Background

At COP21 in 2015, world governments collectively agreed to limit global warming to well below 2 °C relative to pre-industrial levels and to pursue efforts to limit global warming to 1.5 °C. This was further referenced in the Glasgow Climate Pact at COP26 in 2021, when governments committed to 'keeping 1.5 °C alive'. Every fraction of a degree counts towards achieving the Paris temperature goal and avoiding the worst impacts of climate change, but while it is still possible to restrict warming to 1.5 °C, we are currently not on track to achieve this without overshooting. Deep, rapid cuts to emissions are needed to reach Net Zero.

In this webinar, we considered what is meant by Net Zero and looked at the UK Government's priorities for achieving their aim of reaching Net Zero by 2050. We considered the science backdrop and how this can help with the implementation of Net Zero, sharing lessons learnt by the Met Office in implementing our Net Zero strategy. Finally, we discussed industry sustainability. We were joined by speakers from the University of Leeds, the Department for Energy Security and Net Zero, and the Civil Aviation Authority.

Key webinar talking points

Climate science

There is a near linear relationship between global mean temperature rise and cumulative CO_2 emissions. Every tonne of CO_2 we add to the atmosphere adds to global warming - reaching Net Zero and limiting cumulative CO_2 emissions is a requirement to stabilise the climate.

When we consider climate targets such as restricting warming to 1.5 °C, we can quantify the cumulative emissions to date and those that will be in the atmosphere if we reach this 'limit'. The difference between those emissions is referred to as the remaining carbon budget. If we were to reduce non-CO_2 greenhouse gases such as methane, then we could theoretically increase the remaining carbon budget for the same climate target. Alternatively, we could stabilise the climate at a lower temperature for the same remaining carbon budget.

As the remaining carbon budget is continually shrinking, it is very likely that we will overshoot the 1.5 °C target. The only way we can then come back to 1.5 °C is to reduce the cumulative CO_2 emissions in the atmosphere and effectively reach a negative CO_2 emissions regime. CO_2 removal is one of the potential techniques to achieve this, but the technology is only in its infancy and hasn't been tested at the kind of scale that might be required. It is therefore important that we mitigate as fast as possible now rather than relying on CO_2 removal.

Methane is known as a near-term climate forcer. Rapid, deep and sustained cuts in methane would have positive climate and additional benefits such as air quality. A recent study by Zosia Staniaszek[1] showed that not only would such cuts decrease the rate of warming in the immediate decades following intervention, but that surface ozone concentrations and air pollution would also decrease. This would be considered a co-benefit or win-win. At COP26, a global methane pledge was announced, with over 150 countries signed up to reduce global anthropogenic (human-induced) emissions by 30% from 2020 levels by the year 2030. If that ambition were to be realised, we would expect to see air quality, human health and crop yield benefits as a direct result.

In addition to anthropogenic emissions of methane, there are also natural sources of the gas. Tundra and wetland are examples of these. Wetlands are currently the single largest source of natural methane emissions into our atmosphere. Whilst these are taken into account in the study above, we also need to consider permafrost. Carbon is currently stored in frozen organic soils in the Arctic regions. If that thaws it will release carbon into the atmosphere. This is referred to as a positive climate feedback, i.e., changes to the climate resulting in further changes which magnify climate change further. The benefits of reducing emissions may then be even greater than some studies currently indicate.

IPCC AR6 Synthesis Report: Climate Change 2023

The IPCC Synthesis Report of the sixth assessment report (AR6) cycle was published the day before this webinar. It made it clear that the international community is not on a 1.5 °C pathway, but that alternative strategies and effective policies still remain possible. The report also emphasises that for every tenth of a degree of warming, the risk of droughts, flooding, heat waves etc. increases. It is therefore imperative that we reach Net Zero as soon as possible, limiting the cumulative CO_2 emissions that are reaching our atmosphere.

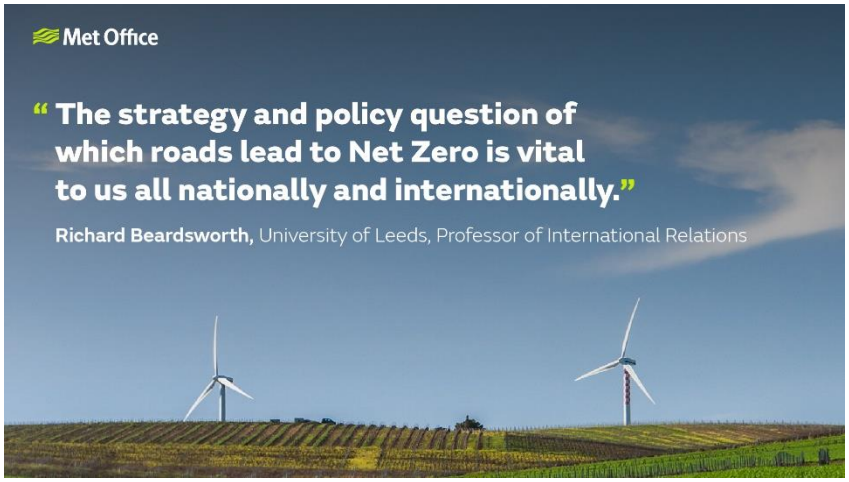
The Emissions Gap Report[2] published last year showed a clear gap between current ambitions and Nationally Determined Contributions and what is required to stabilise the climate and reach Net Zero.

[1] The role of future anthropogenic methane emissions in air quality and climate, Zosia Staniaszek et al. 2022
[2] UNEP Emissions Gap Report 2022

There is a huge challenge in trying to bring more ambitious targets forward in time, but science can continue to support the path towards Net Zero and support stabilisation of the climate through supporting mitigation pathways and assessment of those pathways.

UK policy

The strategy and policy question of which roads lead to Net Zero is vital to us all nationally and internationally. The UK Government ratcheted up its climate ambition ahead of COP26 in Glasgow with the aim of reaching 68% greenhouse gas emission reductions by 2030 against a baseline of 1990, a clear condition of achieving Net Zero by 2050. In 2021, the UK Government published its Net Zero strategy, which sets out how the UK will achieve reaching Net Zero emissions by 2050.



There are a number of key policies highlighted in the strategy which demonstrate how the Government will reduce emissions, including, for example, a fully decarbonised power system by 2035, future proofing of industrial sectors and a number of nature-based solutions such as restoration of peatland in England, increased tree cover through afforestation and increased biomass feedstock production and use. In addition to the Net Zero strategy, the Climate Change Act also sets legally binding interim targets for five-year carbon budget periods. These require reductions in emissions across all sectors of the UK economy and put us on the path to achieving Net Zero.

The greenhouse gas inventory is central to the UK's domestic and international efforts to tackle climate change, and robust and accurate reporting of emissions enable us to monitor and measure the impact of mitigation actions and our progress towards our climate targets. With such an emphasis on innovation in the Net Zero strategy, emergent technologies such as Bioenergy with Carbon Capture and Storage (BECCS), Direct Air Carbon Capture and Storage (DACCS) and other greenhouse gas removals (GGR) will need to be included in future inventories. The Department for Energy Security and Net Zero recently launched a multi-year inventory improvement programme. This aims to go beyond immediate measures for improvement and address medium- and long-term needs given the changing science, policy and emissions landscape.

The Climate Change Committee has clearly stated that the UK is not presently on track to meet mitigation ambitions. In terms of the road to Net Zero, we know what we have to do to get there, and the Government now needs to work out how we do that.

Net Zero opportunities and challenges

The road to Net Zero provides us with multiple opportunities and challenges as we work towards setting policies which will aid in the mitigation of emissions and climate change. Innovation has a key role in the Net Zero strategy. GGR provide a major opportunity, and technologies such as BECCS, enhanced rock weathering and biochar have the potential to provide abatement where emission

reductions from other activities are difficult. But these options also present challenges, such as how to deploy them at scale, identifying any potential long-term risks and ensuring the permanence of GGR.

How we use land is also incredibly important in mitigation and this is the only sector which reports both sources and sinks of emissions. It has enormous potential to be able to increase carbon sinks, which will aid in abating emissions from hard to decarbonise sectors. Options include afforestation, peatland restoration and soil carbon sequestration.

With regards to buildings, the UK has a large stock of older houses into which retrofitting climate-friendly measures is a challenge. The contrast of summer and winter temperatures also means a balance needs to be found between insulating a building to the point that it can't cool down (i.e., in the summer) or cooling it down to the point it can't heat up (in the winter). The scale of replacing gas boilers in the UK with heat pumps is also huge.

The Climate Change Committee 2019 Net Zero report[3] indicated that over 50% of measures that we need to put in place to deliver Net Zero are reliant on an element of societal/behavioural change. With regards to transport, there are tools available to help nudge positive choices. For example, passengers booking flights should be able to access information that provides an accurate comparison of how environmentally efficient flights from different airlines are.

Weather and climate science and services can continue to support the path to Net Zero. For example, the Met Office is looking at the impact of alternative fuels such as in a hydrogen economy. Science can also provide further evidence on remaining carbon budgets and climate monitoring.

Industry sustainability

We know that industry considers climate change an existential threat to the health of their business, particularly as consumers are becoming more climate conscious. Transport is one of the areas that is most difficult to decarbonise, and aviation is, of course, part of that. Aviation delivers significant economic and cultural benefits globally. However, we also know that the sector is facing a challenge to mitigate emissions, noise and other adverse impacts. Like many other sectors, sustainability in aviation is a complex, long-term challenge.

The aviation and aerospace industry are investing in new, more sustainable fuels, new forms of propulsion and more efficient operating procedures. Governments in the UK and globally are setting targets and introducing policy incentives through physical measures, for example to create the

[3] https://www.theccc.org.uk/publication/net-zero-the-uks-contribution-to-stopping-global-warming/

conditions for industry to deliver their required improvements. And regulators such as the Civil Aviation Authority also have a distinct role and a responsibility to enable the achievement of targets.

The Jet Zero Council is one example of collaboration between industry, government and regulators to focus efforts on developing low and zero emission technology and the UK Government's Jet Zero Strategy proposes a 2040 target for all airports to be Net Zero. The drivers for change, particularly in aviation, are technology innovation and sustainable fuels, and the enablers are regulations, road maps, investments and incentives.

Final summary

There is a near linear relationship between the global mean temperature rise and cumulative CO_2 emissions. Every tonne of CO_2 emissions we add to the atmosphere adds to global warming - reaching Net Zero and limiting cumulative CO_2 emissions is a requirement to stabilise the climate. As the remaining carbon budget is continually shrinking, it is very likely that we will overshoot the 1.5 °C target and it is important that we mitigate as fast as possible now rather than relying on CO_2 removal.

The UK Governments Net Zero strategy sets out how the UK will achieve reaching Net Zero emissions by 2050. A number of key policies highlighted in the strategy demonstrate how the Government will reduce emissions, including, for example, a fully decarbonised power system by 2035, future proofing of industrial sectors and nature-based solutions. In addition to the Net Zero strategy, the Climate Change Act also sets legally binding interim targets for five-year carbon budget periods. These require reductions in emissions across all sectors of the UK economy.

Innovation plays a key role in the Net Zero strategy with a drive to develop new processes and technologies that can reduce emissions and mitigate against existing greenhouse gas levels. Land also has enormous potential to be able to increase carbon sinks, which will aid in abating emissions from hard to decarbonise sectors.

Weather and climate science and services can continue to support the path to Net Zero. For example, the Met Office is looking at the impact of alternative fuels such as in a hydrogen economy. Science can also provide further evidence on remaining carbon budgets and climate monitoring.

There is much to be said for not forgetting to consider the public and the consumer sentiment in the whole climate change debate - having consistent messages to raise awareness and to educate the public. The consumers and public are the people that will have to respond to the government nudges for positive behaviours in all sectors. When opportunities exist to take up government incentives, for example on heat source pumps, the consumer is then educated enough to understand that there is an opportunity to make savings and also do good to the environment.