Leeds Climate Commission

"Enabling climate action in a can-do city"

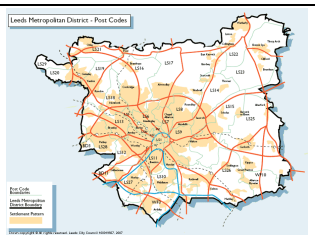
A SCIENCE-BASED CARBON BUDGET, CARBON TARGETS AND CARBON-ROADMAP FOR LEEDS

Context

- A landmark 2018 report from the United Nations Intergovernmental Panel on Climate Change (IPCC) has warned of the multiple risks of climate change, and the need to restrict global warming to 1.5˚C[1] above pre-industrial levels.
- The risks of climate change include the increased frequency and intensity of extreme weather events such as storms, floods, heatwaves and droughts, rising sea levels, significant disruption to food and water systems, loss of habitats and growing numbers of species extinctions.
- These risks and impacts are forecast to increase significantly as levels of warming increase – with scientists particularly concerned about the potential for natural feedback loops, for example where thawing permafrost releases currently locked-in stores of CO2 and methane (a potent greenhouse gas) that will then lead to further climate change (so-called runaway climate change).
- The science clearly shows that these risks can be significantly reduced if levels of warming are limited. For example, limiting average global surface temperature increases to 1.5˚C rather than 2˚C would mean sea levels increasing by 10cm less by the end of the century, with key habitats and biodiversity hotspots such as coral reefs avoiding destruction. Restricting warming to 1.5˚C rather than 2˚C would also see the Arctic Ocean likely to be free of ice once per century rather than once per decade.
- The UN IPPC has warned that restricting global warming to 1.5˚C above pre-industrial levels will require "rapid and unprecedented changes in all aspects of society".
- Deep transitions or transformations in energy generation and in the ways in which energy is used in houses, public and commercial buildings, transport and industry are required, especially in cities where more than half of the world's population now lives.
- Urgent action is required. The opportunity to limit warming average global temperature increases to 1.5 °C will not last long. Given existing emissions trajectories, the UN IPCC report warns that the window to limit world temperature increases to under 1.5 °C and avoid the worst climate change impacts could close within the next 12 years.

[1] As measured by global average surface temperature increases.

What Leeds Should Do

	**GLOBAL CARBON BUDGET[2]** **420 giga (billion) tonnes CO2e[3]**		**LEEDS CARBON BUDGET[4]** **42 mega (million) tonnes CO2e**

- To restrict increases in global average surface temperatures to no more than 1.5°C, it is estimated that the world can emit no more than approximately 420 giga (i.e. billion) tonnes of greenhouse gases (GHGs) between 2018 and 2050.
- Leeds's share of this (on a per capita basis) is estimated at approximately 42 mega (i.e. million) tonnes. This is the city's overall science-based 'carbon-budget' between 2018 and 2050.
- Leeds's annual GHG emissions in 2005 were about 6.8 million tonnes CO2e. In 2018, Leeds' emitted an estimated at 3.95 million tonnes CO2e. This means Leeds' emissions have fallen by 43% in the last 14 years.
- A significant proportion of the emissions cuts realised so far have come from the decarbonisation of the electricity that Leeds consumes. Structural changes in our economy and gradual improvements in the energy efficiency of Leeds' homes, buildings and industry and in the fuel efficiency of vehicles in the city have also contributed.
- Looking forward, we can expect further reductions in the carbon intensity of electricity supplied through the national grid. If trends in energy and fuel efficiency within the city also continue, we forecast that Leeds' emissions will fall by 59% by 2050 when compared to 2005. This means that without further action Leeds will continue to emit 41% of its 2005 level of emissions in 2050.
- A science-based carbon budget for Leeds suggests that much deeper and faster emissions cuts are needed. The science-based targets – expressed as 5-yearly carbon budgets – are set out below.

Science Based Carbon Reduction Targets for Leeds (relative to 2005 levels)
• 2025 – 70% cut • 2030 – 85% cut • 2035 – 95% cut • 2040 – 97% cut • 2045 – 99% cut • 2050 – 100% cut

- Changes in national policy – especially in the form of continued reductions in the carbon intensity of electricity - will not be enough to deliver on these targets. Significant extra effort within Leeds will also be needed.
- The level of the challenge is especially pressing in the next decade – with the current 43% reduction on 2005 levels of emissions needing to increase to 70% by 2025 and 85% by 2030.
- Without this extra effort within the city, we forecast that Leeds will use its total carbon budget to 2050 within 9 years.

[2] The total amount of GHGs that can be emitted if global average surface temperatures are to have a good chance of being limited to 1.5 °C.

[3] A measure for all GHGs expressed as an equivalent of CO2.

[4] Leeds' per capita share of the global carbon budget that can be emitted if global average surface temperatures are to have a good chance of being limited to 1.5 °C.

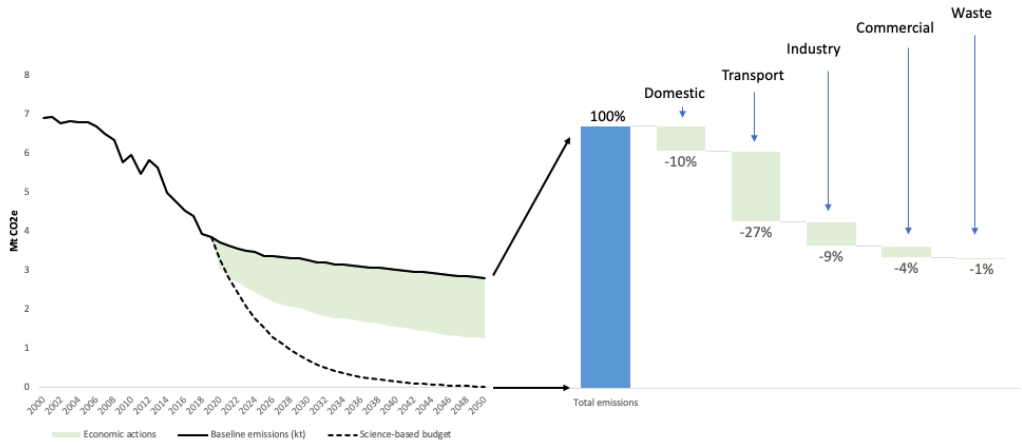
Can We Meet these Carbon Targets and Become a 'Carbon Neutral' City?

- The Leeds Climate Commission had already evaluated all of the existing, available options for reducing the city's GHG emissions as part of its 'mini-Stern' report.
- This report assessed the carbon saving potential of familiar options such as better insulation, more efficient heating and appliances, more efficient or electric vehicles and solar panels that could be adopted across the city.
- The analysis also shows that although these existing options can make a significant contribution to reducing emissions, they will not deliver all of the reductions in GHG emissions required in the targets set out above. For the purposes of this roadmap, we therefore identified and assessed some more innovative options, including some behavioural measures that could contribute to global carbon cuts outside of the city.
- Below we summarise the contribution that can be made by the four categories of options: economically viable options, technically viable options, selected innovative options and behavioural options that make a global contribution.
- We base our analysis on the extent to which each category of options could contribute to closing the gap between our existing emissions levels, and the level of emissions we need to reach in order to stay within our carbon budget through to 2050.

Economically Viable Actions

- Economically viable options are those energy and fuel efficiency measures and small-scale renewable options that would pay for themselves over their lifetime, with the savings being captured and reinvested in further low carbon measures to the point where all of the investments break even.
- In total, adopting all of the cost-effective options across the city would close the gap between current emissions and carbon neutrality by 51%.
- Adopting all of these measures in transport across the city would close the gap by 27%, adopting them in homes by 10%, in public and commercial buildings by 4%, in industry by 9% and in waste by 1%.
- Adopting these options could see Leeds reduce its total energy bill by £277m per year. Households in Leeds could save £81m per year; schools, hospitals, offices and other buildings could save £31m a year and industry in the city could cut its costs by £13.8m a year. All of this would create 4,200 years of extra employment in the city.

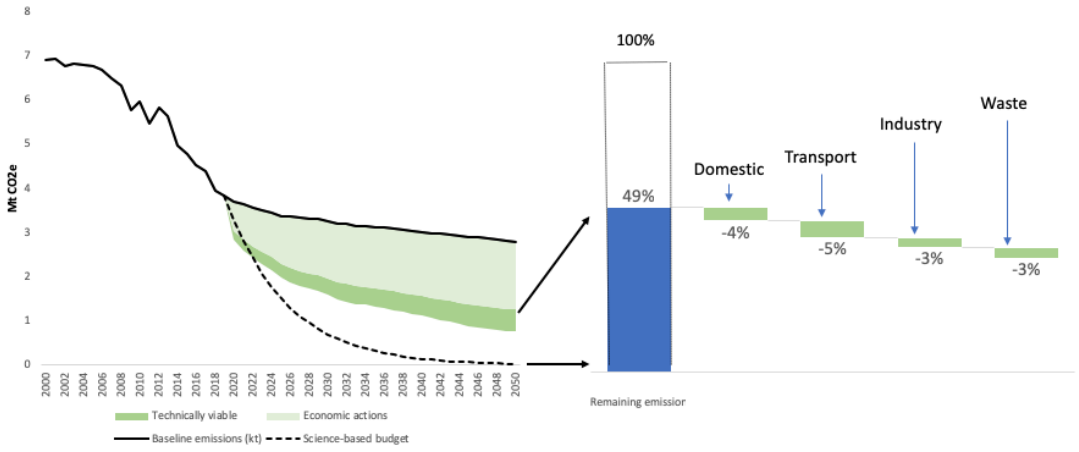
The contribution of economically viable actions to closing the gap



Technically Viable Actions

- Technically viable options are those energy and fuel efficiency options and small-scale renewable options that are technically viable but that would not cover their costs through the direct energy savings that they could generate, even though they could generate significant indirect benefits such as improved public health or better air quality.
- In total, adopting all of the technically viable options across the city would close the gap between current emissions and carbon neutrality by 15%.
- Adopting all of these measures in transport across the city would close the gap by 5%, in homes by 4% and in industry and the waste sector by 3% each.
- The carbon reductions from these technically viable options would be in addition to those that could be realised through the adoption of the economically viable options. This means that we could close the gap between current emissions levels and carbon neutrality by 66% by adopting all economically and technically viable options.

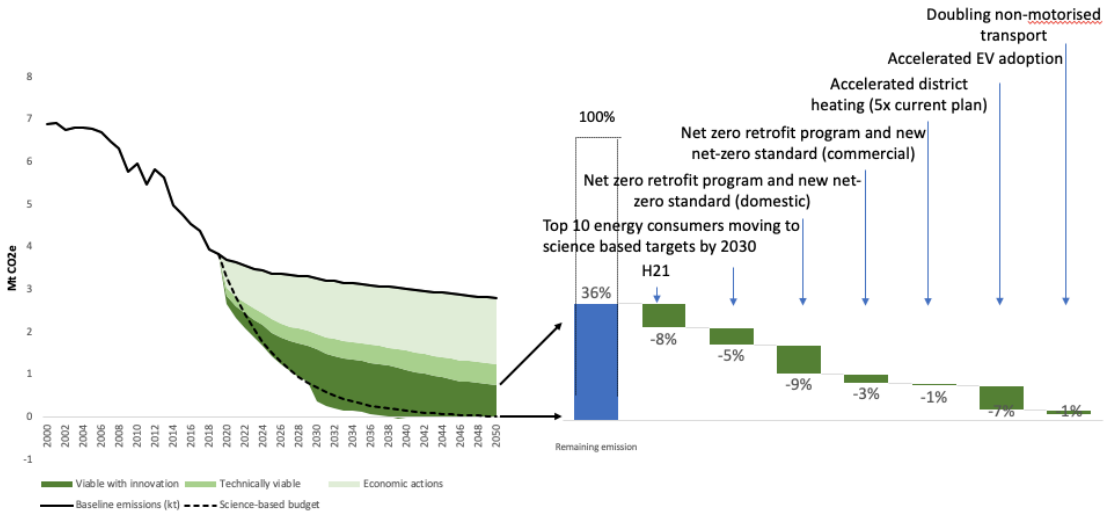
The contribution of technically viable actions to closing the gap



Innovative Actions

- There are many innovative options that could help to close the gap between current emissions levels and carbon neutrality.
- The innovative options selected for assessment here include switching the heating network to decarbonised hydrogen rather than natural gas, working with the largest energy consumers to deliver significant improvements, pursuing deep retrofit of domestic and public/commercial buildings and ensuring that all new buildings are essentially carbon neutral, accelerating role out of district heating and electric vehicles and promoting ambitious levels of active travel such as walking or cycling.
- Analysis shows that adopting all of these options through the 2020s would close the gap between the emissions levels that could be realised if all economically and technically viable options were adopted and carbon neutrality completely.
- Deep retrofit of domestic buildings and a requirement for carbon neutral new homes would close the total gap between current emissions levels and carbon neutrality by 9%, switching to hydrogen heating by 8%, accelerated adoption of electric vehicles by 7% and working with the top ten energy consumers so that they also adopt science-based targets by 5%.
- Adopting these innovative options could require policy support from national government as well as new capacities, significant investment and wide-spread buy-in across the city.

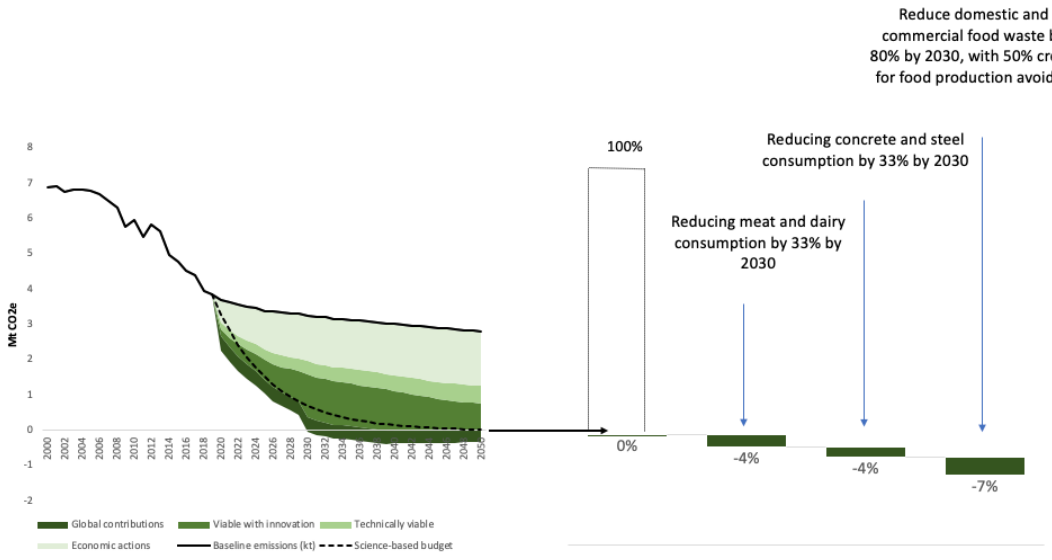
The contribution of selected innovative actions to closing the gap



Behavioural Actions that Make a Global Contribution

- Leeds' carbon footprint is normally assessed based on the fuel and electricity that is consumed with the city. These emissions are sometimes referred to as 'territorial emissions'.
- However, the city's carbon footprint also includes the emissions that occur outside of its boundaries as a result of the demand for goods and services that are consumed within the city. These emissions are sometimes referred to as embedded or 'consumption-based emissions'.
- This consumption-based carbon footprint of the city is significantly higher than its territorial emissions – and Leeds can therefore make a broader contribution to reducing global emissions by changing its consumption patterns.
- These changes could come in many forms, but here we focus on the potential contribution of reducing consumption of steel and concrete by 33% by 2030, reducing consumption of meat and dairy products by 33% by 2030, and reducing food consumption by reducing food waste by 80% by 2030.
- If the city takes 50% of the carbon credit for all of these measures, then the gap between current levels of emissions and carbon neutrality could be reduced by 7% by reducing food consumption by tackling food waste and 3% each by reducing concrete and steel consumption and meat and dairy consumption.

The contribution of behavioural actions to closing the gap



What We Need to Do Next

- If in 2005 we had proposed that we needed to cut the city's carbon emissions by 43% within 15 years that would have seemed ambitious. However, this level of reduction in emissions has been delivered, through a combination of national and local action.
- Nonetheless, the most recent IPCC report clearly shows that further and more rapid reductions in carbon emissions are now needed.
- The analysis presented in this report shows that technically and to a large extent also economically it is entirely possible for Leeds to become a carbon neutral city and to meet ambitious science-based carbon reduction targets.
- However, we should not under-estimate the broader challenges that need to be overcome if Leeds is to make the transition from where it is now to where it needs to be if it is to become a carbon neutral city.
- Delivering the further changes needed to meet ambitious targets – especially in the coming decade when fast and deep carbon cuts are required - will depend on transformative action in all parts of the city.
- It will require political, social and business support within the city, and support from central government, investors and organisations who influence life in the city.
- Leeds City Council formally signing up to the science-based budgets and the 5-yearly carbon targets set out above is a critically important first step – not least in signalling political support for the transition.
- Other organisations – especially the largest organisations and energy users in the city – should also be encouraged follow suit.
- A key challenge is to ensure that the transition is a just and inclusive one – with steps being taken to ensure that people and places are not left behind and that all social groups and economic sectors participate in and benefit from the transition.
- A crucial next step is to establish a city wide 'conversation' to raise awareness, review and refine the options and to start to build public, business and political support for transformative action.
- Moving forward, support has to be maintained, capacities have to be built, ideas need to be developed, finances need to be secured, changes need to be delivered, progress needs to be tracked and learning needs to be accelerated.
- Leeds Climate Commission can play an active role in all of these areas – but transformations are required across the whole city.