- Provide greater support for businesses in heat efficiency

Energy: Power

Challenge

- Significantly increase renewable energy generation and storage
- Increase local energy security
- Develop community ownership of energy generation and storage
- Develop smart energy system solutions
- Reduce the amount of wasted energy in the City

Hull already has over 23MW²¹ of renewable energy installed generating over 27,000MWh of energy each year. However, to meet the carbon neutral target these figures will need to increase significantly to make a meaningful local contribution to decarbonisation in Hull. In 2017, the domestic sector consumed 370GWh and non-domestic sector consumed 711GWh of electricity all of which will need to be delivered through carbon neutral sources by 2030 to meet our target.

	Photovoltaic	Onshore Wind	Anaerobic Digestion	Plant biomass	Total (MW)
2014	7.3	0	0.9	1	9.2
2015	11.1	0.1	0.9	0.1	13
2016	21.7	0.1	0.1	0.1	23.6
2017	22	0.1	0.9	1	23.9

Table 3: MW installed capacity in Hull²²

	Photovoltaic	Onshore Wind	Anaerobic Digestion	Plant biomass	Total (MWh)
2014	5,958	90	3,101	5,446	8,637
2015	7,929	140	2,766	6,939	17,774
2016	14,977	111	3,312	4,940	23,340
2017	19,741	125	2,768	4,857	27,491

Table 4: MWh generated in Hull²³

The national decarbonisation of the electricity grid will deliver the step change required in carbon neutral electricity and the offshore wind energy market, of which Hull plays such a crucial part, is at the heart of the solution, predicted to provide

²¹ A MW (megawatt) is a measure of power and is the “rate” of energy transfer and a MWh (megawatt hour) is the flow of that energy over an hour.

²² <https://www.gov.uk/government/statistics/regional-renewable-statistics>

²³ <https://www.gov.uk/government/statistics/regional-renewable-statistics>

30GW by 2030²⁴. However, there are significant opportunities within Hull to generate renewable energy from wind turbines and primarily the growth in roof top solar, particularly on large industrial premises and office accommodation as well as domestic roof tops. There are also opportunities to install solar canopies on surface car parks to generate power for electric vehicle charging as well as shading of vehicles.



Solar power generation car park canopy: BRE.co.uk

Hull's growth of renewables industries can be supported through city wide procurement frameworks and the creation of community energy bonds to increase local investment and ownership of a carbon neutral future.

Alongside the development of increased renewable energy generation will be the need for increased storage capacity to make the most of generation peaks. Renewable energy storage either through batteries, heat or gas will need to be developed significantly and has the potential to contribute to the hydrogen economy through the generation of green hydrogen. Battery storage will need to be developed at the grid, community and domestic scale, and utilise the opportunities of electric vehicle batteries as part of a smart power grid system.

As with the heat, discussed above, there are still opportunities to reduce the unnecessary waste of electricity through inefficient equipment and processes. There is also much that can still be done to reduce energy use and costs through carbon neutral behaviour.

The development of energy saving technology as well as improving the efficiency and effectiveness of renewable and storage technologies provides significant

²⁴ <https://eandt.theiet.org/content/articles/2019/09/massive-seabed-auction-could-double-uk-s-offshore-wind-power/>

opportunities for innovation in product and service development. The development of community energy systems linked to energy efficiency can reduce the costs of energy in the domestic sector and create new approaches to smart energy systems.

Water is part of the energy system through the tidal flow of the Humber Estuary and the River Hull, the heat contained in the water that can be extracted through water source heat pumps, and the pumping and processing of clean and dirty water. The effective use and movement of water has a large impact on the energy requirements. There is still much that can be done to both reduce the energy impact of water as well as extract the energy benefit.

Carbon Neutral Power Pathway Summary
<p>Council</p> <ul style="list-style-type: none"> • Move to a green tariff for electricity • Increase renewable energy generation and storage on buildings and land • Undertaken deep energy retrofit of buildings • Provide targeted advice to business on energy efficiency • Work with Northern Powergrid on distributive energy systems
<p>Public Sector</p> <ul style="list-style-type: none"> • Move to a green tariff for electricity • Install renewable energy and storage • Undertake deep energy efficiency in buildings • Develop good energy behaviours amongst staff • Deliver energy savings through procurement • Explore funding models for cross sector renewable energy
<p>Business</p> <ul style="list-style-type: none"> • Move to a green tariff for electricity • Invest in renewable energy and storage • Understand the impact and opportunities of decarbonised power to your business • Support staff to use energy wisely
<p>Government Support Required</p> <ul style="list-style-type: none"> • Maintain support for offshore wind • Relax planning restrictions to increase on shore wind development • Develop solar PV with battery storage incentives for business and community sector • Facilitate distributed power networks and integration

Mobility

Challenge

- Enable a major shift to sustainable travel
- Deliver an electric vehicle infrastructure in particular for properties without off street parking
- Develop a hydrogen transport infrastructure for road, rail and shipping

To meet the 2030 carbon neutral target we need to look more closely at what options/ alternatives are available for moving people, services and goods around, into and out of Hull. This consideration will help Hull focus not on the mode of transport initially but on the issue of mobility as transport is just the “vehicle”, it is sustainable mobility that we want to provide that moves people and goods in the most effective way, Chart 7.

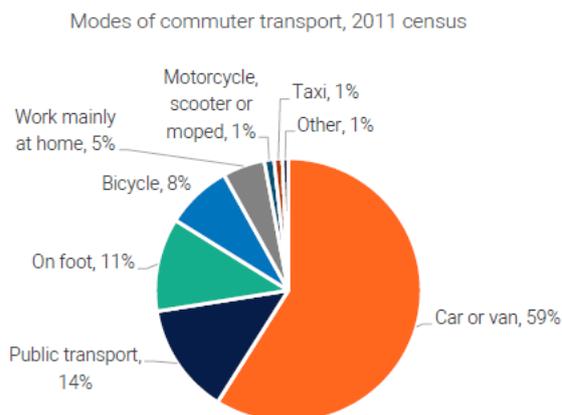


Chart 7: Hull Modes of Transport: Census 2011

The decarbonisation of transport will require a mobility system that actively supports and enables sustainable travel as a priority with all of the associated benefits that a more sustainable, environmentally beneficial and healthier mobility solution can provide including better air quality delivering a reduction in years of ill-health and an increase in years of active life.

To achieve carbon neutrality for existing mobility choices the city needs to do two things, firstly, increase the availability and attractiveness of sustainable travel choices, walking, cycling and public transport and secondly increase the use of zero carbon emission transport through the use of electric and hydrogen powered vehicles.

Hull will need to take steps to increase the use of walking, cycling and public transport through building new infrastructure to support their growth and influencing

modal choice through putting in place appropriate levers based around time/cost/quality interplay to enable these to become attractive and practical choices.

For improvements in the rail infrastructure further engagement will be required with Government/ Network Rail and Transport for the North over the electrification of the main rail line to Hull. Support will also be sought from Government towards improvements to port infrastructure and services for decarbonisation.

The Government has set a national target for a ban on the sale of non-hybrid petrol and diesel cars from 2040 with the aim of accelerating the increase in the uptake in the purchase of electric vehicles. As the Committee on Climate Change have stated the date needs to be brought forward to hasten this transition. Hull will lobby for this change to support its 2030 carbon neutral target.

Chart 8 highlights the growth in the number of charge points installed in HU postcode area is growing including those available to the public²⁵. The Council is increasing the number it has available at its car parks for the public to use as well as those for its own fleet. Businesses and organisations in Hull are also cumaking the move to electric vehicles for their fleets, customers and staff.

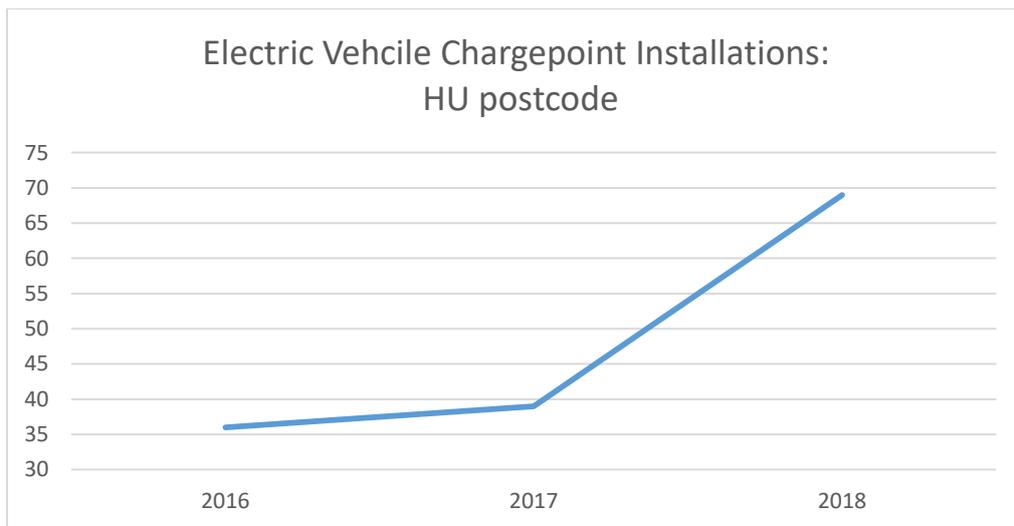


Chart 8: Electric vehicle Chargepoint Installations HU Postcodes: Northern Powergrid notified installations.

The development of charging infrastructure for existing homes is currently being explored and solutions to enable charging for residents without off-street parking will develop over the next few years. This will require significant investment in charging points as well as strengthening the capacity of the electricity network to provide the power requirements. Hull has over 8,000²⁶ properties which have no off street parking provision and therefore Hull will develop an approach to address how

²⁵ <https://www.zap-map.com/live/>

²⁶ 2011 Census number of terraced properties with at least one car

charging facilities can be introduced to serve this type of property and feed this into Government so that policy, funding and business models can be developed to address this situation.

At present there are no commercially available carbon neutral solutions for heavy goods vehicles, freight trains or shipping. The solution, being developed, for these modes of transport is based on hydrogen fuel cell technology but in the short-term the market is moving towards increased use of low carbon fuels notably for rail and shipping sectors with the potential in the shipping sector for the use of on-shore electric connection while berthed to run the ships systems. Through addressing the challenges with the availability of hydrogen as a fuel for heating, as previously discussed, this will enable the development of a hydrogen transport fuel infrastructure. However, there are smaller scale hydrogen production solutions that can provide a stimulus to the transport sector in particular for heavy goods vehicles, and the Council is working with the Transport Systems Catapult on these approaches.

As a major maritime city, the decarbonisation of shipping and port activity is part of our future maritime legacy. While shipping decarbonisation is addressed internationally through the International Maritime Organisation there is the opportunity to work with international partner ports in the North Sea to develop collective approaches to support decarbonisation of ports and shipping.

Carbon neutral Mobility Pathway Summary	
Council	<ul style="list-style-type: none"> • Electrification of fleet vehicles including pool vehicles • Support the development of public electric charging infrastructure • Increase sustainable travel across the city for commuting and business travel • Support the development of electric and hydrogen transport and infrastructure • Work with the Port of Hull and businesses on carbon neutral opportunities
Public Sector	<ul style="list-style-type: none"> • Replace fleet vehicles with electric alternatives • Provide electric charging infrastructure for staff at work • Incentivise sustainable travel amongst staff for commuting and business travel
Business	<ul style="list-style-type: none"> • Replace fleet vehicles with electric and low emission alternatives • Provide charging infrastructure for staff at work • Support sustainable travel for staff and smart working • Assess impacts of carbon neutral transport on own operations and supply chain • Identify growth and innovation potential in carbon neutral transport and infrastructure
Government	<ul style="list-style-type: none"> • Accelerate the date for the ban on the sale of non-hybrid and electric cars forward • Increase support for hydrogen fuel infrastructure for road, rail and shipping • Provide funding for hydrogen heavy goods vehicles • Provide funding for the electrification of the main rail line into Hull

Consumption

Challenge

- Embedding a circular economy approach within the economy and supply chain
- Significantly reduce the amount of food waste and develop a more plant based diet
- Understand and reduce the embedded carbon in development and purchases
- Increase understanding of consumption derived emissions to drive design and production innovation

The need to reduce consumption emissions alongside production emissions presents a significant challenge to all cities.

Hull's consumption emissions, based on an initial estimate, amount to an additional 2,600 ktCO₂e or 1.8 times²⁷ the production emissions for Hull, although there will be some double counting between production and consumption emissions²⁸ and is subject to further analysis over the coming months.

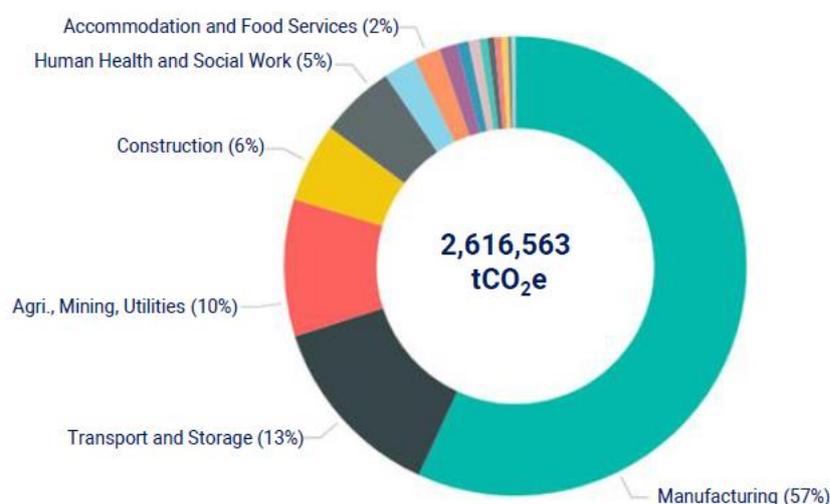


Chart 9: Hull Consumption Emissions by Sector

The eight areas identified in Chart 9 represent the majority of consumption emissions with manufacturing covering 57%, transport and storage 13%, Agriculture, mining and utilities 10% and construction 6%.

²⁷ Hull Consumptions Emissions Assessment: September 2019 Anthesis

²⁸ A report produced by Anthesis on the consumption emissions of the city is available at www.hullcc.gov.uk

This new understanding of Hull's consumption emissions provides clear focus of the areas where resources will need to be directed to impact upon this area of emissions.

Manufacturing covers some of the largest employers in Hull covering 18,000 employees and 15% of the workforce and presents a key area of the local economy where there are significant opportunities for business to work together on carbon emissions reduction and developing the skills within the economy on sector based consumption emission reduction. This can also support the development of knowledge and skills sharing on carbon reduction through supply chains.

RB for example have a leading approach to their emissions reduction and are committed to setting a science based carbon target and engaging with all of their supply chain to understand the full extent of the carbon impact of their businesses.

The report undertaken by Anthesis provides significant insight into the consumption emissions and therefore areas where work can be developed over the coming years.

While much of the action around consumption emissions will need to take place through increasing awareness and knowledge within the public and private sector businesses, there are also community scale opportunities.

There are opportunities also to deliver consumption emission reduction alongside other projects through the achievement of co-benefits. The development of local projects around issues such as food poverty and food waste reduction have a direct link into addressing consumption emissions within Hull derived from the agricultural sector.

Hull Food Partnership

The Hull Food Partnership was formed in 2017 with the aim of promoting sustainable food principles across the city. Managed by a multi sector steering group with representation from Economic Regeneration and Public Health, the partnership has over 40 members, from large organisations such as Wilberforce College, to independent food outlets and community centres. In June 2019 the Hull Food Partnership achieved the nationally accredited Sustainable Food City Bronze Award for Hull after submitting evidence of sustainable food approaches in Hull and an action plan for future priorities.

The partnership works with organisations and communities across the city to address climate change by promoting a vibrant local food economy and local food production, also access to healthy food and tackling food inequality. The ethos of the partnership is to encourage individual and corporate sustainable food choices that reduce food miles, reduce food waste, and support the local food economy.

An important approach to understanding the consumption emissions in production and development is through an assessment of the embedded carbon. The Environment Agency undertake embedded carbon analysis of flood defence investment to help them meet their 2030 carbon neutral target. This clear

understanding links through exploring how carbon can be reduced in the development and specification process as well as identifying opportunities to offset or sequester the carbon emissions that cannot be avoided. This also enables the Environment Agency to deliver co-benefits around natural flood systems and habitat creation and restoration.

Carbon Neutral Consumption Pathway Summary	
Council	<ul style="list-style-type: none"> • Undertake embedded carbon analysis of construction projects • Increase understanding of organisations consumption emissions and reduction approach through procurement • Understand scope of influence for decarbonisation through commissioning • Understand business waste volumes and reduce
Public Sector	<ul style="list-style-type: none"> • Increase understanding of organisations consumption emissions and reduction approach through procurement • Understand business waste volumes and reduce
Business	<ul style="list-style-type: none"> • Increase knowledge of own consumption emissions • Identify opportunities to develop low and zero carbon products and services • Engage with supply chain on consumption emission reduction • Catering establishments assess use of “Winnow system” to reduce waste
Government	<ul style="list-style-type: none"> • Increase awareness of consumption emissions • Support business in developing and procuring low consumption emission products • Produce consumption emission data by local authority area

Innovation

Challenge

- Embed circular economy throughout the local economy
- Develop Hull as a Green SMART innovation centre
- Ensuring that opportunities in future low carbon industries are maximised
- Grasp the economic opportunity around knowledge, digitisation and skills

As we progress to a carbon neutral Hull there are significant economic opportunities that will need to be developed and provide the inspiration for innovation in products and services. The growth of knowledge in particular that around data mining, digitisation and robotics provide real opportunities for innovation. The development of innovation, within skills acquisition and reskilling programmes, enables innovation to become part of the DNA of the carbon neutral Hull economy. The development of an inquisitive mind from early education enables innovation to become part of an economic approach and increases the opportunities throughout the economy.

The development of a carbon neutral city provides significant opportunities for innovation in products, services and systems as well as new industrial sectors. Moving from a carbon based economy with our current high dependence on petrochemical products to one based on bio based compostable plastics is a significant market and with the cities close links to its surrounding rural economy, provides opportunities. Further, the development of bio-based products has a global market place to access and increase productivity.

There is a need to innovate within the existing plastics sector to develop products that are less polluting in manufacture and in end of life disposal. There will still be a need, for the foreseeable future, for traditional manufactured plastics within the medical and care sector, for example, but innovation will need to address many of the existing challenges.

Innovation in ensuring that waste resources do not fall out of the recycling system and can be remanufactured effectively will reduce the unintended consequences of plastics and other valuable resources.

The development of a hydrogen economy for heat and transport, as already discussed, will lead to innovation in product design and manufacture within the heating sector, for example that can build upon the existing knowledge with local companies like Ideal Standard as well as the development of innovation from within the University and extensive SME businesses in Hull.

Carbon sequestration through carbon capture and storage, in particular utilisation of the carbon, can release new products and processes in line with a circular economy approach as well as increase value. The close link between the Humber and both

the hydrogen and carbon capture and storage development at the moment puts Hull in a key position to maximise its benefits.

The circular economy, which is developing globally, provides important opportunities for resource efficiency through product and service design to ensure resource value is maximised and enable future use through both demanufacture and waste as primary resource. The University of Hull is part of two international research projects looking into the potential within the plastic sector and looking at the wider circular economy opportunities across all value chains for businesses and communities.

To maximise the benefits of a circular approach Hull will build upon the existing circular and industrial symbiosis relations within the city, establishing innovation opportunities and market places for companies to use and reuse existing resources, so Hull can maximise the value of all the products within its system.

Hull's smart city systems that are already at the heart of technology organisations like C4Di and Connexion who are providing the building blocks for innovation. Hull, through its public and private sectors, holds vast amounts of data and will develop spaces where data can be shared and explored to create new products and services. The development of a smart system around energy, resources and transport, for example, can have impacts beyond Hull and provides a fruitful area for increased productivity and export beyond the city boundary. As the first full fibre broadband city in the UK²⁹, Hull is the ideal place as the test bed for carbon neutral smart system solution. Hull will leverage this advantage to maximise the long term productivity and employment benefits.

While the Committee on Climate Change has stated that nationally the country can become net zero by 2050 using known and available technology there are significant opportunities to innovate as we move towards net zero, particularly as the city has a 2030 target. The target provides the city with a call to accelerate the move to carbon neutrality, and deliver an innovation approach that will achieve carbon neutrality, with fewer resources and maximise the available embedded value in existing and new areas of the economy. Hull will utilise our greatest innovators, our residents and businesses, so that we use the insight from experience and familiarity to drive a society wide innovation approach.

²⁹ <https://metro.co.uk/2019/10/11/hull-becomes-uks-first-city-with-full-fibre-broadband-coverage-10896919/>

Carbon Neutral Innovation Pathway Summary

Council

- Understand the circular economy opportunities within business operations
- Develop city system for circular economy visibility to increase value
- Identify opportunities to bring in funding to support innovation throughout the economy
- Facilitate Green SMART innovation
- Work with education establishments on innovation pathways

Public Sector

- Understand the circular economy opportunities within business operations
- Make data available to innovators to identify and develop products, insight and services

Business

- Identify opportunities for circular economy within own business and key supply chain
- Consider innovation opportunities within emerging carbon neutral economy and support resources required

Government

- Provide support for circular economy development and product innovation
- Develop national resource exchange systems to increase productivity and value maximisation

Skills and Jobs

Challenge

- Increase awareness and attractiveness of a carbon neutral future economy
- Increase the ambition to be part of a decarbonised future economy
- Develop innovation, skills and training for low carbon technologies
- Ensure that carbon intensive sector jobs are transitioned to carbon neutral
- Understand the skills and training transition required in key sectors

The growth in the future economy will be dominated by the creation of new jobs within the green economy and the development of new skills within many sectors underpinned by an education system developing through school that identifies the challenges of a carbon neutral Hull and the opportunities available. At present the green economy is the fastest expanding part of the UK economy with the low carbon and renewable energy economy growing by almost 7% in 2017 and the global economy and has been growing faster than any other sector for a number of years. It is expected that this growth will increase over the coming decades with Europe seeing up to 2 million additional jobs in this sector up to 2030³⁰.

Hull has already experienced this growth and transition in the economy with the Siemens Gamesa offshore wind turbine blade manufacturing factory which has seen new green economy jobs created and new skills gained within the economy, and the Energyworks energy from waste plant as well as the Ron Dearing UTC developing the skills required for future industrial change. The opportunity for growth within the green energy sector is significant and with Government support for offshore wind increasing and greater certainty within the market supporting inward investment. Other areas of green energy from photovoltaic and solar panels, air source heat pumps, hydrogen are all sectors that will grow as we move away from gas to heat our homes and offices, as well as key linked industries of carbon capture utilisation and storage.

Women into Manufacturing and Engineering

WiME is a business led programme designed to inspire girls and women to consider careers in manufacturing and engineering. The WiME Humber events have seen over 1,600 girls, parents, teachers and careers advisers attend. Airco, Siemens Gamesa and Swift Group started as the initial WiME Partners and partner numbers has now grown to 45 companies. The companies involved range from software, renewables, energy, chemicals, construction to ports & logistics and advanced manufacturing.

WiME has supported people into employment at companies including Airco, ABP, BP, Humber Bridge, Ideal Boilers, Ineos, Siemens Gamesa, Spencer Group and Swift Group.

³⁰ United Nations International Labour Organisation World Employment Social Outlook 2018

Underpinning the future jobs and skills market will be the education we provide Hull's young people from primary school onwards. This needs to cover not only how living within a carbon neutral Hull will require changes to the behaviours currently in society but also to provide the young people with the inspiration to play a leading role in how our future carbon neutral Hull is shaped across all sectors throughout this century.

The construction sector will require large changes to how construction takes place with the increase of Modern Methods of Construction likely to be required to meet higher energy efficiency in new buildings across the domestic and commercial sectors. The increase in energy efficiency work within the housing retrofit sector has also seen new skills developed around external wall insulation and the installation of photovoltaic panels on roofs of homes and commercial premises. This is likely to increase over the coming decade.

The expansion on the use of smart and app based technologies has already seen an increase in the use of smart energy controls in homes such as Tado, Nest and Hive and the use of technology such as "Alexa" and "Google Home" all provide the opportunity for an increase in the green service sector.

The decarbonisation of transport through the growth of electric vehicles will see the current skills in the repair and servicing industry change as will the growth of hydrogen vehicles within the HGV fleet, shipping and rail.

These structural economic transitions demonstrate the rapid changes that are happening but also that they will accelerate rapidly over the coming decade if we are to become a leading carbon neutral economy.

Hull is at a critical point in understanding the green economy skills required for the future growth of the city and how it can ensure that business, industry, training providers, schools and colleges are in the best place to take maximum advantage of the opportunities and ensure that the transition away from a carbon based economy generates new employment and growth and that these opportunities are made accessible to all.

Carbon Neutral Skills and Training Pathway Summary	
Council	<ul style="list-style-type: none"> • Work with training providers and businesses to ensure that the right training courses are available in the City for its key economic sectors • Ensure that staff within the Council and its companies have the training and skills required for the green economy • Work with schools to raise understanding of the employment opportunities in the green economy in the City and the qualifications, training and apprenticeships available • Work with partners to address gender gap in a carbon neutral economy
Public Sector	<ul style="list-style-type: none"> • Assess how a carbon neutral economy will affect service demand and requirements • Ensure that all employees have the training and skills required for the green economy

- Humber LEP to develop a strategic skills plan focusing on green economic transition to support the SME sector

Business

- Understand the opportunities to your business of developing existing products and services for the green economy and the new skills and training required
- Understand how the transition away from carbon intensive activity and fuel sources will affect your current staff training and skills and the new ones that will need to be acquired

Government

- Provide funding to business and training bodies to ensure that courses can be developed and resourced effectively
- Work with national accreditation bodies to ensure that the right skills are available for the green economy
- Support the development of local skill and training transition audits in key sectors

Fair Transition

Challenge

- Ensuring that carbon neutral heating doesn't increase fuel poverty
- Ensuring that businesses and residents understand what a net zero Hull looks like
- Ensuring that the jobs in high carbon industries and businesses are protected
- Ensuring that residents are able to access new carbon neutral economy jobs

The move to a carbon neutral Hull will need to ensure that everyone benefits from the changes, and that it does not create additional burdens on vulnerable residents and businesses in particular transition within current high carbon dependant sectors.

The role of young people in ensuring a fair transition is crucial as there is a high level of interest and inspiration that they are bringing to addressing the challenge of climate change. Ensuring a fair transition needs to be inclusive and working with Hull's young people to shape the future and address the social and economic potential impacts of carbon neutral Hull is critical.

The most pressing issues is ensuring that the move to zero carbon heating does not increase the numbers of residents in fuel poverty and is developed to reduce this number. Improvements in energy efficiency and thermal performance within homes will help reduce the demand for heating in some homes. However, the implications of potential increased heating costs, from electric and hydrogen heating need to be better understood, so that effective approaches to alleviating fuel poverty can be taken locally, but also so that Hull can provide the evidence to shape Government policy and investment in this area.

Becoming a carbon neutral city will require action to ensure that residents are equipped for the changes in the workplace. This includes training for new entrants to the jobs market and reskilling for those currently in employment, be that in business and industries that are currently high carbon based as well as those required for the new "green" jobs in the economy.

There will be significant new industries in hydrogen generation, carbon capture utilisation and storage, electricity grid development and electric/ hydrogen transport sectors for example, that will require both new skills and reskilling. There will be an increase in automation and data analysis services as SMART approaches are developed.

The carbon neutral economy will need to generate an increase in employment opportunities and productivity for residents and working with local business and industries and training providers develop a clearer understanding of how sectors will be affected as the pace and scale of change increases over the next decade to ensure that courses at colleges and training centres can be made appropriate.

There will need to be clear economic analysis of the local economy and engagement with business and entrepreneurs to support transition to a carbon neutral city and ensure that not only jobs are created and protected but also that productivity in the local economy grows as a result of the changes that will happen.

The delivery of carbon neutrality through changes in transport will have significant benefits for improving air quality, a key challenge for Hull. Poor air quality disproportionately impacts residents who live in areas with a high concentration of roads or close to trunk roads, polluting industries and businesses. The port also creates significant air quality challenges from ship movements and freight movements associated with port activity.

The transition to a carbon neutral mobility sector will require, as previously discussed, a move to a system that incentivises more sustainable modes of travel like public transport. However for those that are currently dependent upon car travel and can only access second hand vehicles there is a challenge. The number of electric vehicles in Hull at present and in the foreseeable future will not generate a significant enough second hand market for the price to not be beyond the reach of our lower paid residents. The Government's 2040 target for hybrid and electric vehicles, mentioned above, is unlikely to create a substantial second hand market for at least 15-25 years unless the target date is brought forward and the current costs of an electric vehicle fall and the availability of electric vehicles increases markedly.

Linked to this is the challenge to provide a charging solution for residents without off street charging as discussed above in the Mobility chapter as well as developing a robust and efficient sustainable travel system.

Consequently, a key approach moving forward over the next ten years is to obtain a greater insight into achieving fair transition and develop both local responses based upon our understanding but also provide the evidence to Government to facilitate policy changes to ensure a fair transition to a carbon neutral society. Hull will be able to learn from working being developed, at present, by the Scottish Just Transition Commission³¹ to help understanding the approaches requiring adoption.

Fuel poverty, access to charge points, access to sustainable travel, jobs in existing businesses and jobs in new and developing businesses are just the start of our journey to fully understand and ensure fair transition to a carbon neutral Hull.

Carbon Neutral Fair Transition Pathway Summary
Council <ul style="list-style-type: none">• Continue to reduce fuel poverty• Undertake Citizens Inquiries into the key transition challenges and opportunities• Integrate Fair Transition assessment within climate commission work programme to identify key risks and solutions• Ensure investment organisations have signed up to the voluntary Task Force on Climate Related Financial Disclosures
Public Sector

³¹ <https://www.gov.scot/groups/just-transition-commission/>

- Ensure that roadmaps for carbon neutrality establish fair transition
- Assess organisation investment companies have signed up to the voluntary Task Force on Climate Related Financial Disclosures

Business

- Understand the impact on the current and future skills required by workforce
- Understand cross sector skills deficits to support the development of effective training provision

Government

- Develop future work assessments of carbon neutral economy and sectoral challenges
- Undertaken fuel poverty assessment of carbon neutral heating
- Develop national approach to fair transition addressing local challenges

Carbon Sequestration

Challenge

- Significantly increase the amount of land developed with Natural System Solutions
- Develop a carbon reuse economy
- Enable local carbon sequestration of embedded carbon in development
- Ensure that technical carbon sequestration is developed that benefits Hull

Carbon sequestration presents a natural and technical element approach; tree/habitat creation, restoration and management and carbon capture and storage. While the city does not have a concentration of high carbon emitting manufacturing or power generation as other parts of the Humber, the proximity of Hull to the proposed carbon capture and storage networks, provides the opportunity for Hull business with significant carbon emissions to utilise technical carbon capture technology, on site, and feed into the proposed network to the southern north sea being developed under the Zero Carbon Humber³² project.

Hull is working closely through the Humber Local Economic Partnership (Humber LEP) with partners so that it can ensure that as the carbon capture and storage infrastructure develops the city can ensure that businesses are able to take advantage.

The technical carbon sequestration approach will address carbon at the point of emission for some businesses, and the City will take significant steps to reduce its emissions through the activities covered in the other chapters though there will still be some carbon emission that will be generated. These emissions can only be addressed through natural carbon sequestration or natural system solutions. The Committee on Climate Change has identified that nationally there needs to be a significant increase in tree planting to meet this gap between reducing emission and storing carbon from those emissions that cannot be avoided.

Local analysis has identified that applying the national net zero tree planting target to Hull will require the planting of 22,000-36,000 trees a year. In the 2019 planting season Hull has planted 14,000 trees and another 44,000, over the period 2020-2022, will be planted in the HEYwoods area. While the planting in Hull in the last year places it as the leading local authority area for tree planting within the Northern Forest area, the scale of tree planting required over the coming decade is significant and will require new funding models to sit alongside current sources as well as a clear understanding of Hull's tree planting land capacity.

³² <https://www.zerocarbonhumber.co.uk/>

	Unit	UK	Hull	HEYwoods
Total Land Area	<i>km²</i>	242,495	71.5	2,479
Committee on Climate Change 30,000ha/year target	<i>Hectares per year</i>	30,000	9	307
	<i>Trees per year</i>	75,000,000	22,114	766,717
Committee on Climate Change 50,000ha/year target	<i>Hectares per year</i>	50,000	15	511
	<i>Trees per year</i>	125,000,000	36,856	1,277,861

Table 5: Committee on Climate Change Net Zero tree planting requirements pro-rated for Hull

To ensure that natural systems solutions provide the carbon neutral solutions for the city, there is a requirement to more fully understand what the scope is for tree planting, both within and outside the city. The carbon sequestration potential will also need to be considered against other land use opportunities such as energy generation discussed previously.

This assessment will enable a target to be set for the full potential for tree planting alongside other natural system solutions.

Hull, with its close relationship to the river and estuary, has a greater potential to deliver carbon sequestration through multiple habitat creation solutions. It is able to develop approaches that store carbon quickly in the short term, more slowly over the long term and provides habitats that are adaptable to climate change so that carbon does not leak from the natural system as the climate warms.

The Humber Estuary, River Hull and drain systems provide opportunities to look at different natural carbon storage solutions, aside from trees, to see how different grasses and the way that water edges are managed can increase carbon storage capacity and provide increased biodiversity benefits.

The development of natural system solutions provide significant co-benefits with society wide benefits. Within urban areas trees³³ and habitats in parks, school grounds, gardens, business parks, road sides and in the public realm provide air quality benefits and natural cooling and shading. These areas alongside wider woodland and habitats reduce flood risk, increase biodiversity and provide access to the countryside and nature, which has proven physical and mental health benefits³⁴.

Alongside the creation of new carbon sequestration and the use of net biodiversity gain through planning, there is a need to continue to maintain Hull's existing tree

³³ <https://leaf.leeds.ac.uk/i-tree-leeds-putting-a-value-on-the-citys-trees/>

³⁴ <http://publications.naturalengland.org.uk/file/10620067>

cover and habits. Increasing community ownership of areas that have been developed such as those in Gipsyville and North Bransholme has long term benefits.

The development of increased tree planting and habitat creation for sequestration benefits provides the opportunity to generate new funding models linked to local businesses, funding carbon offsetting as part of a wider decarbonisation strategy. The Committee on Climate Change has stated that carbon sequestration should take place within the UK, and the city therefore, has the opportunity to develop an effective local natural system solution funding model and leading sequestration approach based on reducing carbon emissions and ensuring effective climate adaptation.

Carbon Neutral Sequestration Pathway Summary	
Council	<ul style="list-style-type: none"> • Work with local business and Government on technical carbon capture and storage opportunities • Assess all Council land holdings for PV, battery and sequestration potential. • Develop local natural carbon sequestration investment model for the city • Deliver national leading net biodiversity gain schemes through Planning • Develop with partners the natural assets of the city to establish global leading urban sequestration solutions
Public Sector	<ul style="list-style-type: none"> • Develop funding models with partners for natural sequestration investment • Assess estate for carbon sequestration potential
Business	<ul style="list-style-type: none"> • Support local natural carbon sequestration solutions • Develop local natural carbon sequestration as part of a wider decarbonisation strategy • Assess whether a technical carbon capture approach would be viable for your business and steps required
Government	<ul style="list-style-type: none"> • Provide long term funding for tree planting in line with the recommendations of the Committee on Climate Change • Provide funding to assess the impacts of different natural sequestration solutions in Estuary and River habitats • Provide funding to link sequestration and adaptation natural system solutions

Glossary

Net Zero/ Carbon Neutrality:

Production based Carbon emissions cannot exceed zero. This does not mean that no carbon emissions are released, or no fossil fuels are burnt, but that the small amount that are released are subsequently captured, by natural means (e.g. trees and mangroves) or by human-made inventions (e.g. carbon capture and storage).

Decarbonisation

Means reducing greenhouse gas (GHG) emissions from the production and consumption of goods and services. The phrase is broadly used to describe the activities undertaken to achieve net zero or carbon neutrality.

Natural System Solutions:

This covers a suite of natural solutions to capture carbon as has been done by the environment over millennia. Solutions include tree planting (urban areas, parks, woodland and forests), habitat creation such as peat bog restoration, inter-tidal mud flats, and mangrove and seagrass tidal areas. This also includes the management of these areas to preserve and enhance their carbon storage abilities.

Carbon Capture Utilisation and Storage:

This is a process where by a chemical reaction is engineered in waste gases from a process so that the carbon dioxide is captured. The carbon dioxide is then moved either by vehicle or more likely by an underground piped network for storage most likely within former depleted oil and gas caverns offshore. The carbon could also be utilised in other processes such as brewing or greenhouse growing.

Carbon Budgets:

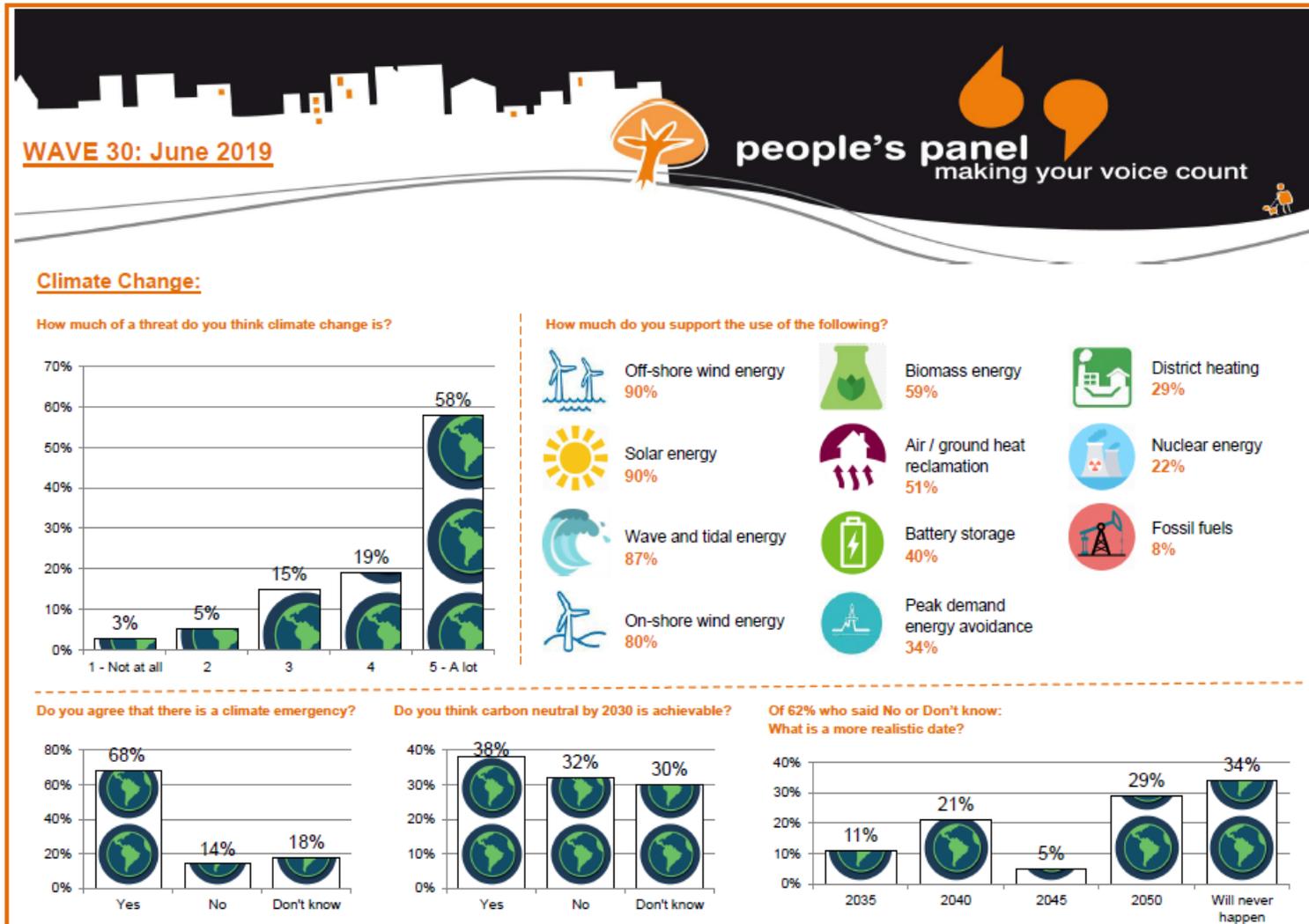
These take a maximum amount of carbon (e.g. 20 tonnes) that can be emitted over a set period of time (e.g. 20 years) and breaks this down into a series of budgets for example 5 tonnes per 5 year budget period so that the overall 20 year budget of 20 tonnes is not exceeded. Carbon budgets are contained in the Climate Change Act and Paris Agreement setting total UK and global carbon.

Carbon Targets:

This sets a future target for carbon reduction e.g. carbon neutral by 2030. However, if this is not linked to a carbon budget, of maximum carbon emissions over a time period, then meeting a target for carbon reductions may mean that significantly more carbon may be emitted

Appendix 1

Peoples Panel June 2019 Climate Change Infographic



Appendix 2

United Nations Sustainable Development Goals

No poverty

Zero hunger

Good health and well-being

Quality education

Gender equality

Clean water and sanitation

Affordable and clean energy

Decent work and economic growth

Industry, innovation and infrastructure

Reduced inequalities

Sustainable cities and communities

Responsible consumption and production

Climate action

Life below water

Life on land

Peace justice and strong institutions

Partnerships