

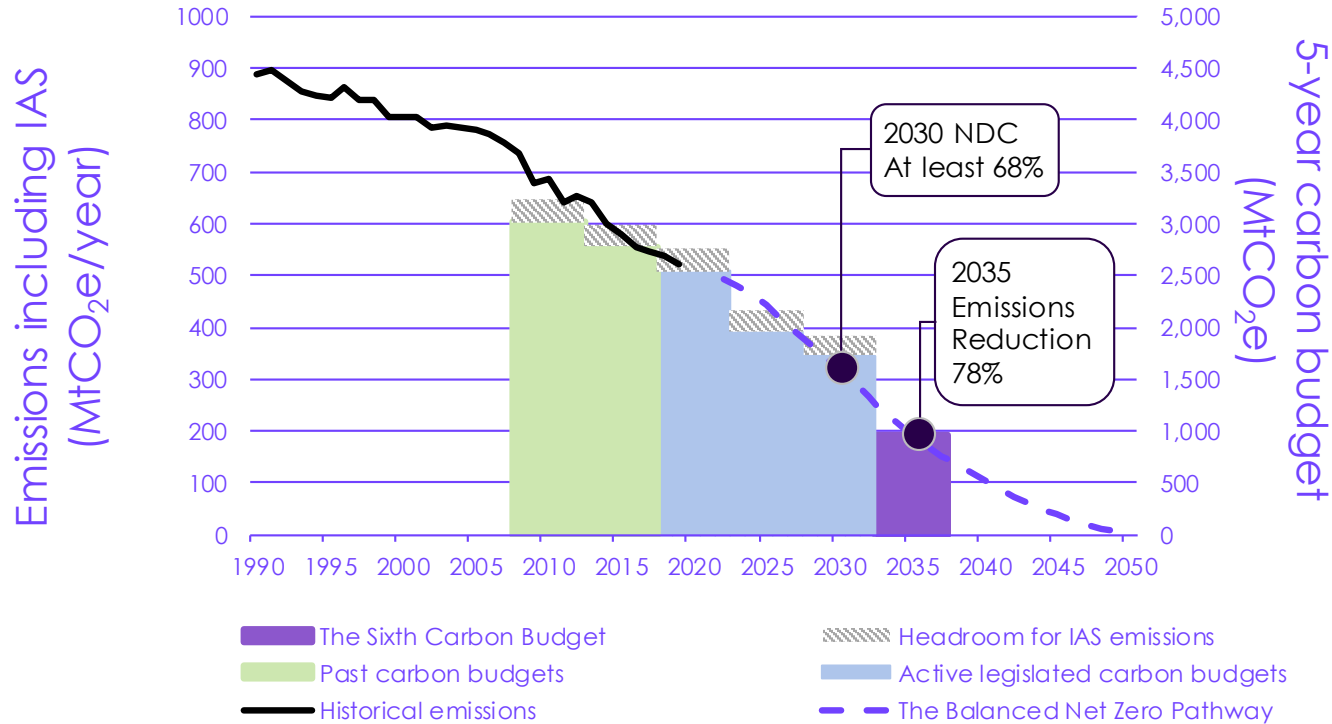
27th January 2021

Delivering Net Zero

David Joffe

Our recommended path

The recommended sixth carbon budget and 2030 NDC on the way to Net Zero by 2050

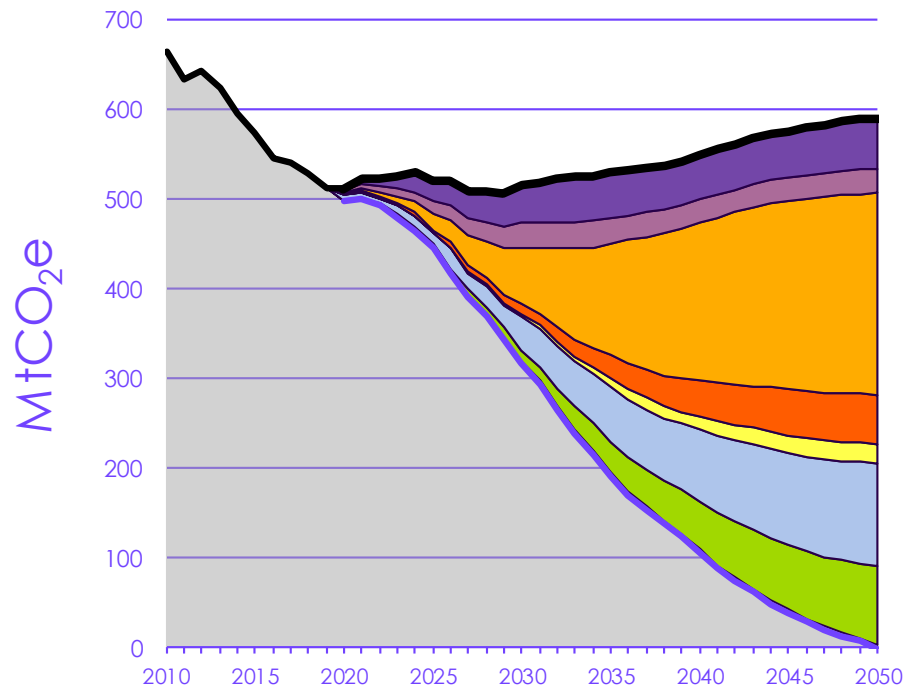


Notes:
Emissions shown including emissions from international aviation and shipping (IAS) and on an AR5 basis, including peatlands. Adjustments for IAS emissions to carbon budgets 1-3 based on historical IAS emissions data; adjustments to carbon budgets 4 and 5 based on IAS emissions under the Balanced Net Zero Pathway.

Source:
BEIS (2020) Provisional UK greenhouse gas emissions national statistics 2019; CCC analysis.

Emissions abatement

Meeting the Sixth Carbon Budget requires actions across four key areas



1. Reducing demand and improving efficiency
 - Reduced demand for carbon-intensive activities
 - Improved efficiency in use of energy and resources
2. Take-up of low carbon solutions
 - Electrification
 - Hydrogen and other low-carbon technologies
 - CO₂ capture from fossil fuels and industry
3. Expansion of low-carbon energy
 - Low-carbon hydrogen and electricity production
4. Offsetting emissions
 - Natural carbon storage and greenhouse gas removals

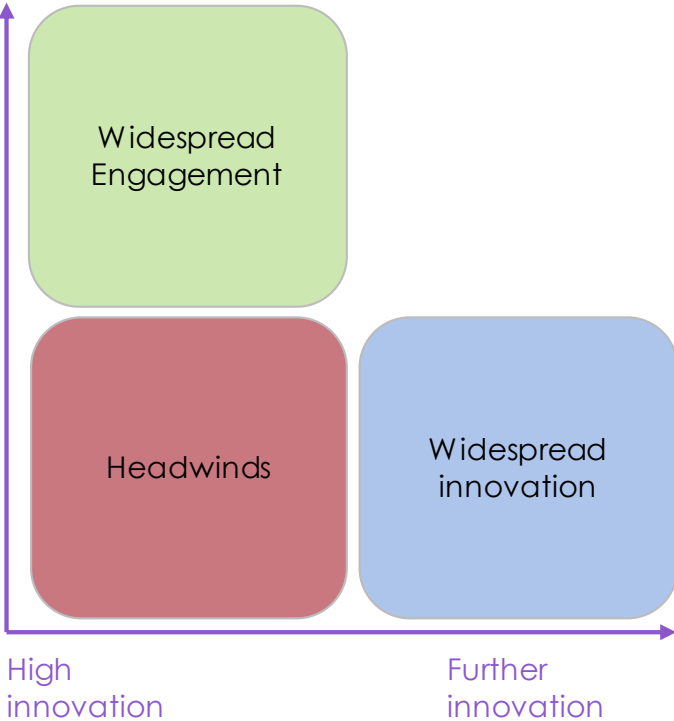
Source: BEIS (2020) Provisional UK greenhouse gas emissions national statistics 2019; CCC analysis

Our approach

Three exploratory scenarios to reach Net Zero by 2050

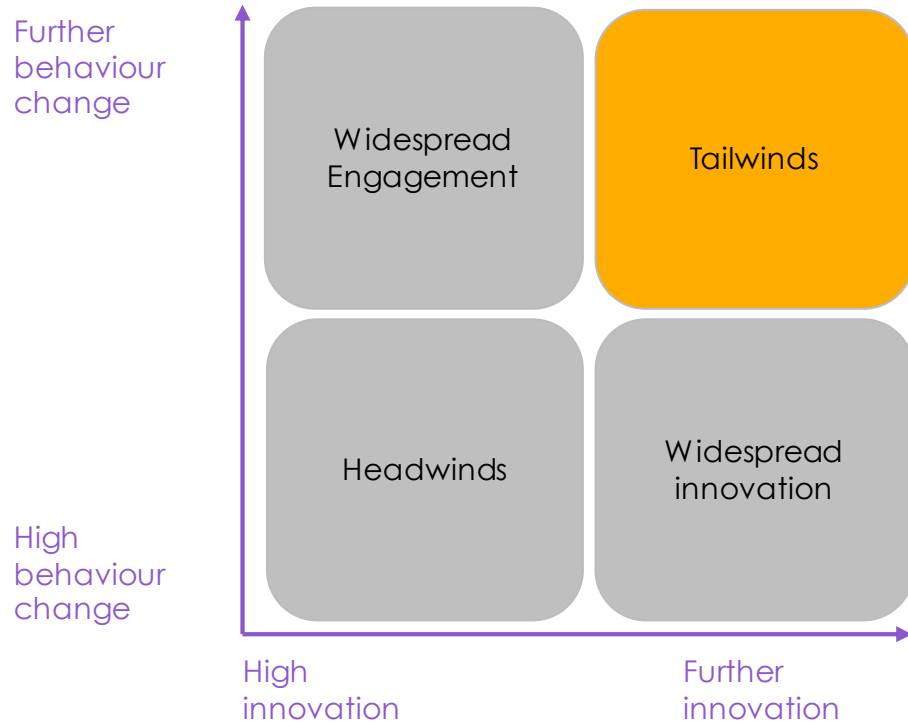
Further behaviour change

High behaviour change



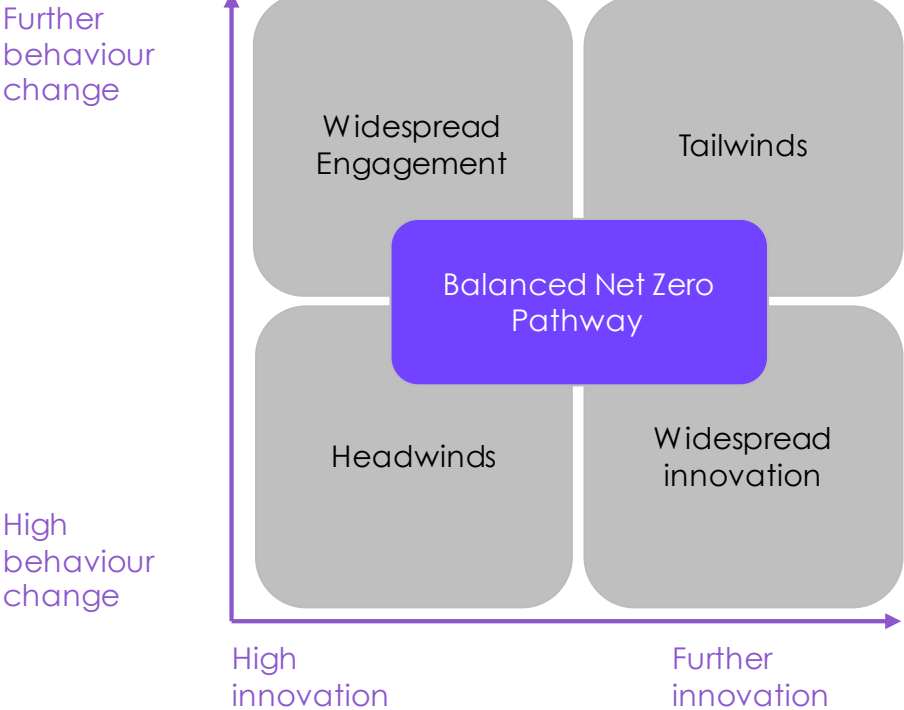
Our approach

One highly optimistic scenario with success on infrastructure, innovation, societal and behavioural change



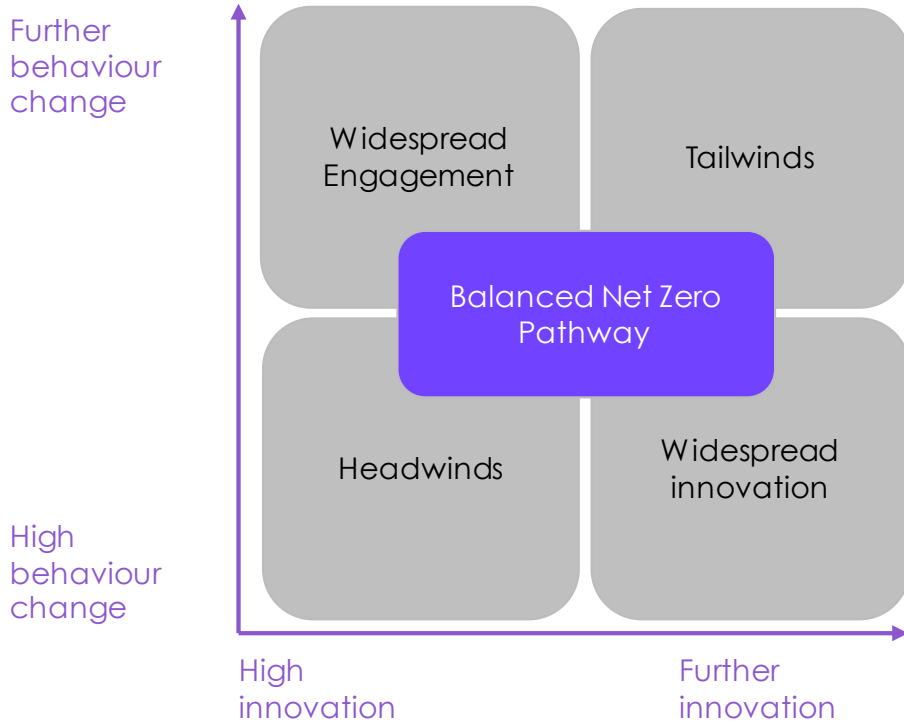
Our approach

A balanced pathway to keep options open



Our approach

Consistent with the Paris Agreement



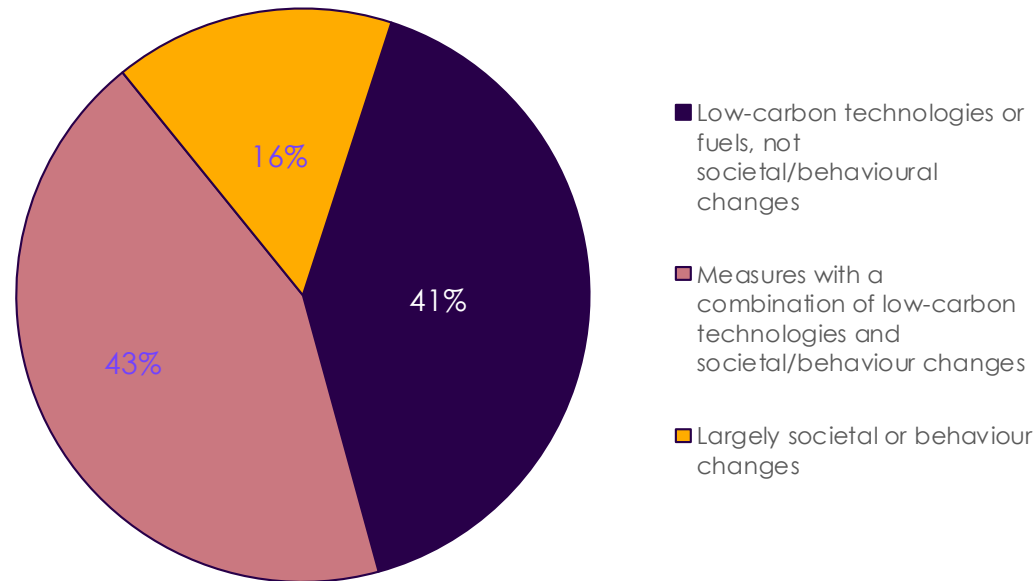
Climate science and international circumstances

- Need deep reductions globally to 2030 to keep 1.5°C in play
- Paris demands 'highest possible ambition'
- UK leadership matters as President of COP26
- Equity arguments reinforce need for strong UK action

Delivering Net Zero

Role of behavioural and societal change in meeting the Sixth Carbon Budget

- Over 40% of the abatement to 2035 is through low-carbon technologies or fuels, with very limited behavioural change
- Over 40% involves at least some degree of change from consumers (e.g. driving an electric car, or installing a heat pump instead of a gas boiler).
- Over 15% of the abatement measures in our scenarios require consumer choices – both to reduce demand and improve efficiency. Shifting quickly towards healthier diets, reducing growth in aviation demand and choosing products that last longer and therefore improve resource efficiency are all key. In the Widespread Engagement scenario this is even higher, at 19%.



Source: CCC Analysis

Progress required by 2035

Breaking the back of the Net Zero challenge

- **Emissions reduction:** Our recommended path achieves nearly 2/3 of the emissions reduction required for Net Zero by 2035, halfway to 2050
- **Investment:** every new car/van and heating appliance to be Net-Zero compatible by the early 2030s – further emissions reductions will follow as these roll through the stock
- **Energy supply:** 100% low-/zero-carbon electricity by 2035, with supply doubling by 2050 as sectors electrify
- **Infrastructure:** Development of hydrogen and CCS infrastructure by 2030, to enable decarbonisation where renewables / electrification can't do everything
- **Greenhouse gas removals:** First deployment by 2030, and mechanism established for 'hard to decarbonise' sectors (e.g. aviation) to pay for them

Phase-out dates of high-carbon activities under the Balanced Pathway		
Technology/behaviour	Phase out date (sales)	Backstop date (operation)
New fossil-fuelled cars & vans	2032	2050
Gas boilers	2033 (homes) 2030-33 (commercial)	2050
Oil boilers	2028 (homes) 2025-26 (commercial)	2050
Gas power generation (unabated)	2030 (no build of unabated gas plants)	2035
HGVs	2040	Beyond 2050
Biodegradable waste sent to landfill	N/A	2025 ban on all municipal & non-municipal biodegradable waste going to landfill
Unabated energy-from-waste plants	From today, new plants and extensions should be built with CCS or CCS ready	2050

Our recommended path

The frontloaded shape of the path

Our recommended sixth carbon budget requires faster progress prior to 2035 than it does thereafter to 2050.

Four key motivations for frontloading:

The UK's global contribution

UK carbon budgets must reflect the 'highest possible ambition' for near-term emissions reduction under Paris Agreement, minimising cumulative emissions of long-lived GHGs on the path to Net Zero

Investing for the recovery

The changes ahead are capital-intensive. The required investment programme can help boost the UK's economic recovery from the COVID pandemic to the benefit of GDP and employment.

Building on current momentum

Setting a Net Zero target has built considerable momentum in businesses, local/regional government and citizens. Our proposed budget aims to extend that clarity to the coming 15 years, requiring strong action across every emitting part of the economy.

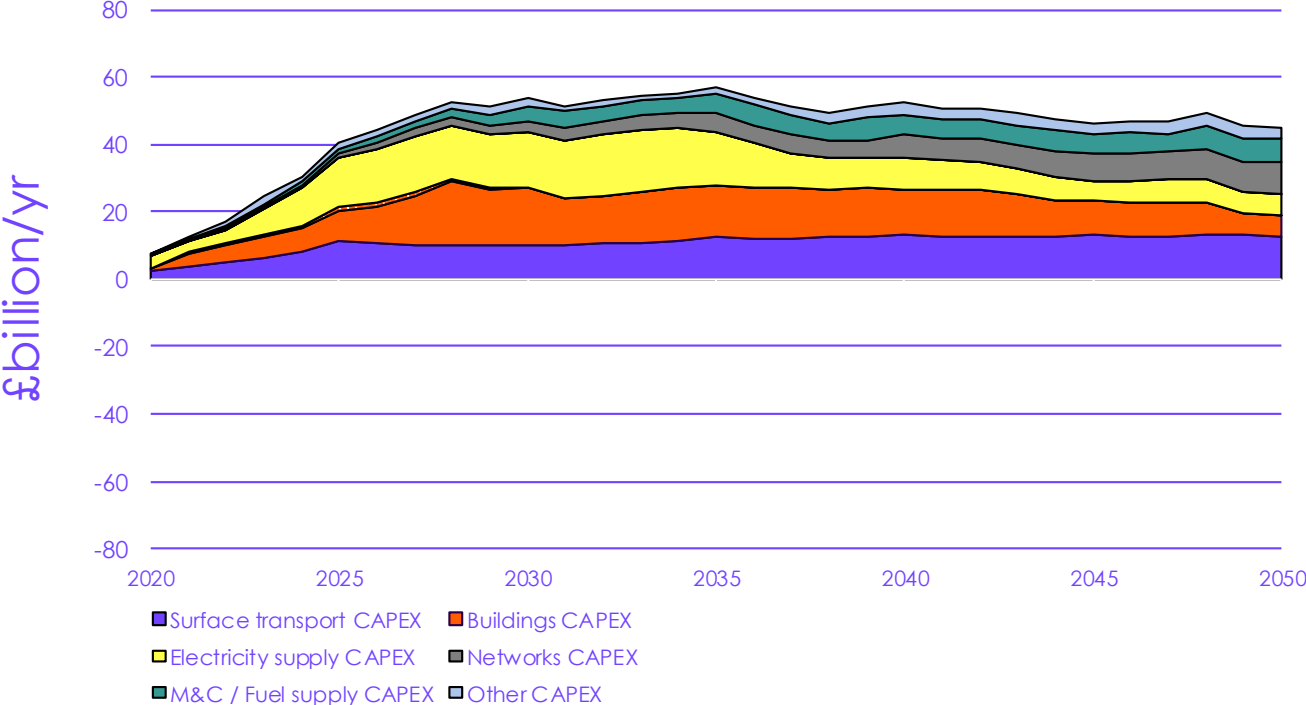
Making progress in every sector

Our pathways reflect the need to make progress to prepare for the 2050 target. The most rapid emissions reductions occur over 2025-2035. Opportunities are created following an initial period to develop low-carbon supply chains, markets and infrastructure. e.g.

- Cost-saving opportunities.
- Health benefits.
- Innovation and option creation.
- Limiting reliance on greenhouse gas removals.
- Maintaining a 'critical path' to Net Zero by 2050.

Investing for Net Zero

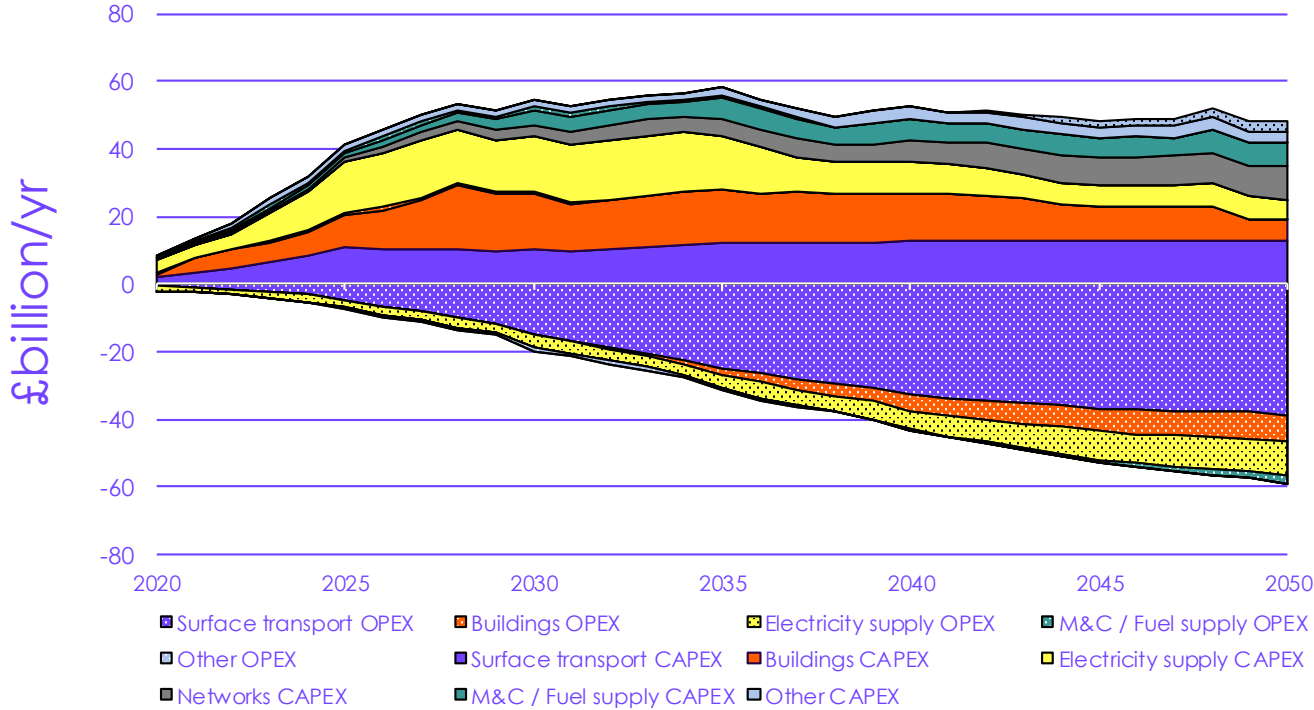
Major investment programme, delivering offsetting operating cost savings



Source: CCC analysis.

Investing for Net Zero

Major investment programme, delivering offsetting operating cost savings

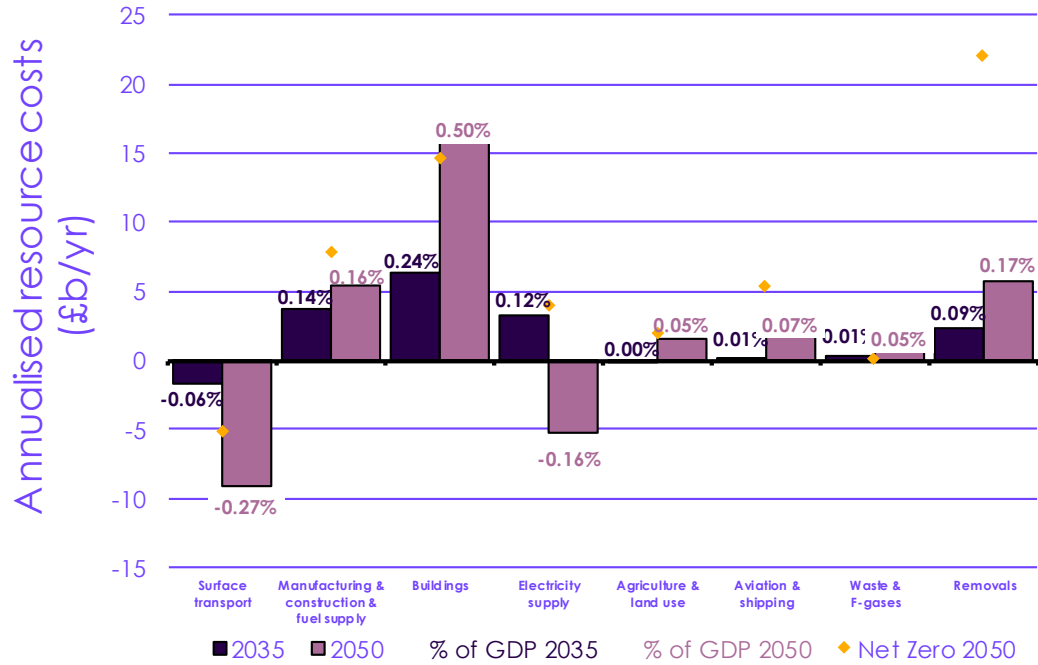


Notes:
 Costs of electricity are included in the energy supply sector, whereas costs of other low-carbon fuels such as hydrogen and bioenergy are included in the sectors that use these fuels.
 M&C is manufacturing and construction. "Other" category includes aviation, shipping, land-use, land-use change and forestry, agriculture, removals, waste and F-gases. CAPEX refers to additional annual capital investment. OPEX refers to savings due to operational cost reductions

Source: CCC analysis.

Resource costs

Annualised resource costs in 2035 and 2050



- Costs are unevenly spread across the economy
- Electricity supply and surface transport yield significant costs savings by 2050
- Measures to decarbonise the waste, LULUCF sources and F-gases sectors can be implemented at little or no cost
- Measures to decarbonise buildings, manufacturing and construction, and shipping incur annualised resource cost of £80/tCO₂e or more by 2050
- Enhancing land use sinks, and growing the removals sector will also incur greater costs

Source: CCC Analysis

Economic and societal benefits

A green recovery

Investment boost

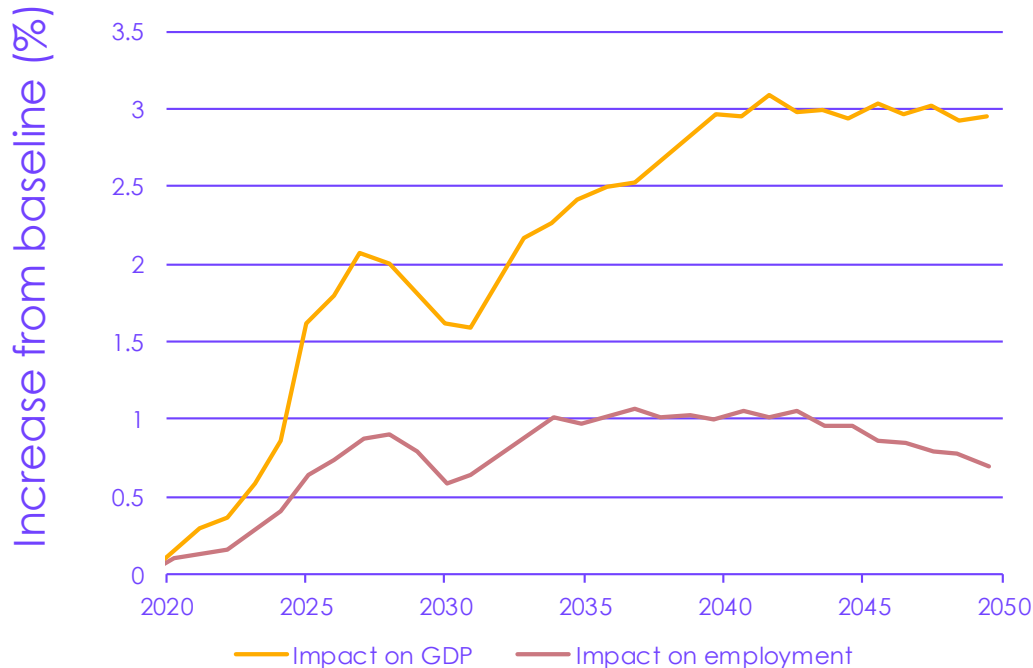
- Added investment rising by £40 billion over 2020s
- Potential to boost GDP up to 2-3% (Cambridge Econometrics modelling)

Job impacts

- Circa 200,000 extra jobs in building retrofit alone
- Further opportunities in the energy sector, EV supply, low-carbon manufacturing and tree planting. Plus possible general boost from stimulus.

Industrial opportunities

- Green finance, electric vehicle supply chain, low-carbon hydrogen, low-carbon products, CO₂ removal



Source: CCC Analysis

Economic and societal benefits

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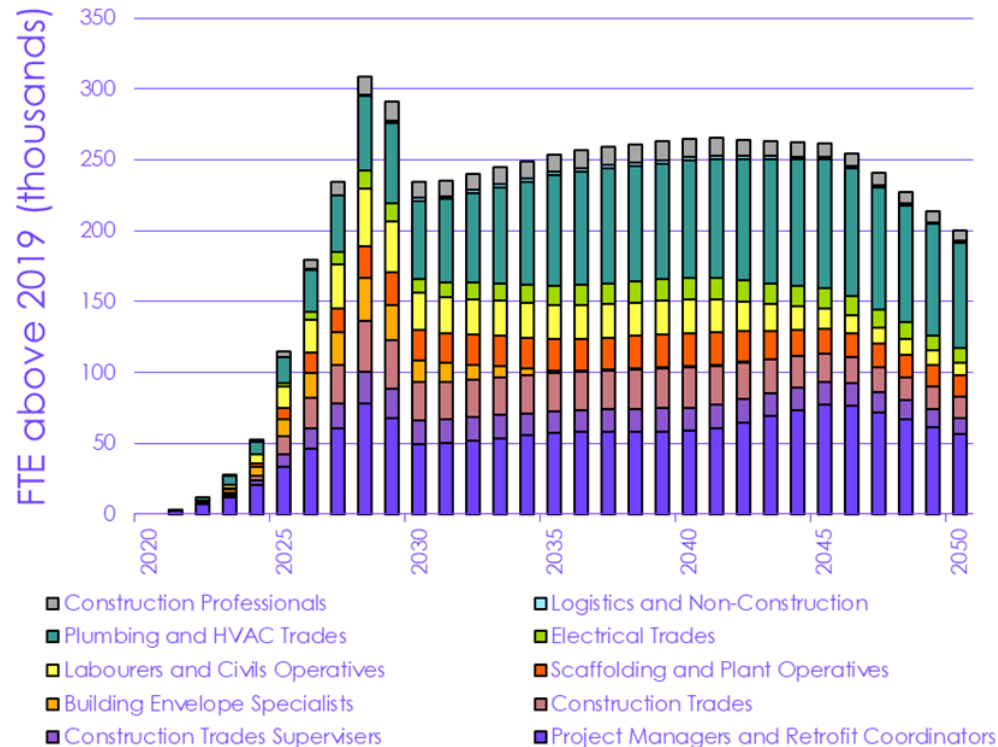
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Source: CCC Analysis

Co-benefits

Health and wellbeing

- Active travel
- Healthier diets
- Cleaner air
- Quieter streets
- More comfortable homes
- More access to green space

Environment and biodiversity

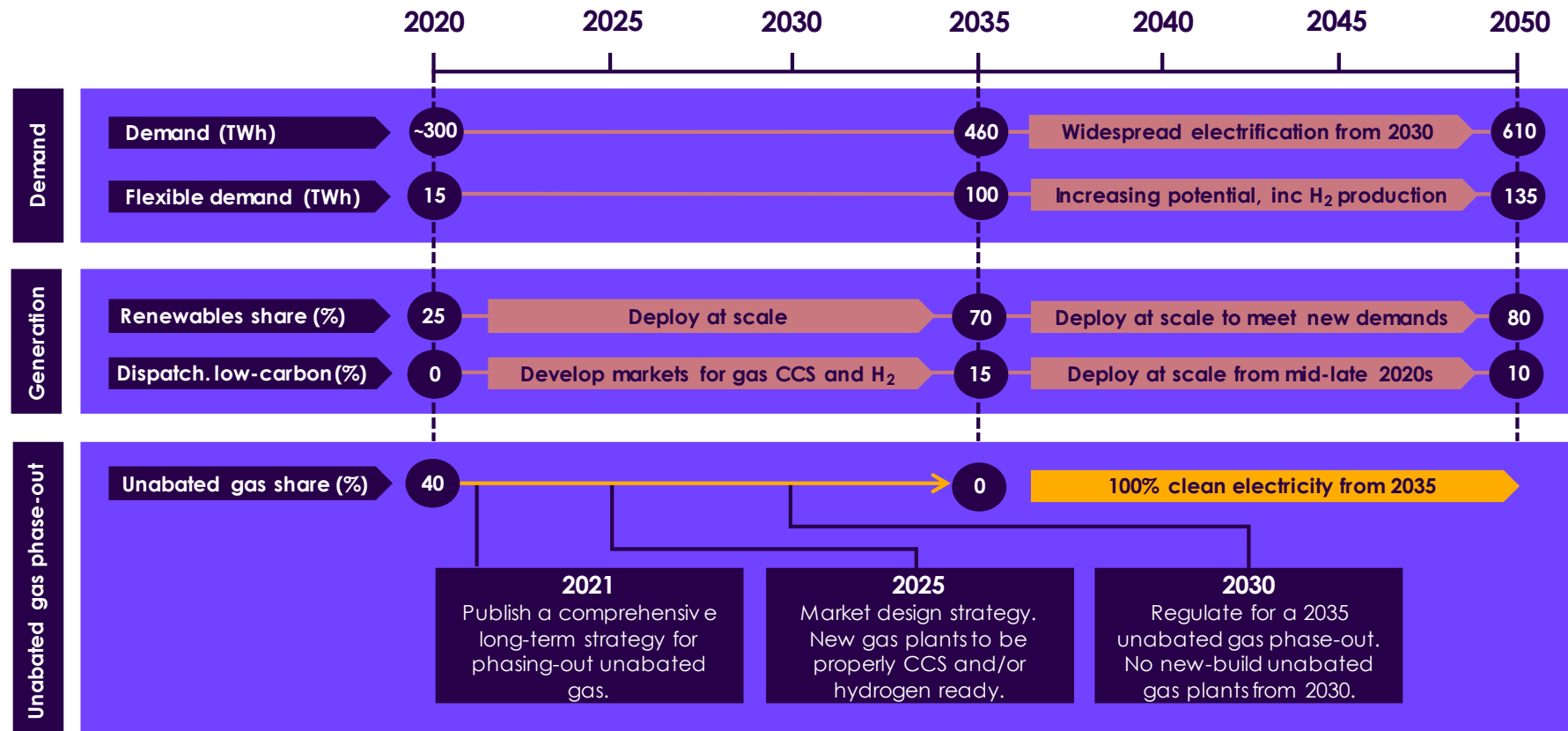
- Peatland restoration protects biodiversity, improves air and water quality and helps prepare for climate change
- More mixed woodlands and hedges supports biodiversity, helps flood prevention, improves animal welfare, helps air quality, brings recreational benefits
- Improved nitrogen efficiency helps with water and air quality, with biodiversity benefits

Economy-wide policy for the Sixth Carbon Budget

Key priorities

- **Fairness:** key role for HMT Net Zero Review in how costs are paid, also need a Just Transition Strategy with a regional and skills focus. Planning must start now.
- **People:** public engagement must build on the UK Climate Assembly, with clear information and education, involvement in choices and policy design, provision of options.
- **Places:** Policy must be coordinated across all levels from local to national. Both in delivering low-carbon solutions and ensuring a just transition.
- **Investment:** policy must set a clear direction and provide investable incentives. Financial rules and regulations, including disclosure, can help low-carbon funds to flow.
- **Delivery:** Government must organise itself for the major delivery challenge ahead.
- **The Net Zero Strategy** should be published in the first half of 2021 and clearly and quantifiably demonstrate how it would deliver the Sixth Carbon Budget and Net Zero 2050
- **Consumption emissions:** policy should target reductions in consumption emissions alongside territorial. The Committee will track progress in our annual reports.

Summary of advice on electricity generation



Source: CCC Analysis

High level principles to guide the buildings transition

- Energy efficiency is a fundamental first step, or the scale of the problem gets too big.
- System costs are not a major differentiator between electrical and hydrogen heat, so public support is likely determine the shape of our decarbonised future.
- Full hydrogen conversion is unwieldy (100-150GW of gas reforming + CCS; or 300 GW offshore wind capacity if just using electrolyzers), so sensible to plan for a range of solutions.
- Electrification likely to remain the primary route to decarbonise, with hydrogen providing flexibility.
- With coordination, solutions can vary by region, depending on local resources, infrastructure and consent.



The best solution for HGVs is currently uncertain

But now is the time to act, with trials + planning

Early 2020s – large-scale trials:

- Commercial demonstrations
- 50-150 vehicles per trial, lasting up to 5 years
- Collect and communicate data on costs, system performance/reliability, and commercial suitability

Early 2020s – planning:

- Consult on phase-out date for diesel
- Comprehensive plan for how phase-out can be delivered


2035 – our modelling assumes sufficient incentives to ensure total cost of ownership parity versus diesel

2040 (or earlier) – end of sales of new diesel HGVs

Simultaneously:

- Support schemes to reduce HGV/van use
- Set ambitious CO₂ emissions standards for HGVs

Electricity with ultra-rapid chargers




e.g. Tesla megachargers
Uncertainty over battery developments. Impact on electricity grid.

Hydrogen

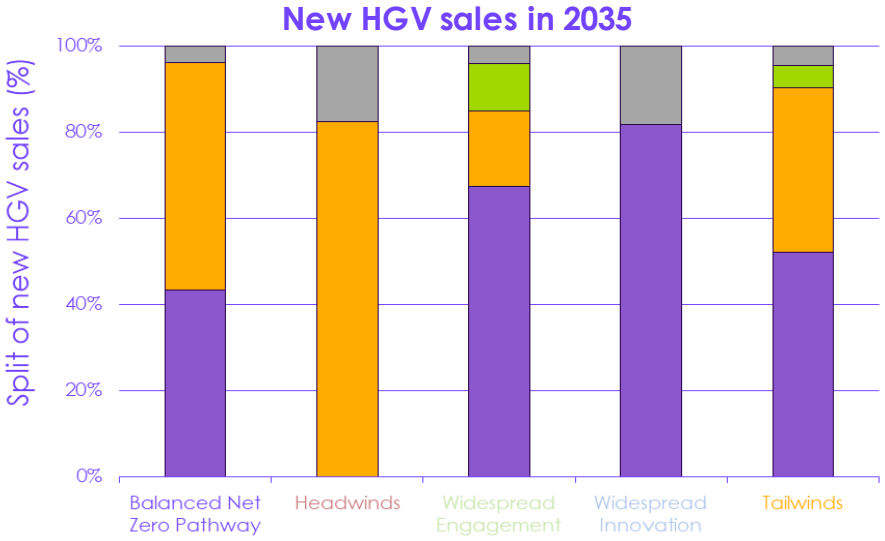


e.g. Toyota
Producing hydrogen is more energy intensive than direct electrification.

Electricity with on-road recharging

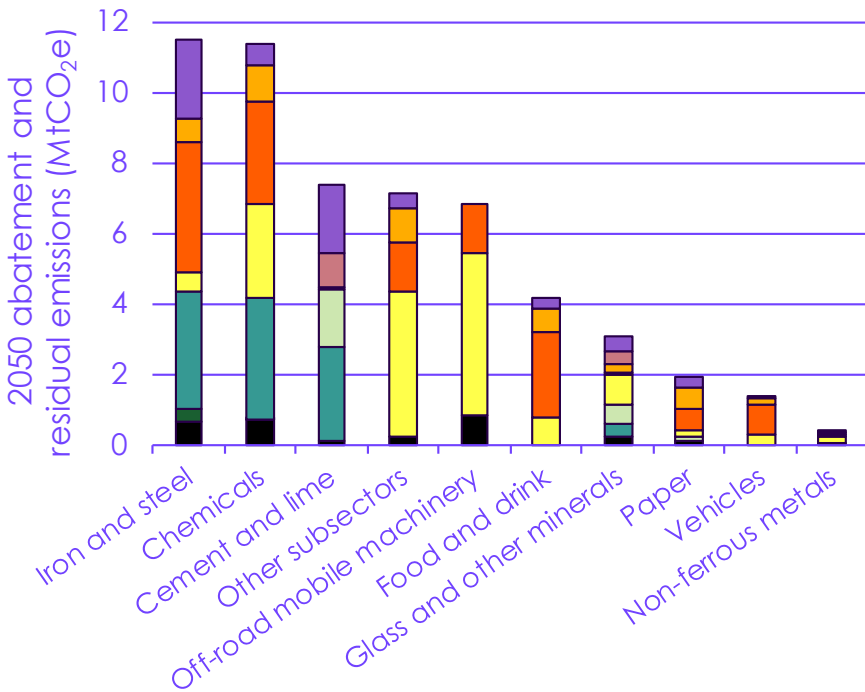
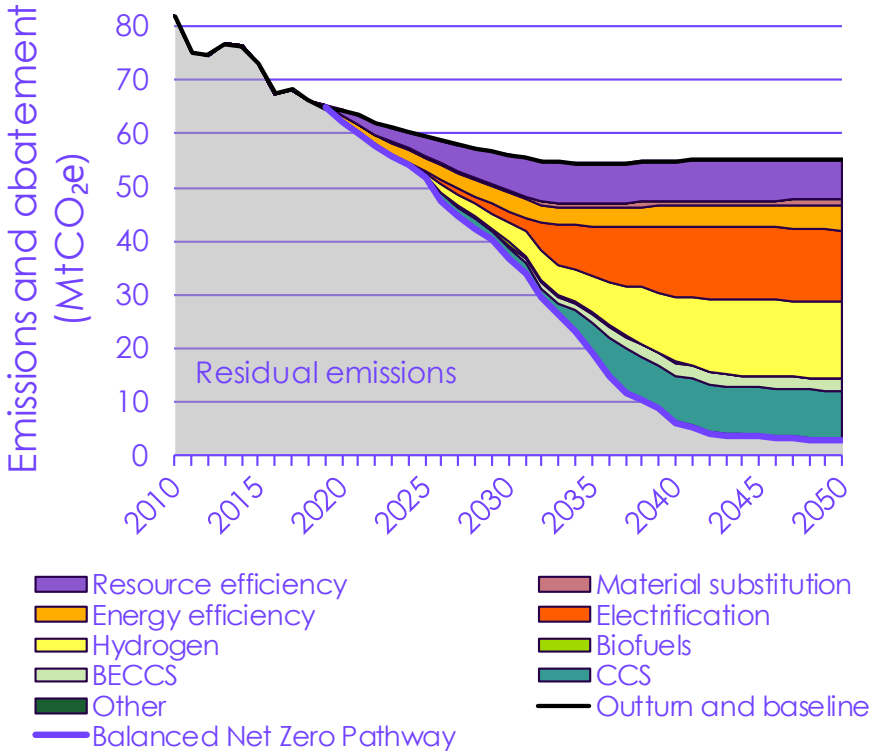


e.g. Scania/Siemens
Costly and lengthy infrastructure roll-out required.



The Balanced Pathway for manufacturing and construction

Resource/energy efficiency, electrification, hydrogen and CCS are all important



Note: Cement includes correction vs published report

Key policy recommendations

Supporting policies

Infrastructure development

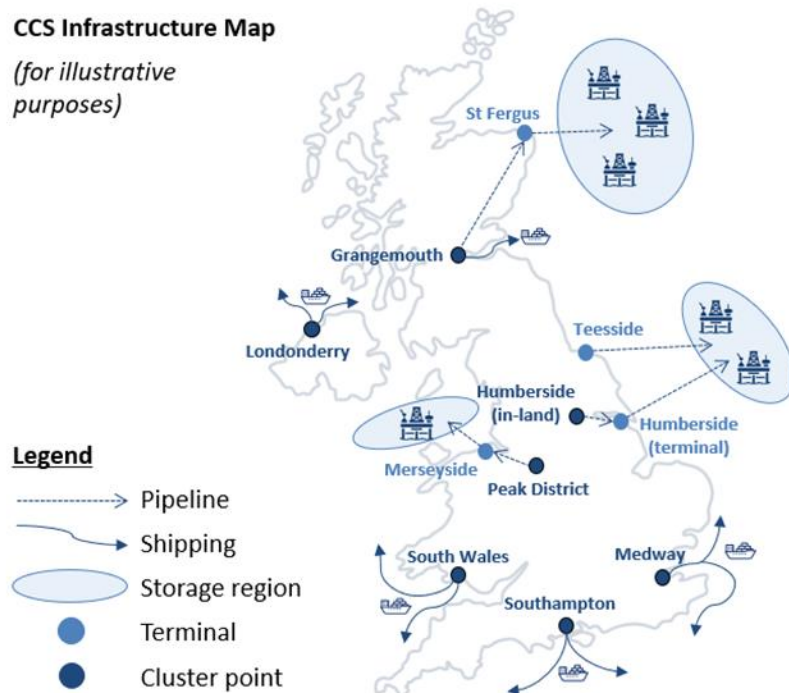
- Establish at least two CCS clusters in the mid-2020s, at least four by the late 2020s, and further clusters around 2030.
- Work with the minerals industries to develop a detailed joint plan for CO₂ transport from dispersed sites.
- Prepare to make decisions about whether initial areas of the gas transmission and distribution networks should be converted to hydrogen.
- Plan for a potential increase in large localised electricity network reinforcements for manufacturers.

Jobs and skills

- Design industrial decarbonisation policies to support and create jobs, especially in regions with reliance on industrial jobs. Prompt award of existing funding can help the recovery.
- Develop the capacity of skills and supply chains.

CCS Infrastructure Map

(for illustrative purposes)

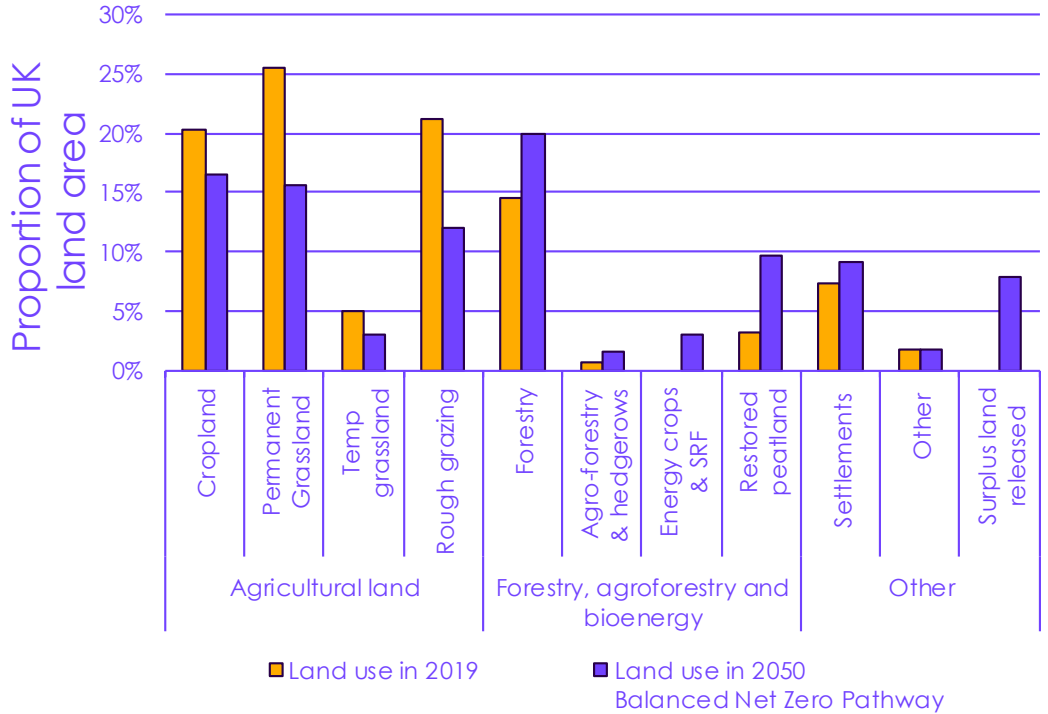


Source: Element Energy (2020) Deep-decarbonisation pathways for UK Industry, report for the Climate Change Committee

Changes in land use

Transformation in land use now to 2050

- Around one-third of agricultural land is freed up through reduced output and more efficient farming practices.
- In total, 25% of the UK land area is forested or used for agro-forestry and energy crop production by 2050 - compared to around 15% today.
- Harmful peat extraction is ended, and nearly 80% of the UK's peatlands are restored to their natural state.



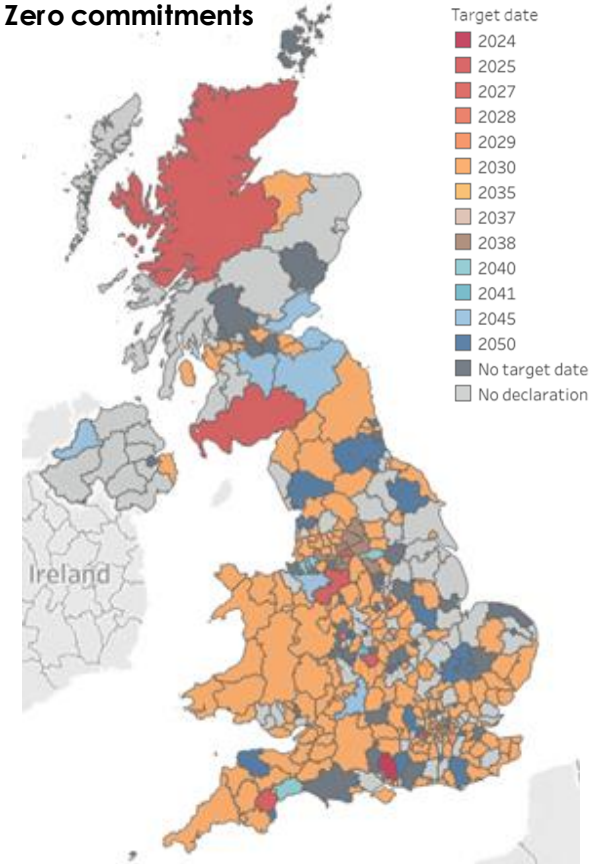
Source: CCC Analysis

Local delivery

How can the local & national work together to deliver Net Zero?

- Over 300 LAs have declared climate emergencies, with Net Zero dates set from the mid-2020s
- Local authorities have powers or influence over roughly a third of emissions in their local areas
- Top-down policies can achieve far greater impact if they are focused through local knowledge and networks
- In England and Northern Ireland, there is no overall plan on how local authorities fit into delivering Net Zero
- Local authorities are making policy and contract decisions now that could lock in emissions beyond the 2020s - coordination is needed
- Regional and cross-boundary coordination and cooperation is needed for transport, waste, energy and heat planning

Local Authority Net Zero commitments



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