The role of energy in meeting the UK’s net zero greenhouse gas targets

Monday 9 September  |  14:00 – 16:30
Conference Auditorium 2, University of Leeds
Where do we stand?
Global warming

CO₂ Concentration – 2017 to 2019

Latest CO₂ reading
September 05, 2019

408.59 ppm

Carbon dioxide concentration at Mauna Loa Observatory

Source: Scripps Institution of Oceanography
Global warming

CO₂ Concentration – 1700 to Present

Latest CO₂ reading
September 05, 2019

Source: Scripps Institution of Oceanography

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Global warming

CO$_2$ Concentration – 800,000 years

Latest CO$_2$ reading
September 05, 2019


Source: Scripps Institution of Oceanography
Global warming

CO₂ Concentration – 800,000 years

Latest CO₂ reading
September 05, 2019

Source: Scripps Institution of Oceanography
Global warming

Observed and human-induced warming

The climate choice

+1.9°C in 2100/+1.4°C by 2200
Emissions peak by 2029; Negative emissions by 2080

+2.7°C in 2100/+2.8°C by 2200
Emissions peak by 2049

+3.1°C in 2100/+3.7°C by 2200
Emissions peak by 2089

+4.8°C in 2100/+7.8°C by 2200
Emissions peak between 2100 - 2150

Source: Projections based on CMIP5 RCP scenarios, from warningstripes.com
What do we do about this?
Global emissions pathways – the need for net zero

Global emissions pathways – the need for net zero

Science and international context

Global emissions pathways – role of each regions

Global emissions pathways – role of each regions

Alternatives to fossil fuels – Global average auction prices by commissioning date

Reducing emissions in the UK
Our approach to forecasting

Climate science

2050 Target

International & EU
Our approach to forecasting

Climate science

2050 Target

International & EU

UK Carbon Budgets (interim targets)
Our approach to forecasting

Sectors: scenarios, costs, required policy

- Climate science
- 2050 Target
- International & EU
- UK Carbon Budgets (interim targets)
- Power
- Buildings
- Industry
- Transport
- Agriculture
- Waste & F-gases
Our approach to forecasting

Sectors: scenarios, costs, required policy

- Power
- Buildings
- Industry
- Transport
- Agriculture
- Waste & F-gases

UK Carbon Budgets (interim targets)

- Fiscal impacts
- Economic impacts
- Security of supply
- Fuel poverty
- Competitiveness
- Air quality & health

Impacts

Climate science

2050 Target

International & EU
How UK net-zero scenarios can be delivered

Energy supply

Energy use

Land

CO₂ storage
How UK net-zero scenarios can be delivered

Energy supply

Energy use

CO₂ storage

Land
## How UK net-zero scenarios can be delivered

<table>
<thead>
<tr>
<th></th>
<th>2020s</th>
<th>2030s</th>
<th>2040s</th>
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<tbody>
<tr>
<td><strong>Electricity</strong></td>
<td>Largely decarbonise electricity: renewables, flexibility, coal phase-out</td>
<td>Expand electricity system, decarbonise mid-merit/peak generation (e.g. using hydrogen), deploy bioenergy with CCS</td>
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<tr>
<td><strong>Hydrogen</strong></td>
<td>Start large-scale hydrogen production with CCS</td>
<td>Widespread deployment in industry, use in back-up electricity generation, heavier vehicles (e.g. HGVs, trains) and potentially heating on the coldest days</td>
<td>Start large-scale hydrogen production with CCS</td>
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<td><strong>Buildings</strong></td>
<td>Efficiency, heat networks, heat pumps (new-build, off-gas, hybrids)</td>
<td>Widespread electrification, expand heat networks, gas grids potentially switch to hydrogen</td>
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<td><strong>Road Transport</strong></td>
<td>Ramp up EV market, decisions on HGVs</td>
<td>Turn over fleets to zero-emission vehicles: cars &amp; vans before HGVs</td>
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<td><strong>Industry</strong></td>
<td>Initial CCS clusters, energy &amp; resource efficiency</td>
<td>Further CCS, widespread use of hydrogen, some electrification</td>
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<tr>
<td><strong>Land Use</strong></td>
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<td>Afforestation, peatland restoration</td>
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<tr>
<td><strong>Agriculture</strong></td>
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<td>Healthier diets, reduced food waste, tree growing and low-carbon farming practices</td>
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How UK net-zero scenarios can be delivered

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<tr>
<td>Aviation</td>
<td>Operational measures, new plane efficiency, constrained demand growth, limited sustainable biofuels</td>
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<tr>
<td>Shipping</td>
<td>Operational measures, new ship fuel efficiency, use of ammonia</td>
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<tr>
<td>Waste</td>
<td>Reduce waste, increase recycling rates, landfill ban for biodegradable waste</td>
<td>Limit emissions from combustion of non-bio wastes (e.g. deploy measures to reduce emissions from waste water)</td>
<td>Move almost completely away from F-gases</td>
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<tr>
<td>F-Gases</td>
<td></td>
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<td>Deployment of BECCS in various forms, demonstrate direct air capture of CO₂, other removals depending on progress</td>
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<tr>
<td>Removals</td>
<td>Develop options &amp; policy framework</td>
<td></td>
<td>Hydrogen supply for industry &amp; potentially buildings, roll-out of infrastructure for hydrogen/electric HGVs, more CCS infrastructure, electricity network expansion</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>Industrial CCS clusters, decisions on gas grid &amp; HGV infrastructure, expand vehicle charging &amp; electricity grids</td>
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<td>Co-benefits</td>
<td>Health benefits due to improved air quality, healthier diets and more walking &amp; cycling Clean growth and industrial opportunities</td>
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How UK net-zero scenarios can be delivered

Role of societal and behavioural changes in the Further Ambition scenario

- Low-carbon technologies or fuels not societal / behavioural changes (9%)
- Measures with a combination of low-carbon technologies and societal / behavioural changes (38%)
- Largely societal or behavioural changes (53%)

Source: CCC analysis
How UK net-zero scenarios can be delivered

Remaining emissions in the Further Ambition scenario by sector (left) and gas (right)

- Source: CCC analysis
How UK net-zero scenarios can be delivered

Total CO₂ captured and stored due to Further Ambition options in 2050

Source: CCC analysis
Importance of innovation

Costs of example low-carbon technologies compared to past projections
Offshore wind (left) Battery packs (right)

A 2030 switchover to electric vehicles would save more money than a 2040 switchover

Net cost of switching to electric cars and vans (£bn/year)

Source: CCC analysis
The impact of innovation on the costs of achieving carbon targets

• Overall, innovation and falling technology costs mean that we now estimate that the UK’s 80% emissions target could be met at a lower cost than we estimated in 2008 – under 1% of GDP in 2050, rather than 1-2% of GDP.

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<th>GHG emissions reduction target (relative to 1990)</th>
<th>Year and report</th>
<th>Cost range estimated for 2050</th>
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<td>60% reduction in CO₂ (~55% reduction in GHG)</td>
<td>2003 - <em>Energy White Paper</em></td>
<td>0.5-2.0% of GDP</td>
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<tr>
<td>80% reduction in GHG</td>
<td>2008 - <em>Building a low-carbon economy – the UK’s contribution to tackling climate change</em></td>
<td>1-2% of GDP</td>
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<tr>
<td>100% reduction in GHG</td>
<td>2019 - this report</td>
<td>1-2% of GDP</td>
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Thank you
Panel discussion

Chris Stark  CEO, UK Committee on Climate Change
Lindsay McQuade  CEO, ScottishPower Renewables
David Powell  Head of Environment & Green Transition, New Economics Foundation
Julia Steinberger  Professor of Social Ecology & Ecological Economics, University of Leeds
Piers Forster  Professor of Climate Physics, University of Leeds and member of the UK Committee on Climate Change
Chair: Peter Taylor  Chair in Sustainable Energy Systems, University of Leeds
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