Committee on Climate Change

14th October 2019

The UK's Commitment to Net Zero

The UK's contribution to stopping global warming

Julia, Baroness Brown of Cambridge DBE FREng FRS Vice Chair of the Committee on Climate Change

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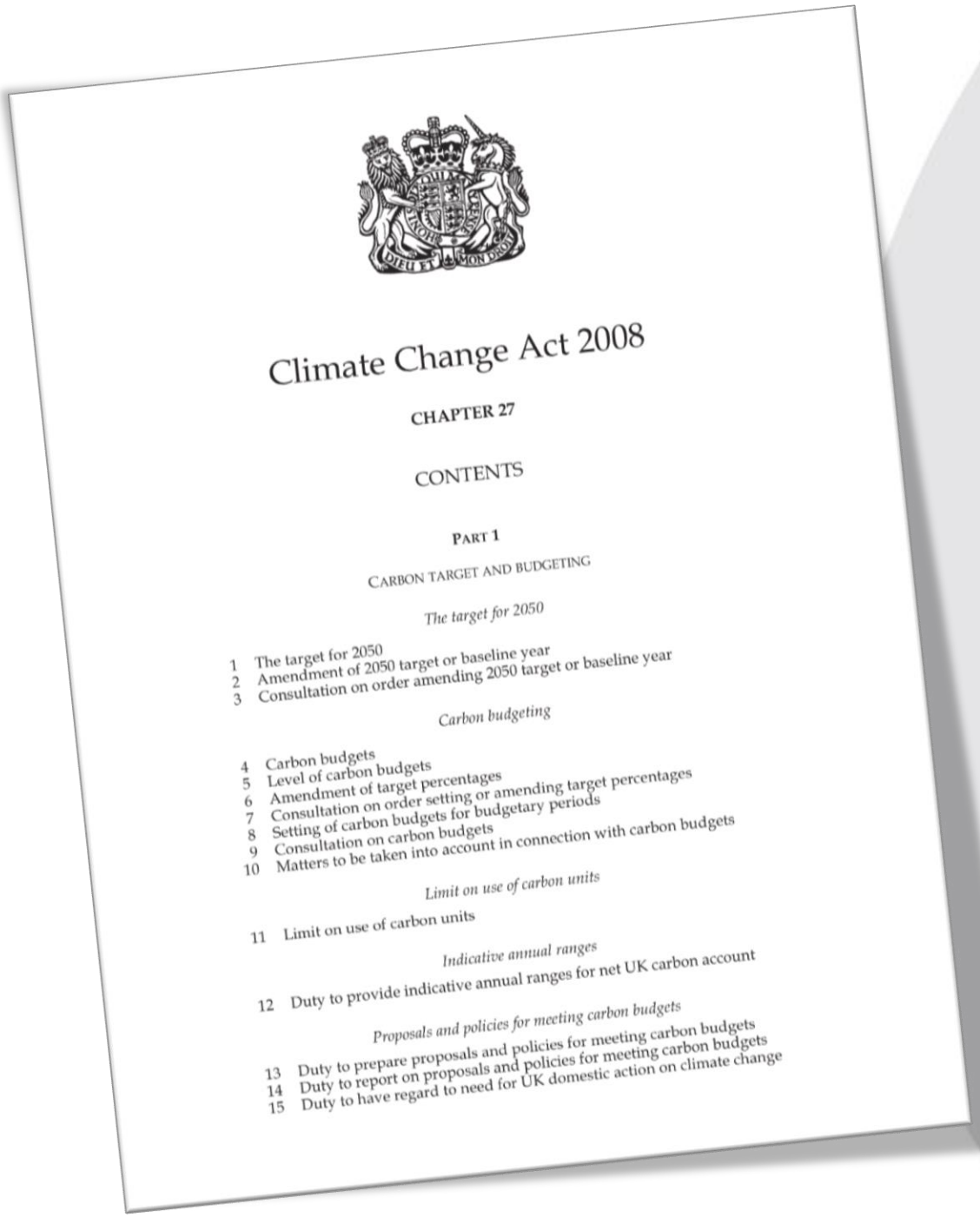
UK Climate Change Act 2008 Net Zero 2019



Climate Change Act 2008

CHAPTER 27

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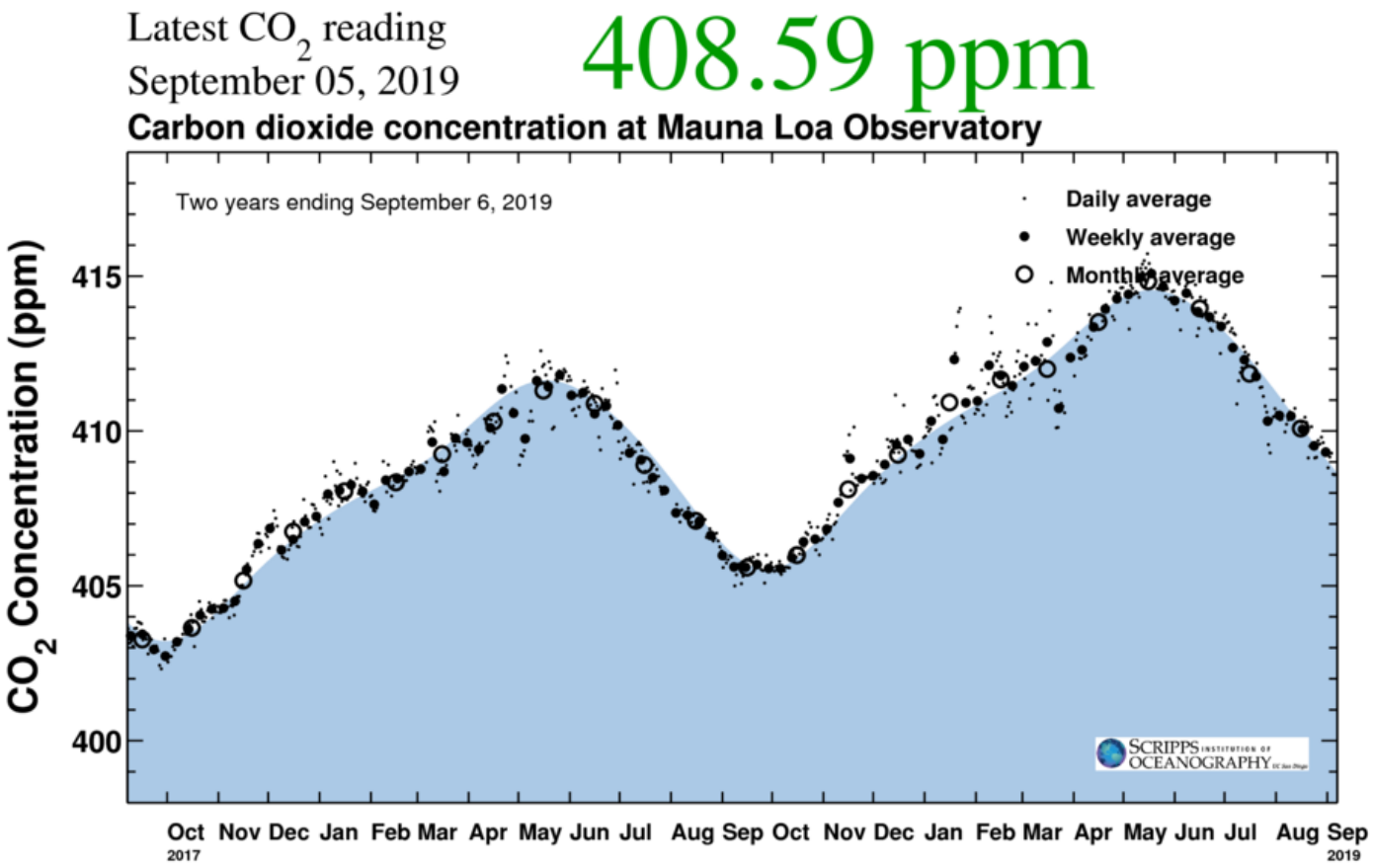
When: science and global imperative?

How: can it be done?

How much: what will it cost?

How big: the scale of the challenge?

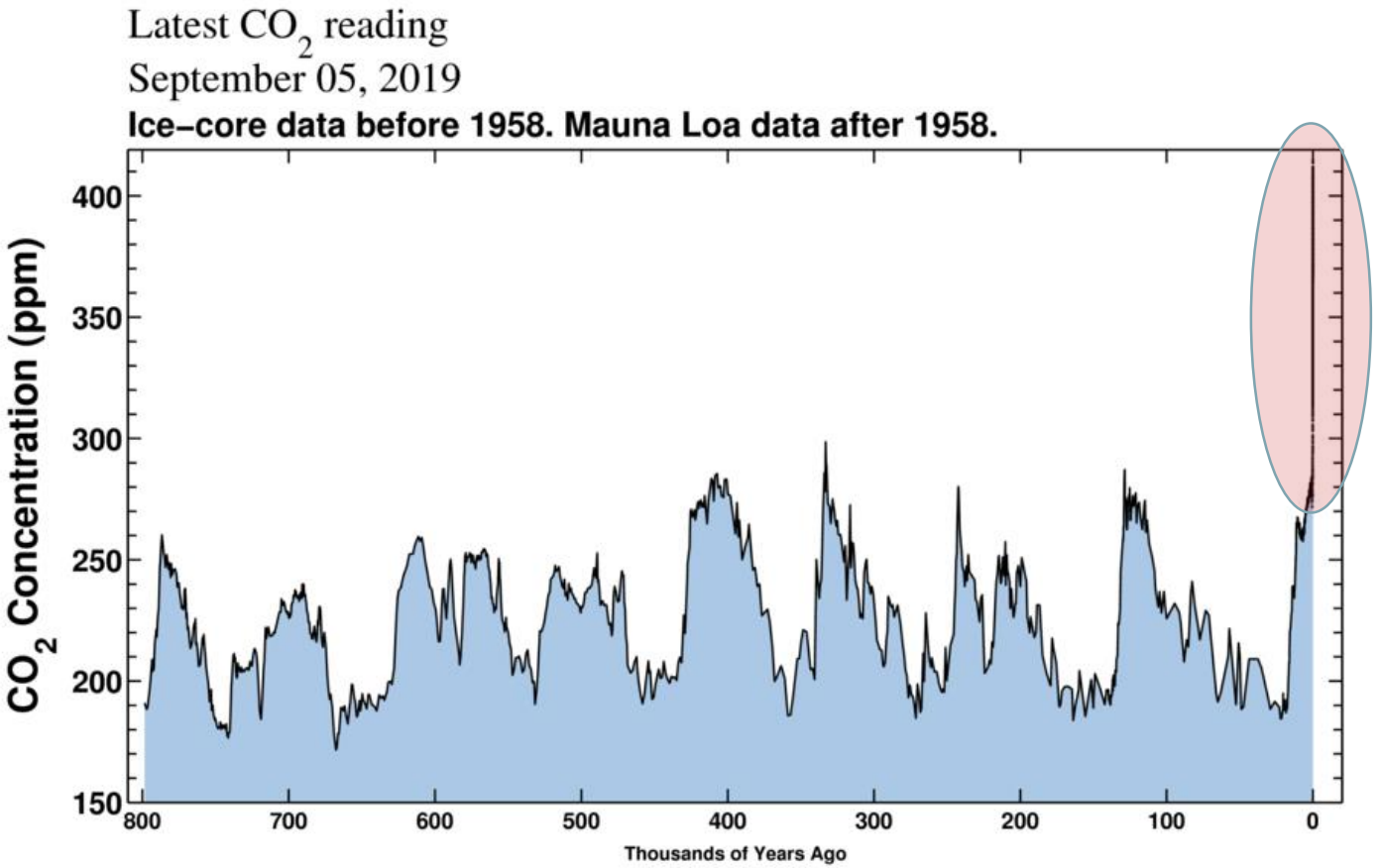
CO_2 Concentration – 2017 to 2019



Source: Scripps Institution of Oceonography

Global warming

CO_2 Concentration – 800,000 years



Source: Scripps Institution of Oceonography

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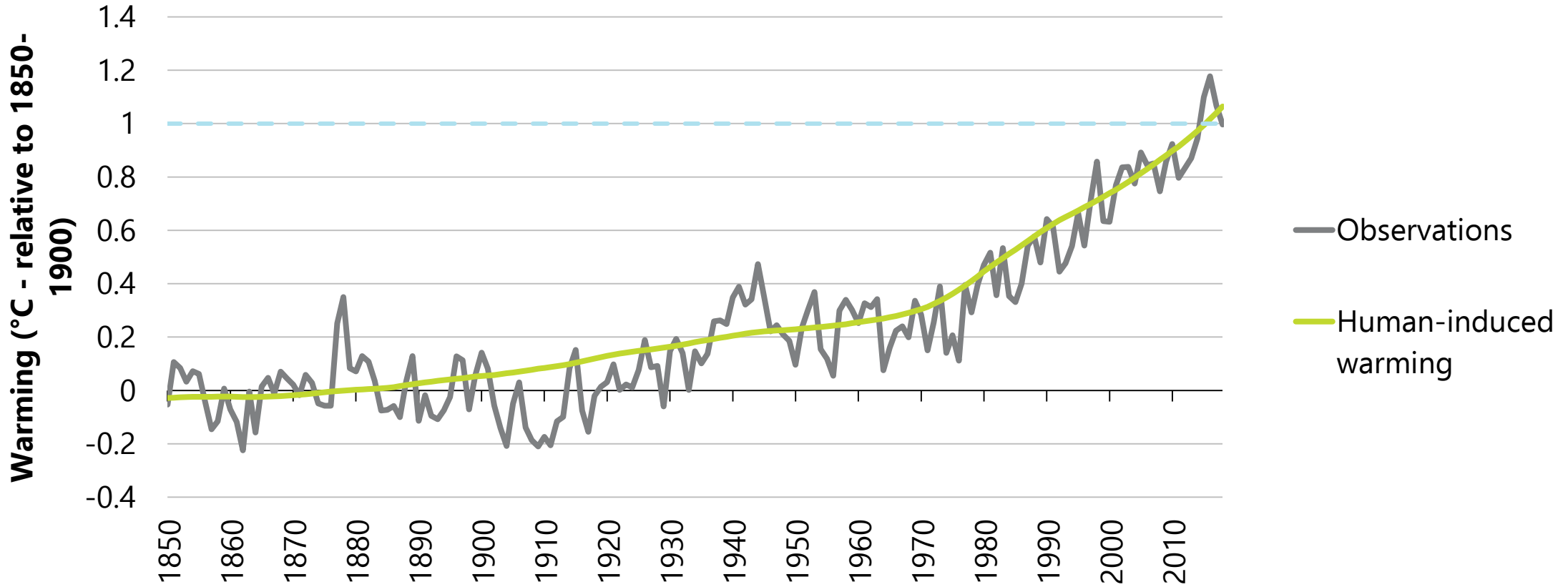
Science and international context
Global emissions pathways consistent with Paris

Observed and human-induced warming



Source: HadCRUT4, NOAA, NASA and Cowtan & Way datasets; IPCC (2018) Chapter 1 - Framing and Context.

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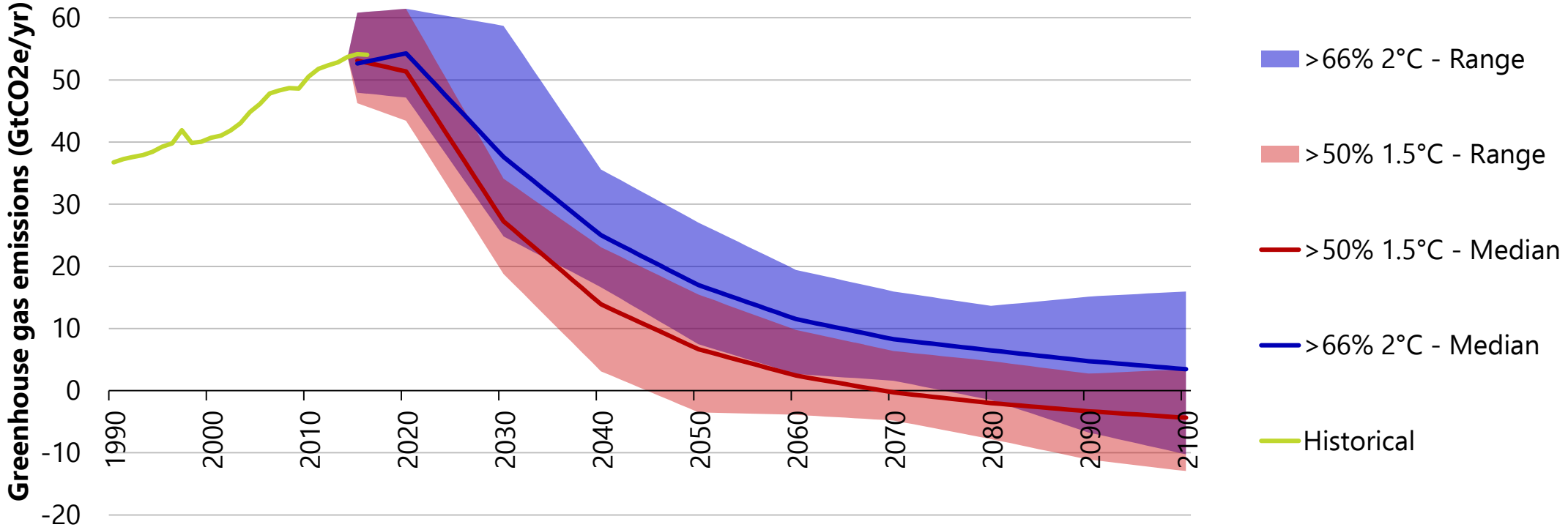

Source: Huppmann, D. et al. (2018) A new scenario resource for integrated 1.5°C research.

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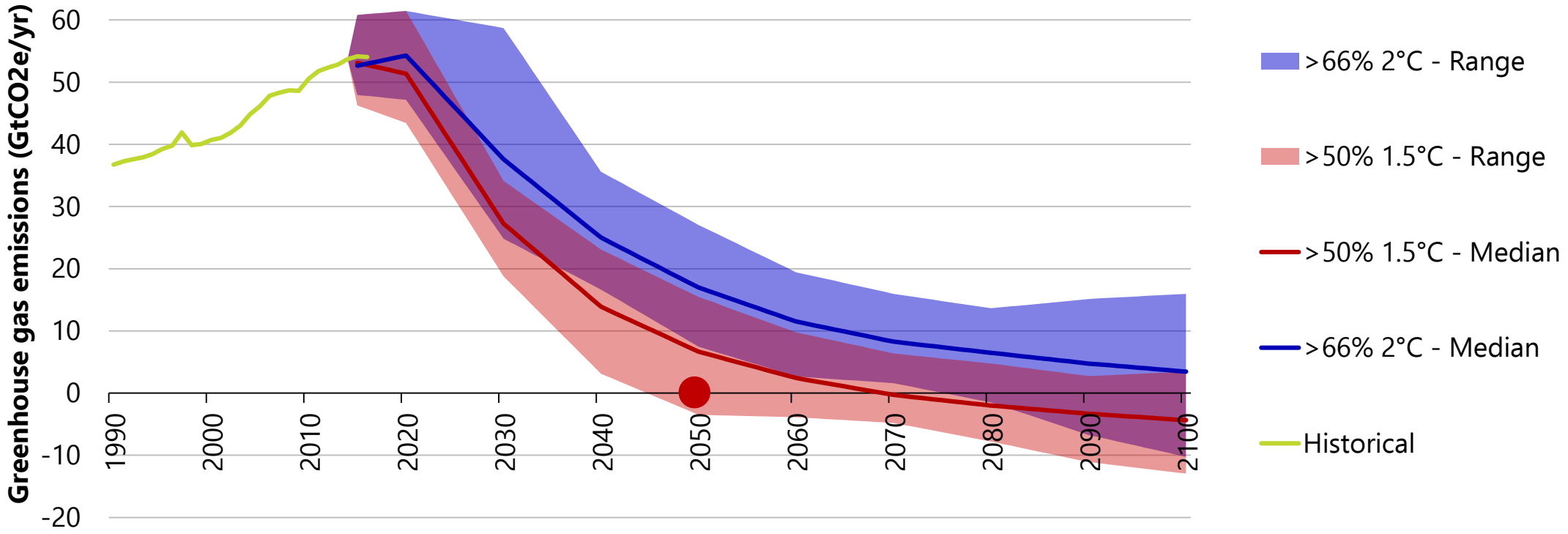

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Science and international context
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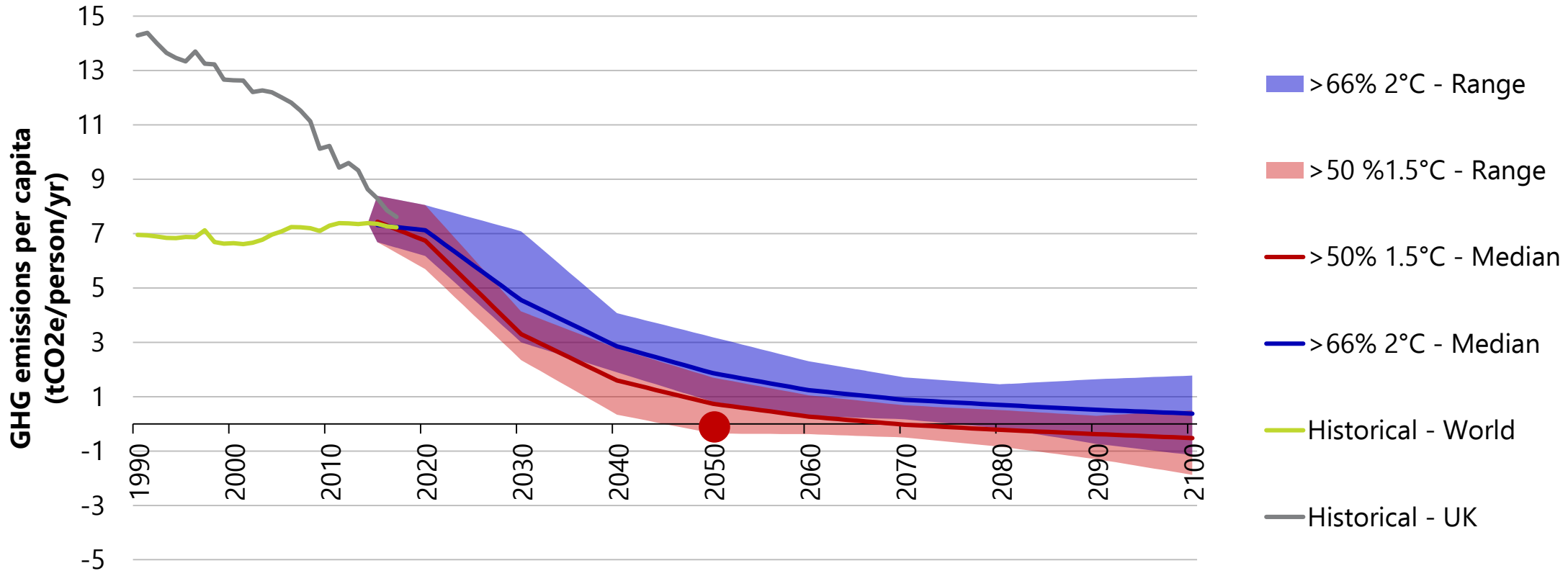
Evolution of global per capita emissions over time



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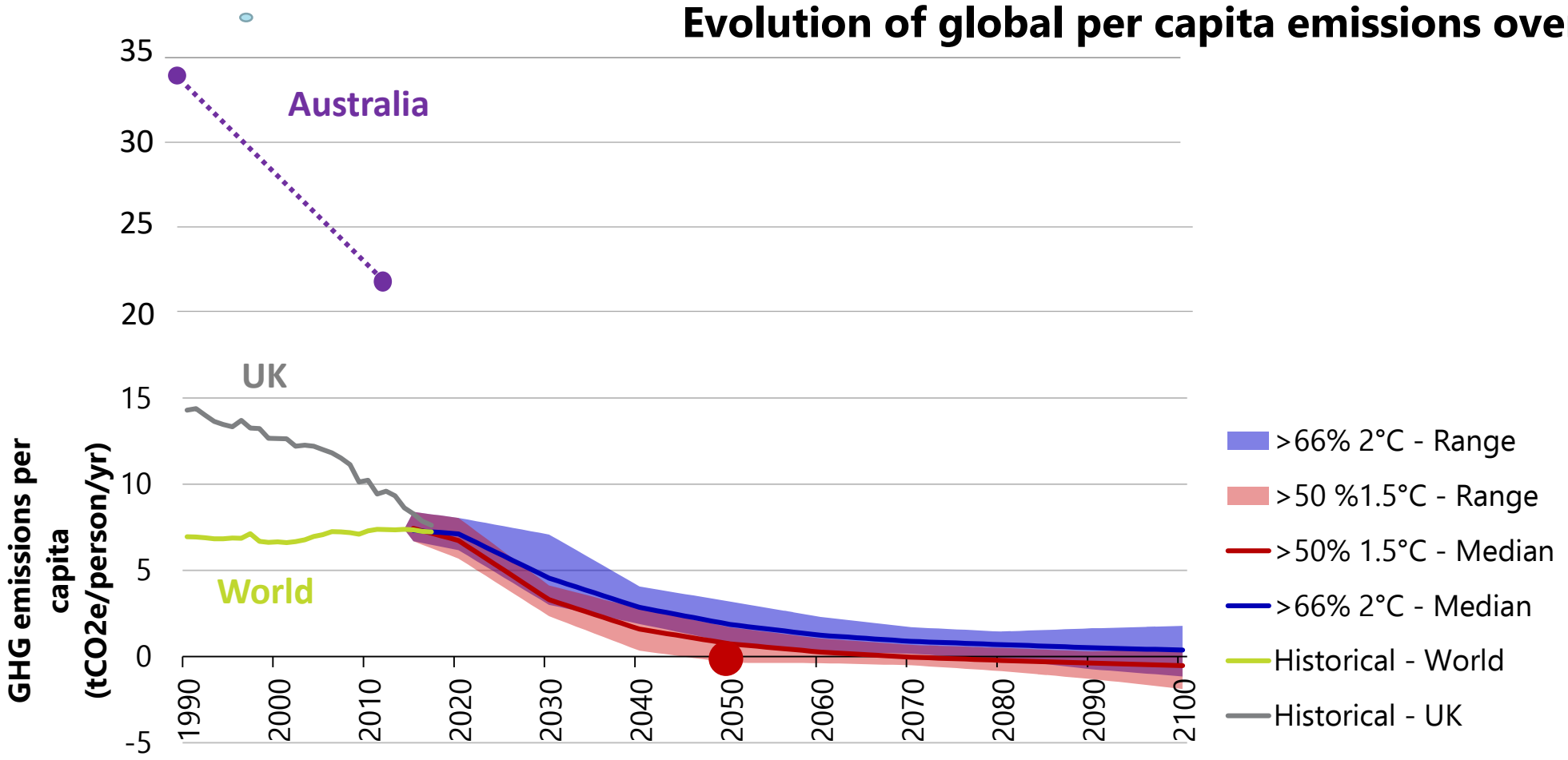

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    - with a significant demand for overseas products – a large carbon footprint
  - Should **support the global effort**
    - increasing effort in rich countries to ease the pace in middle income and developing countries
    - early deployment and cost reduction of new technologies – eg offshore wind
    - facilitating technology transfer and institutional development

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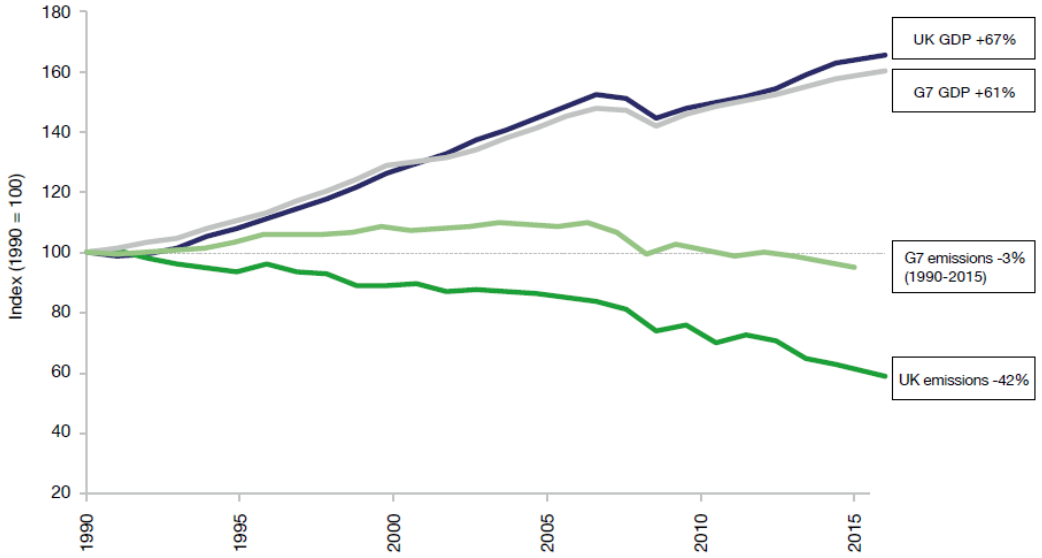
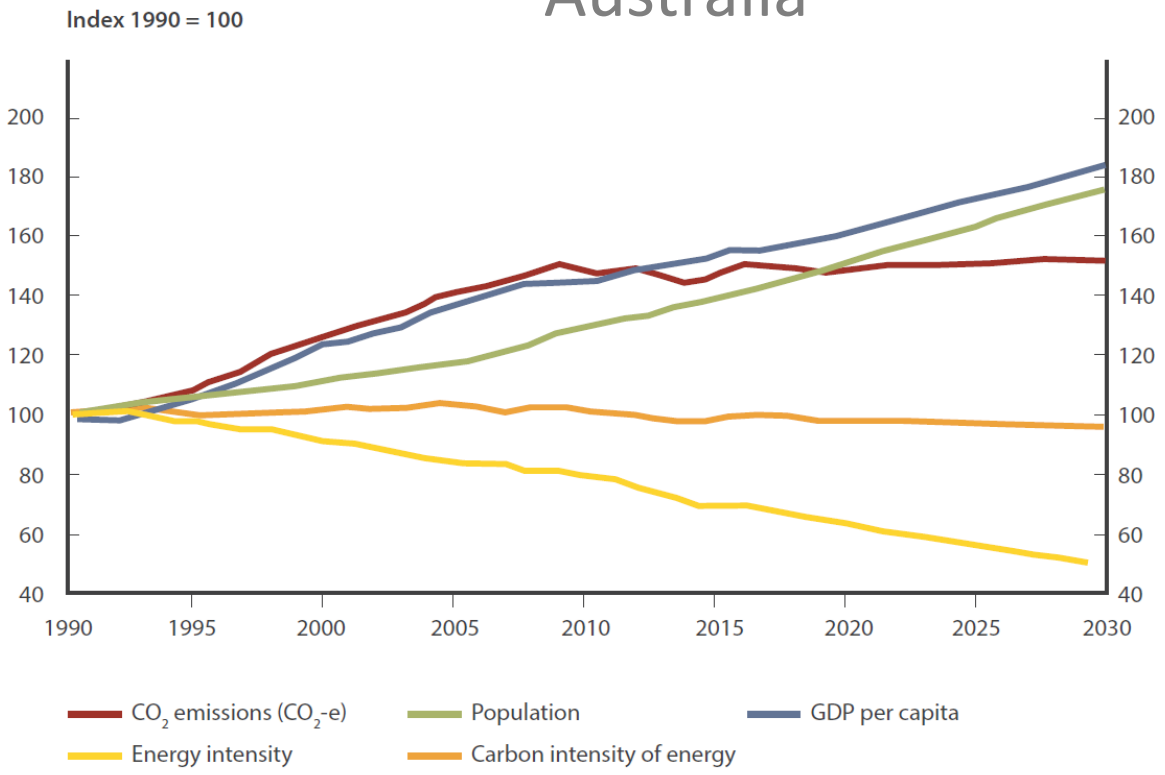
Progress in reducing emissions

UK



Australia



Source: Department of the Environment and Energy 2017; Department of the Environment and Energy analysis

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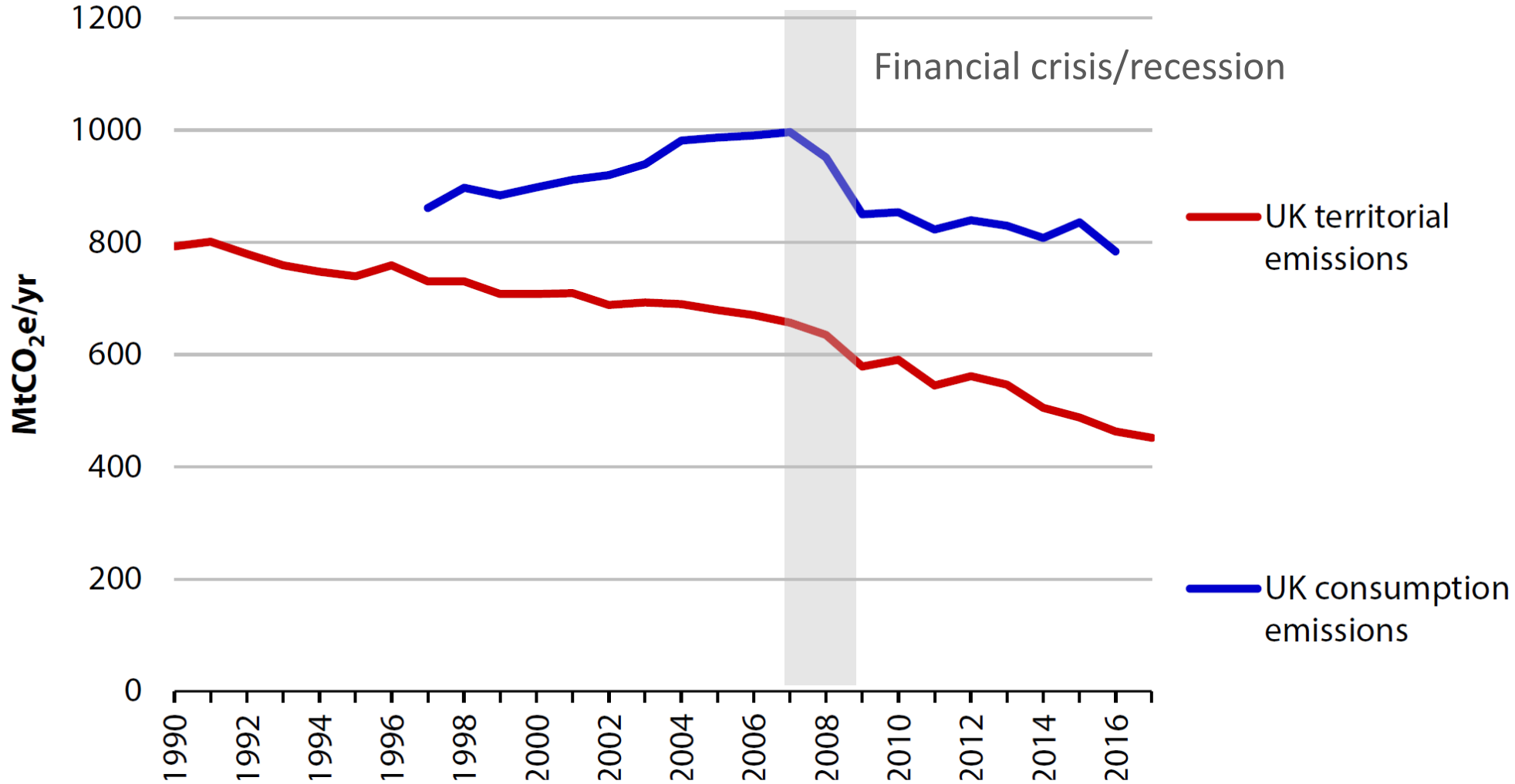
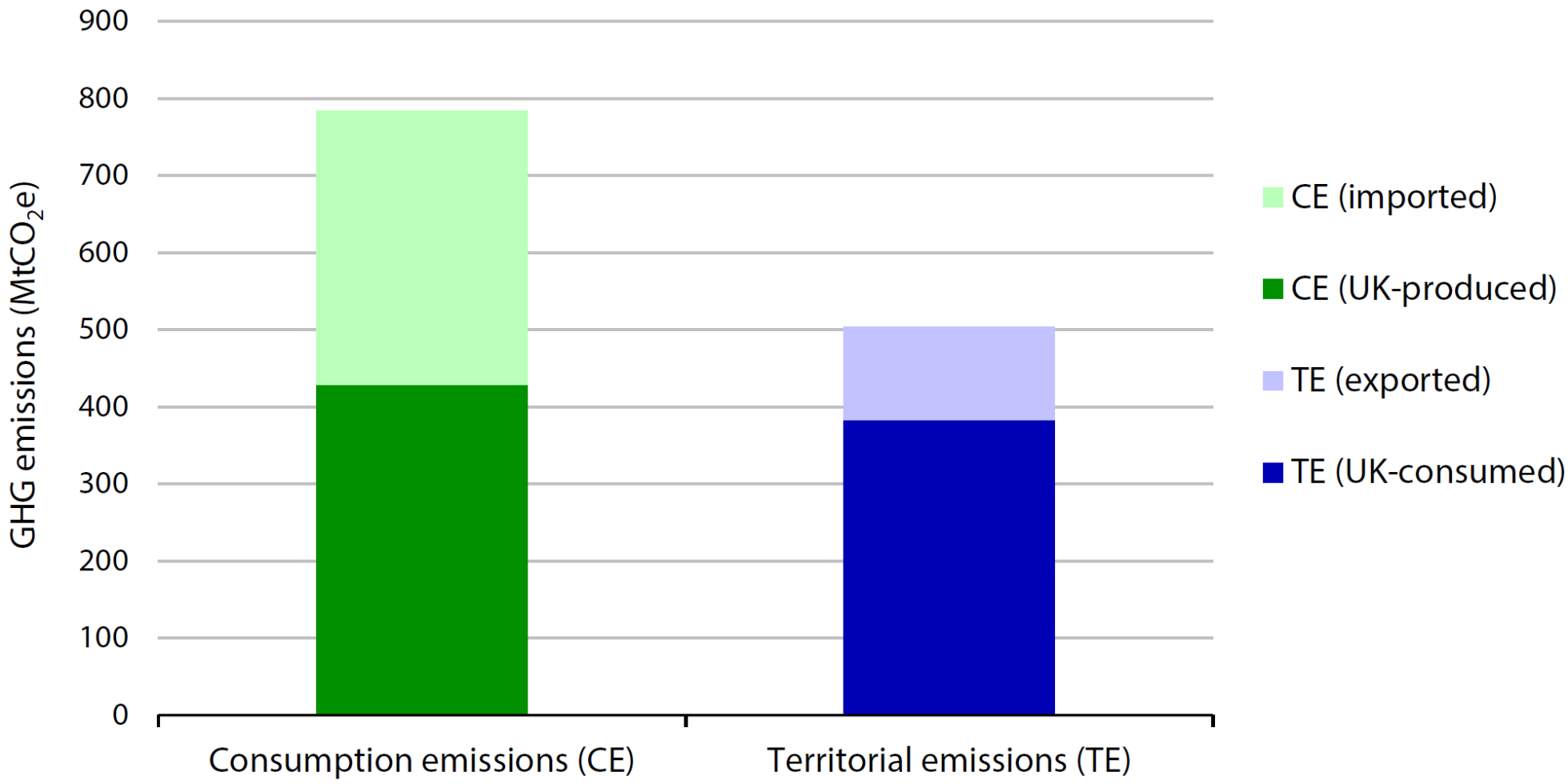
UK Carbon Footprint: consumption emissions



Net Zero – the UK's contribution to stopping global warming CCC 2019. Excludes F-gas emissions and international aviation and shipping

Consumption vs territorial emissions 2016



CCC Progress Report to Parliament 2019 includes international aviation and shipping

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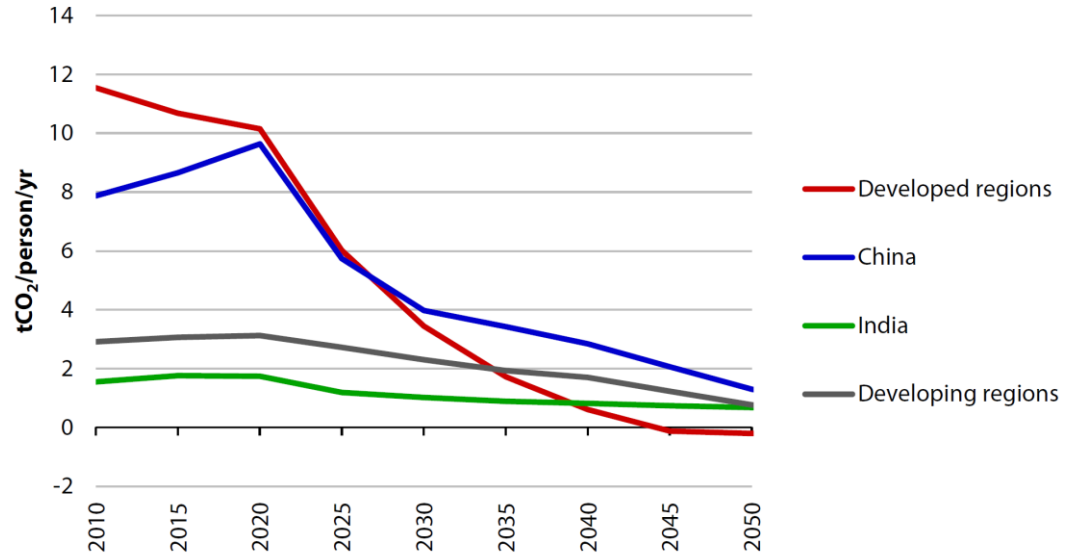
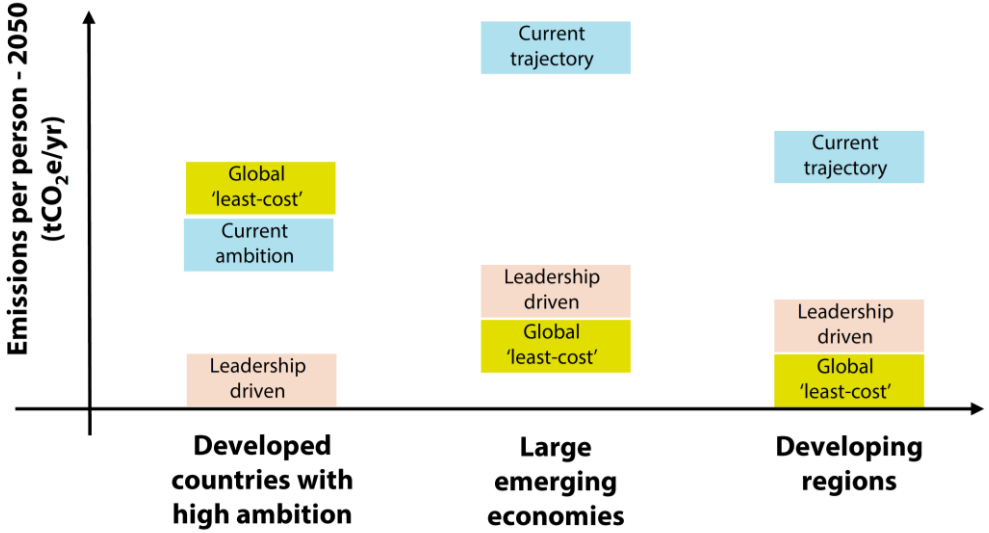
International pathways: leadership driven scenarios

- **Developed regions**
  - In line with emerging commitments: achieve or exceed net zero by 2050
- **Large emerging economies eg China**
  - Improve on NDCs, peak soon, reduce rapidly over next 20 years, reach net zero before the end of the century
  - Efficiency, decarbonising power, electrification, CCS
- **Developing regions**
  - Leapfrog to low carbon development paths, low per capita emissions, can reach net zero until well after 2050
- **Per person emissions from the developed regions in 2050 would be lower than in the rest of the world**





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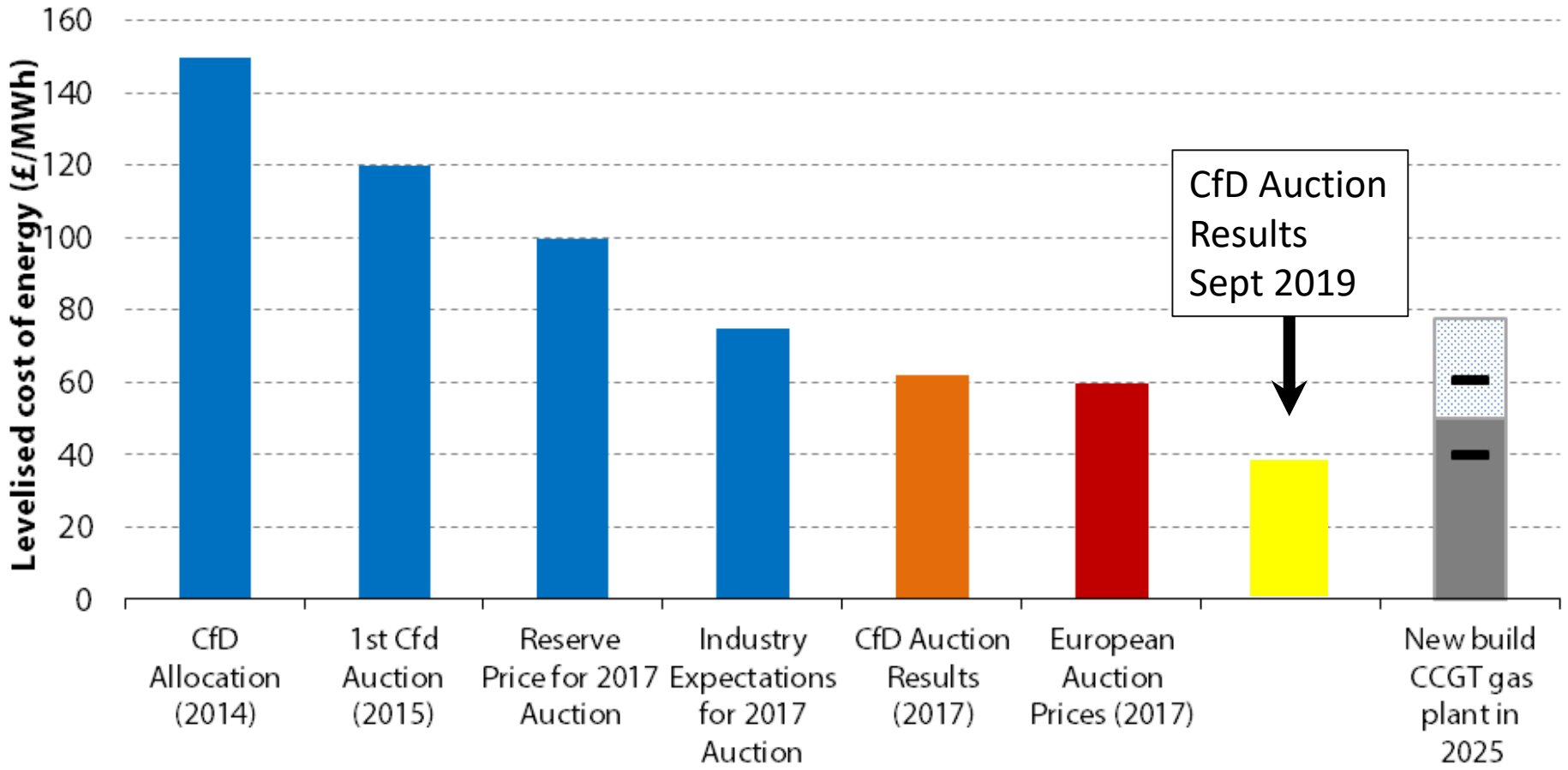
Technology cost reduction: offshore wind

Latest Contracts for Difference auction prices



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When: science and global imperative?

How: can it be done?

How much: what will it cost?

How big: the scale of the challenge?

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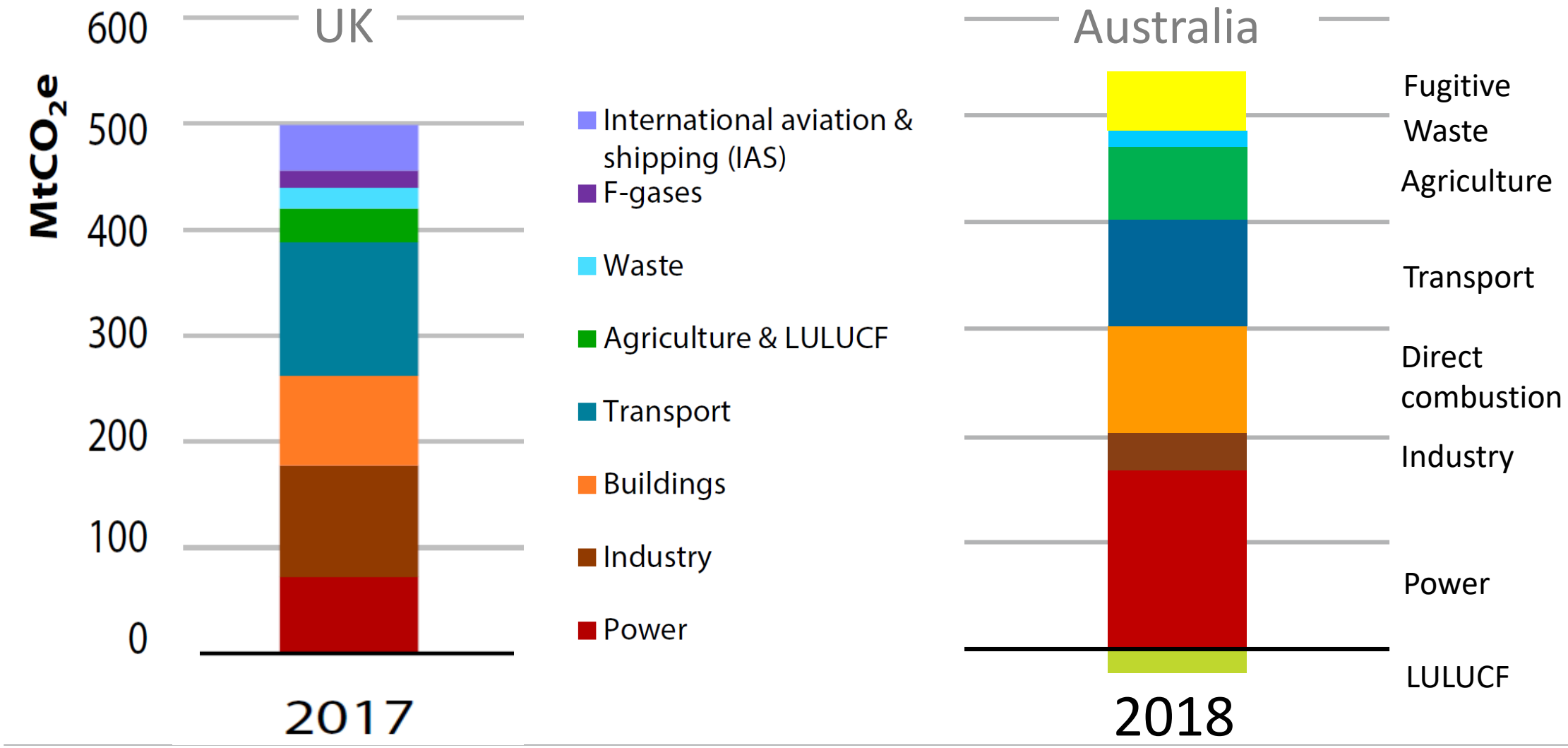
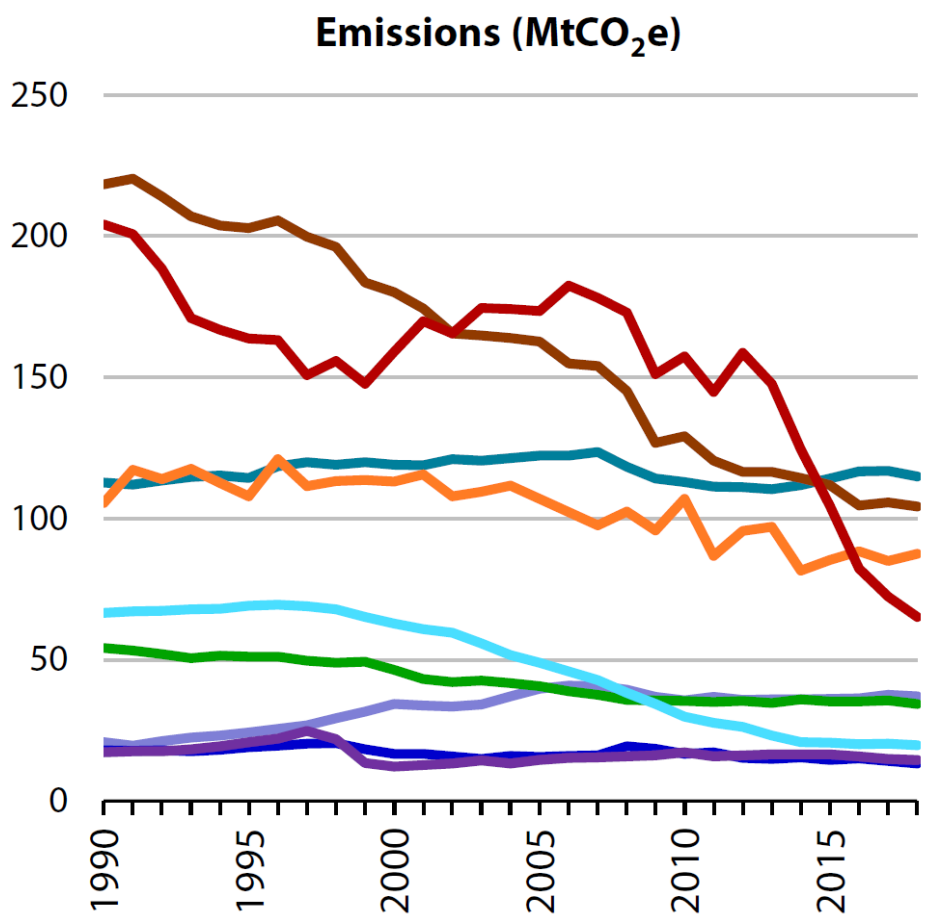
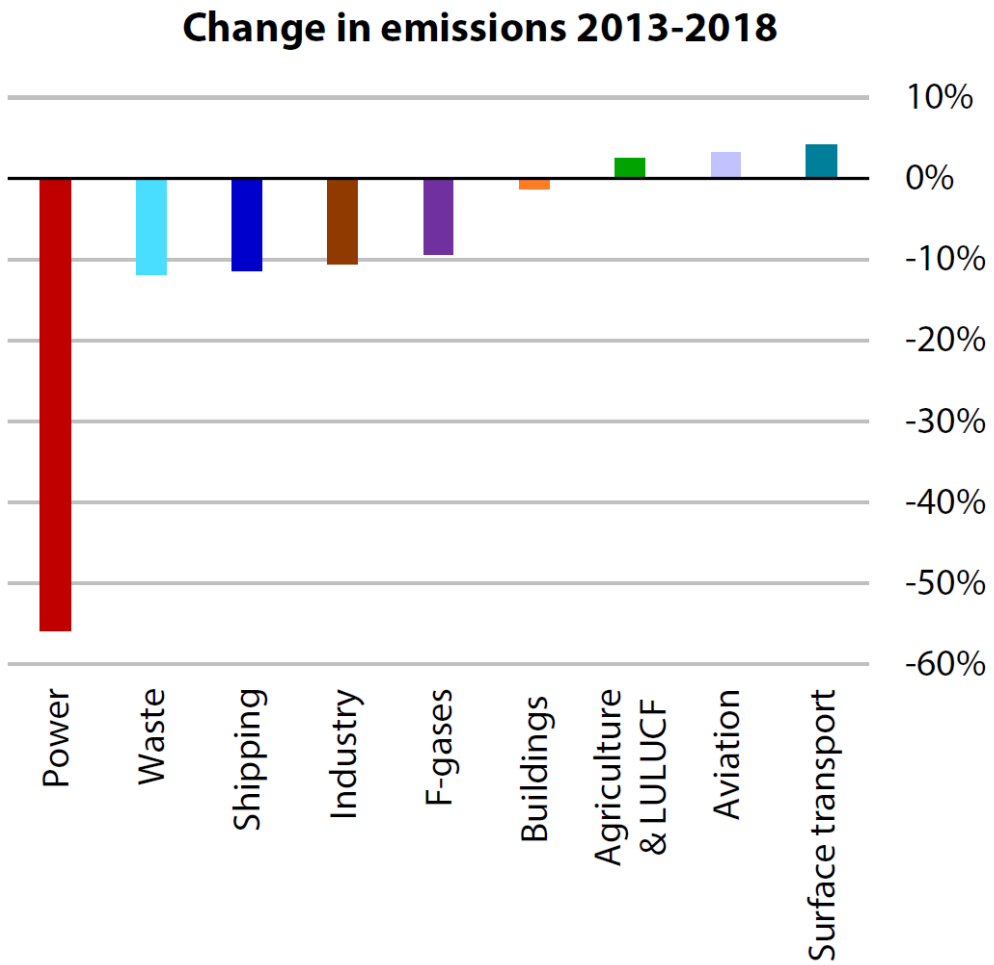
Source of emissions: UK and Australia



The journey so far





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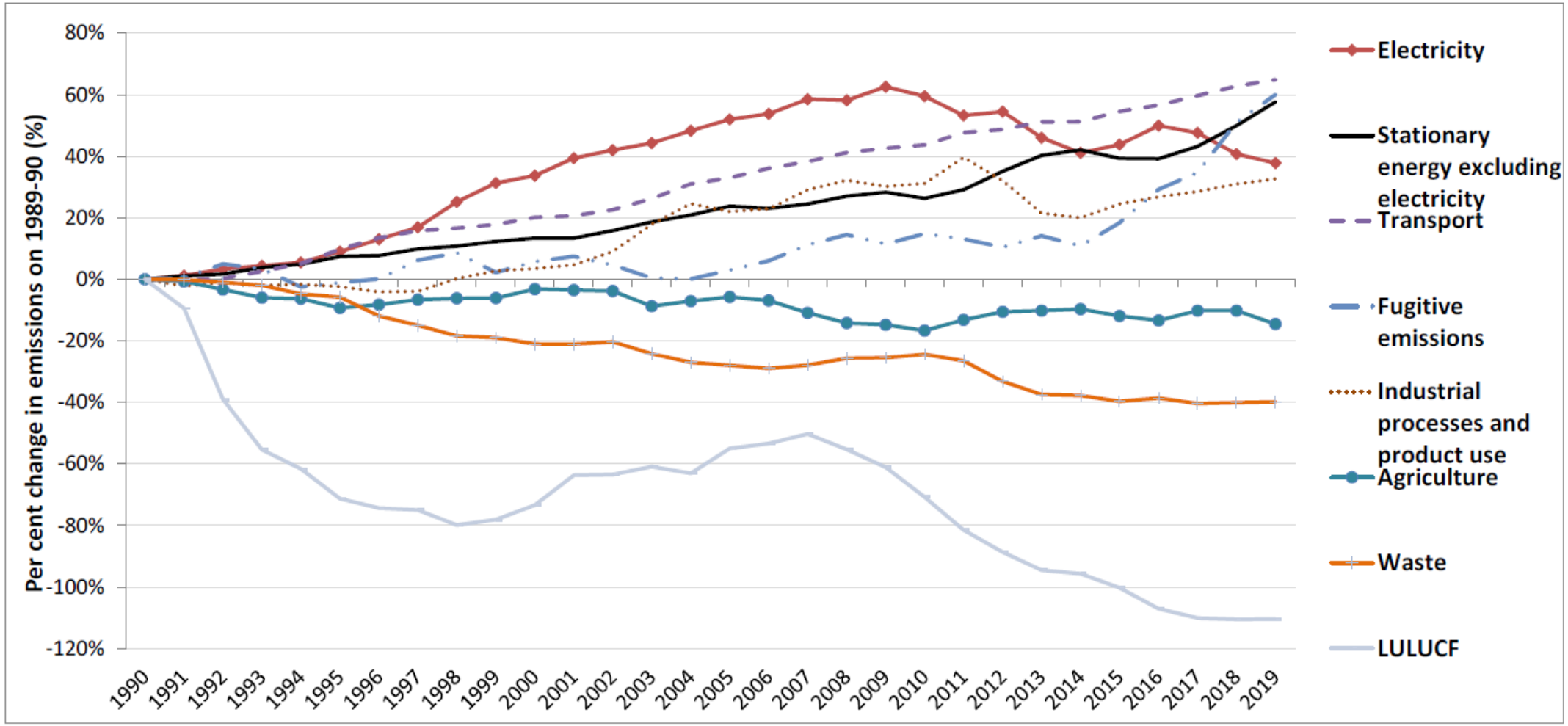
Australia: change in emissions by sector



Source: Department of the Environment and Energy

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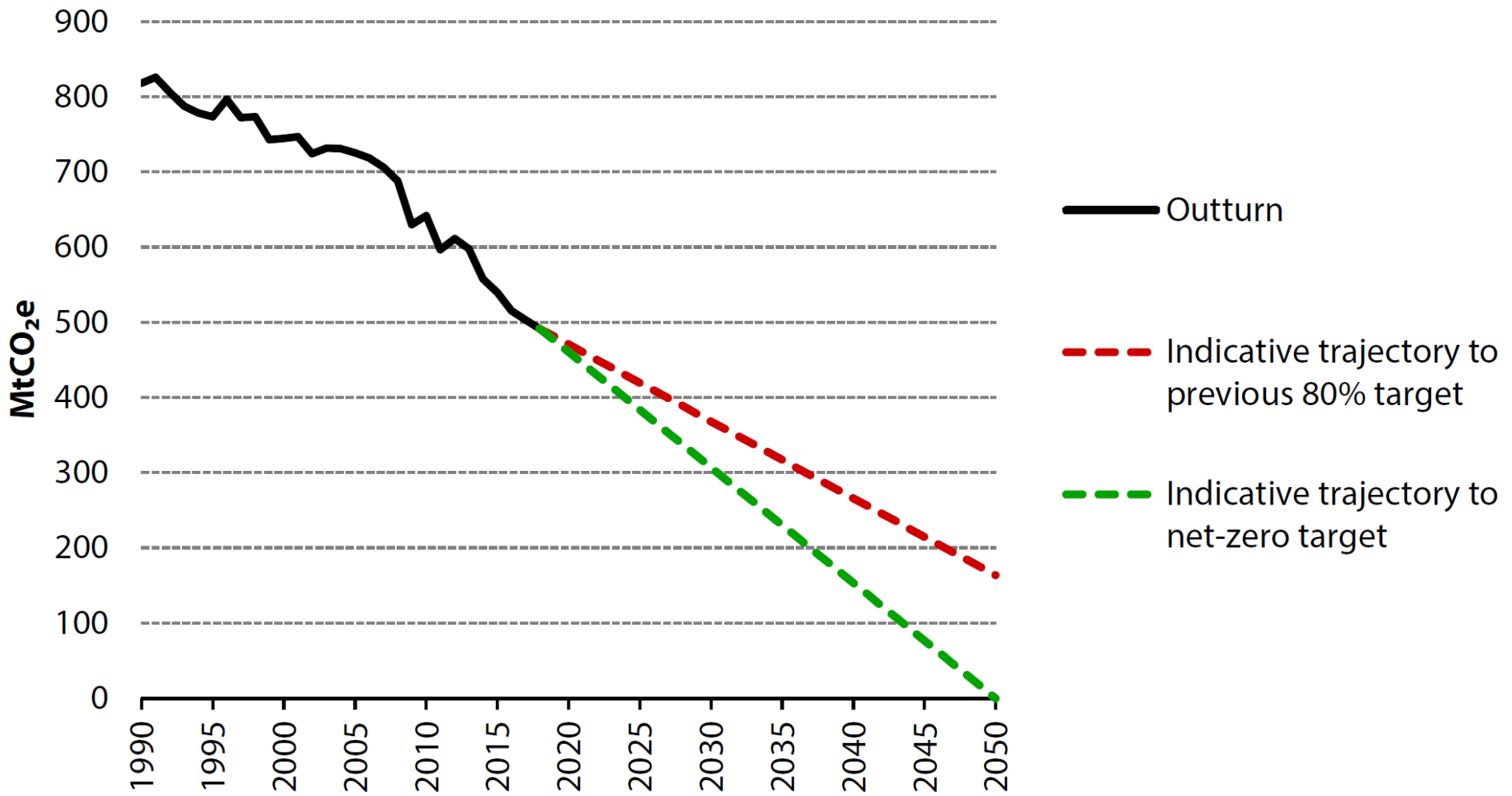
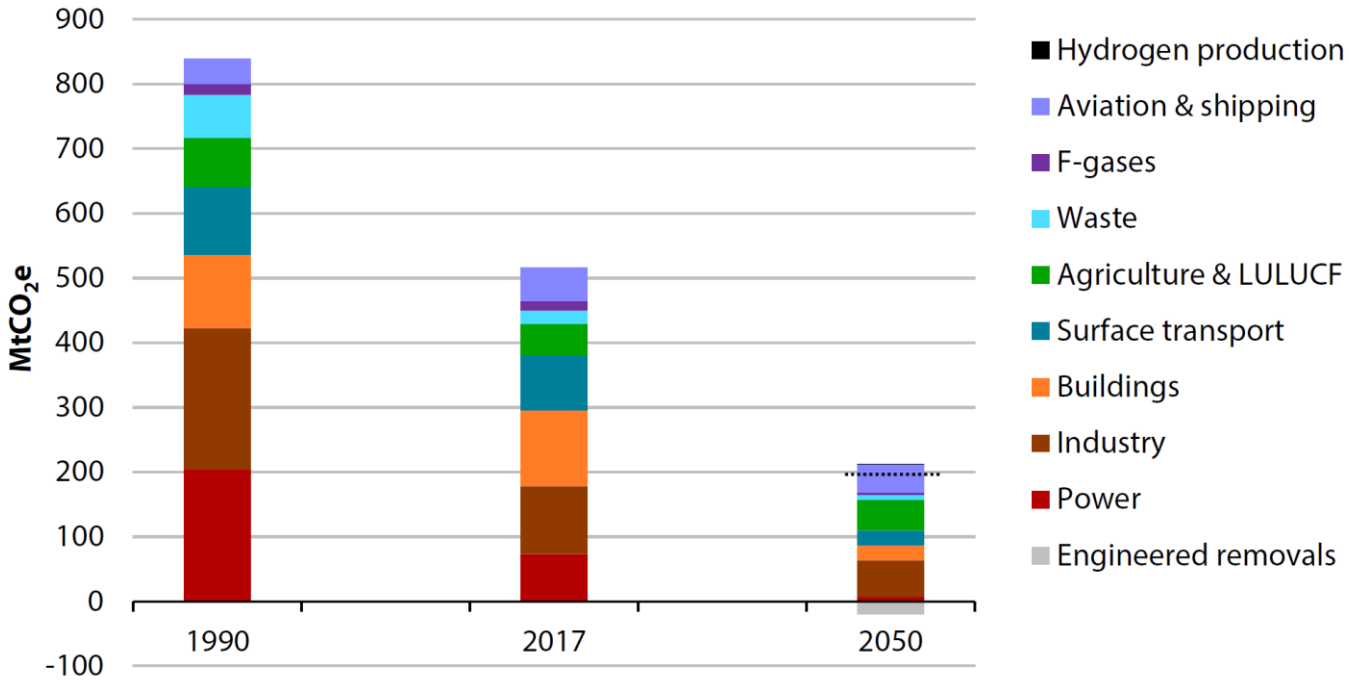
From 80% to 100%



Options to reduce emissions 1

Core options: to 77%

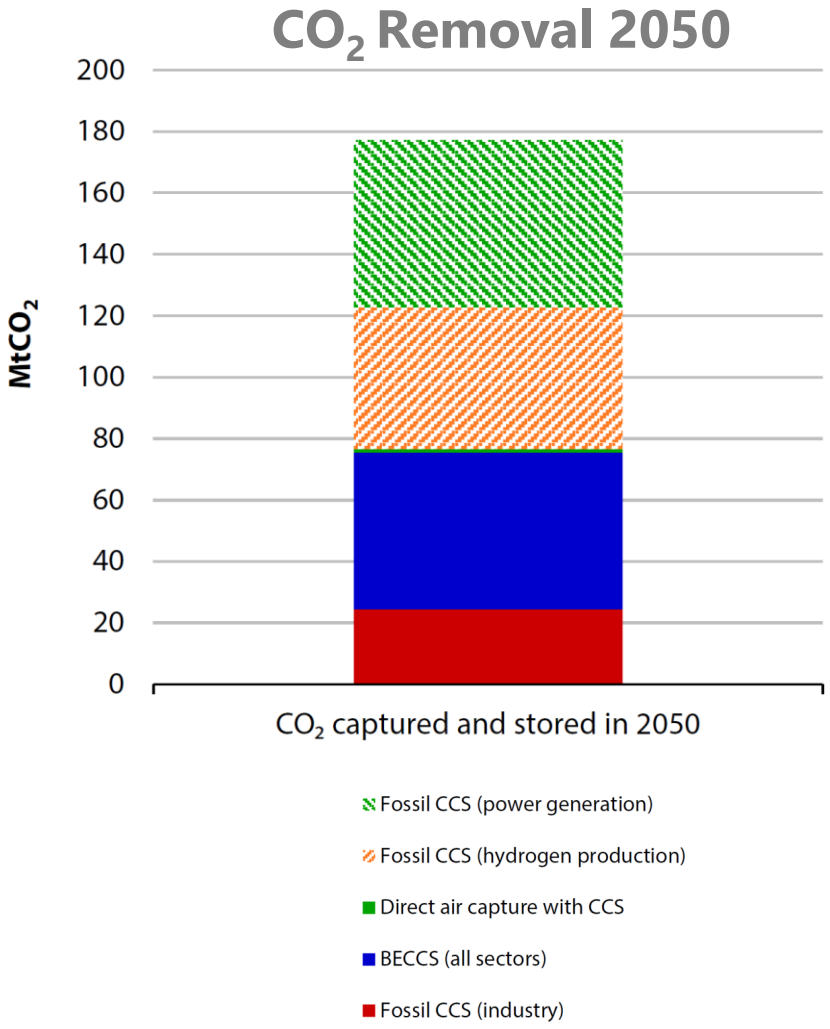
- Low cost, low regret, make sense under the current 80% target
- Broadly reflect Government's current ambition – but not necessarily policy implementation
- eg **energy efficiency**, **electrification**, phase out of conventionally fuelled vehicles by 2040, **progress with zero carbon power generation**, first industrial Carbon Capture, Utilisation and Storage cluster by 2040, wood in construction, limited implementation of BECCS, afforestation 27,000 hectares per annum
- Remaining emissions mainly from industry, agriculture, aviation, heavy transport and heating of buildings
- Carbon prices typically below ~ £20 per tonne



Policies to achieve net zero 1

Further ambition: to 96%

- More challenging, more costly, existing technologies
- Electricity 95% low carbon power, including **hydrogen**
- **Buildings** 90% low carbon heating including **hydrogen**
- All cars and vans electric by 2050; HGVs electric or **hydrogen**
- **Industry**: **CCS, hydrogen** and electrification
- Waste: 70% recycling, zero biodegradable waste to landfill by 2025
- Shipping: faster implementation of efficiency and alternative fuels
- **Agriculture and land use**: improved livestock breeding and diets; 20% reduction in beef , lamb and dairy, increased yields, 30,000 hectares per annum afforestation; 55% peatland restoration, increased energy crops
- Aviation: 60% increase in demand with further technical improvements
- **CO_2 removal**: afforestation, wood in construction, **BECCS**, DACCs – small scale; CCS: 175Mt CO_2 captured and stored in 2050
- Carbon price up to £120/tonne – industry and heat at top end



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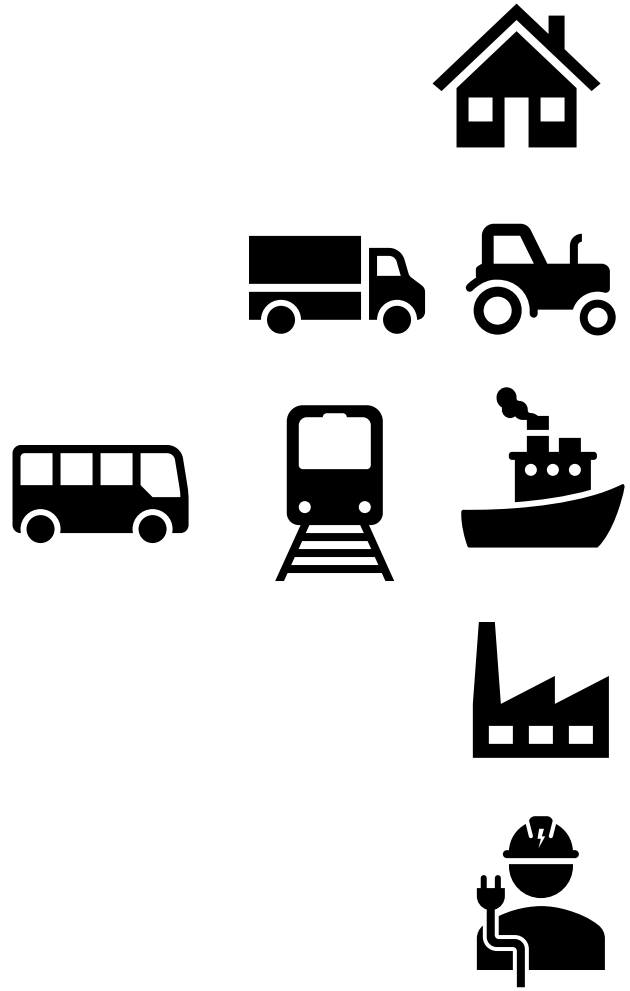
Efficient use of energy

- First: energy efficiency
  - use as little energy as possible
- Second: electrification
  - 80-90% efficient
- Third: hydrogen
  - conversion, compression, use… up to 70% efficient
- Fourth: synthetic fuels
  - reversing highly exothermic reactions – very energy intensive

Where are we using all this hydrogen?

- Buildings heat 50 – 200TWh
- Transport 97TWh
  - HGVs, buses, trains, agricultural vehicles 27TWh
  - Shipping (ammonia) 70TWh
- Industry 70TWh
  - High grade heat 70TWh
- Power 2TWh
  - Peak power back up
  - Mid merit low load factors
- Total 220 – 370TWh



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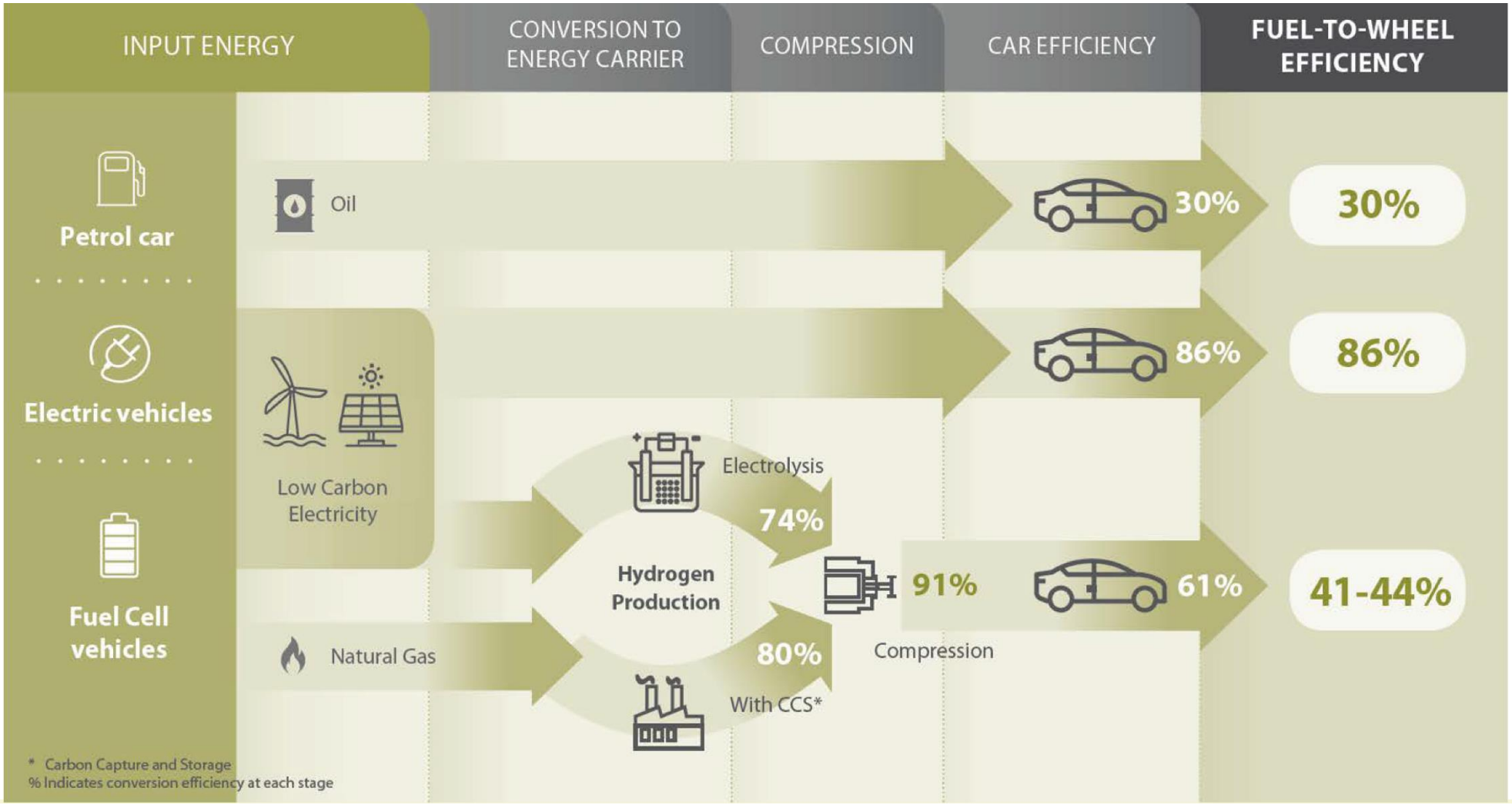
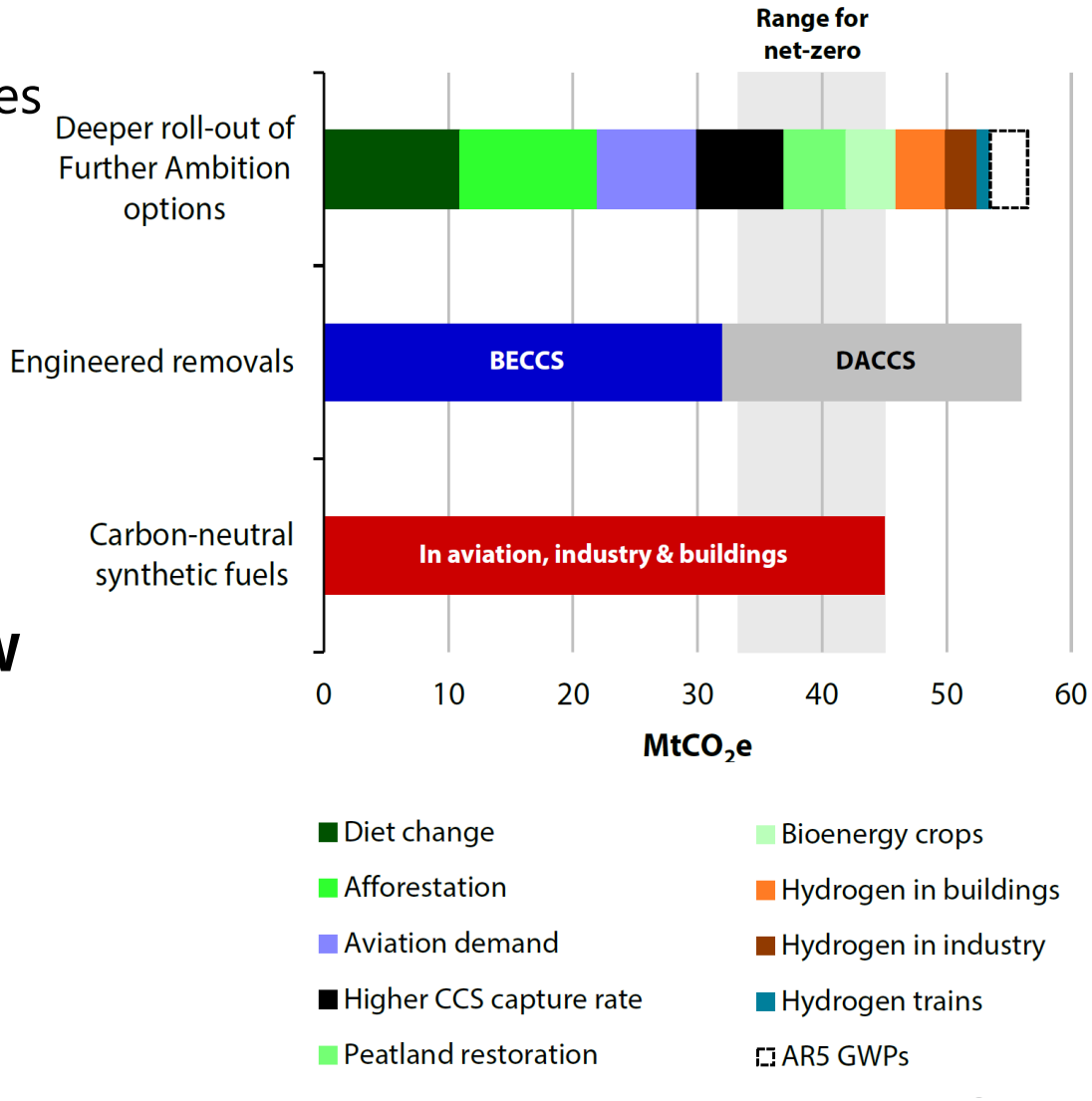
So for cars...



Options to reduce emissions 3

Speculative options: to 100%

- Low technology readiness; high costs; acceptability issues
- Not all available by 2050, some required for net zero
- **Significant societal and behaviour changes**:
  - **50% reduction in beef, lamb and dairy**
  - **No growth in aviation from today**
- Afforestation, 50,000 ha/annum, peatland restoration
- More ambitious **BECCS** – increased energy crops
- Increased **DACCS – 14% increase in CCS, +10GW OSW**
- Enhanced weathering and biochar
- **Synthetic fuels – +33% generating capacity**
- **CCS capture rates at 99%**
- Increased use of hydrogen
- **Carbon price to > £300 per tonne**



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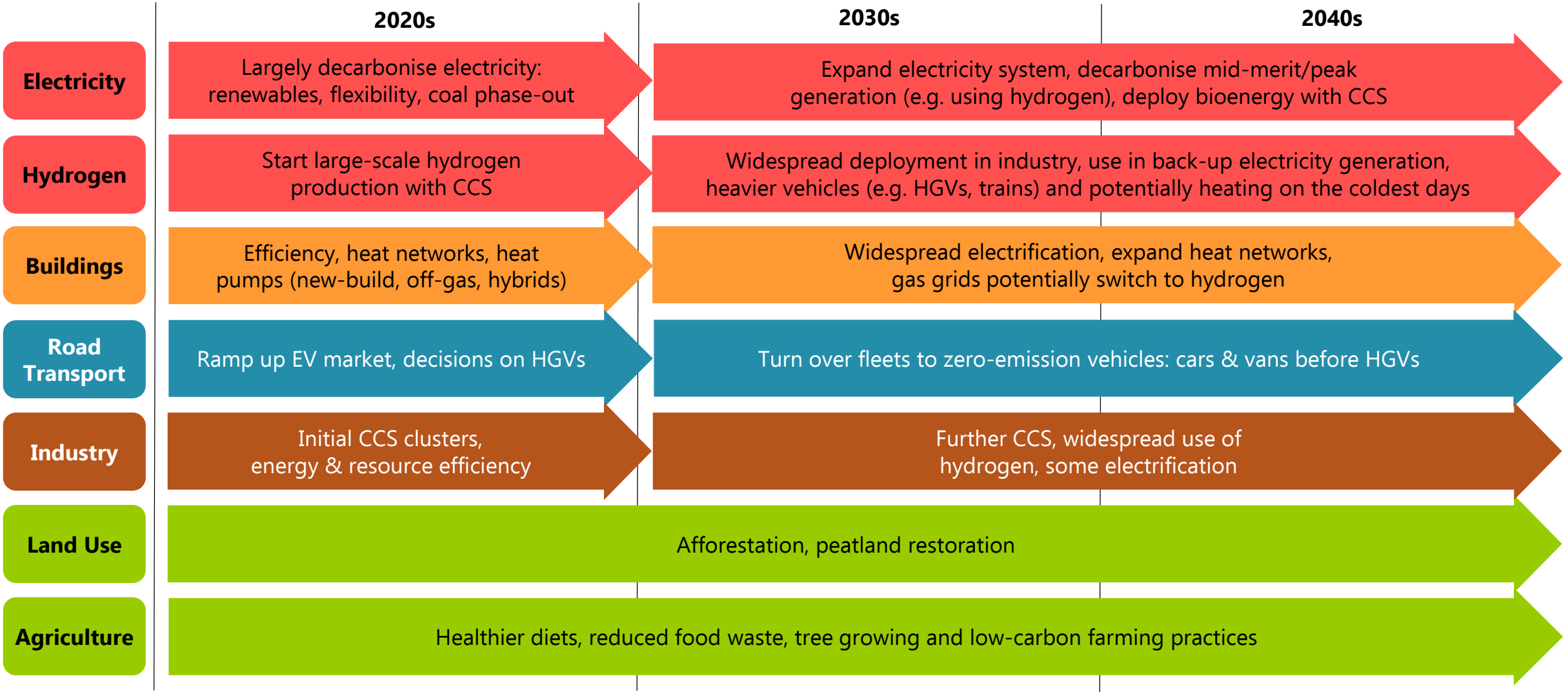
How UK net-zero scenarios can be delivered



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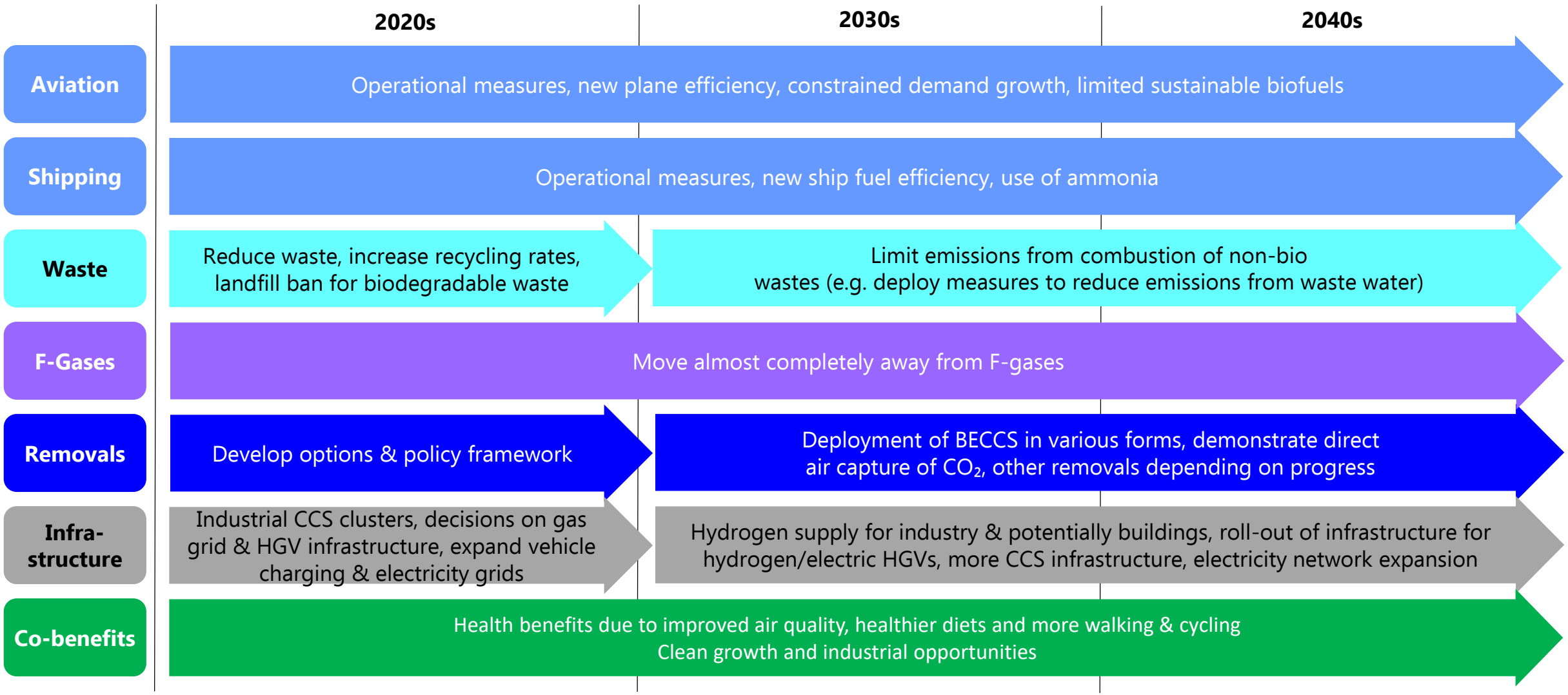

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How: can it be done?

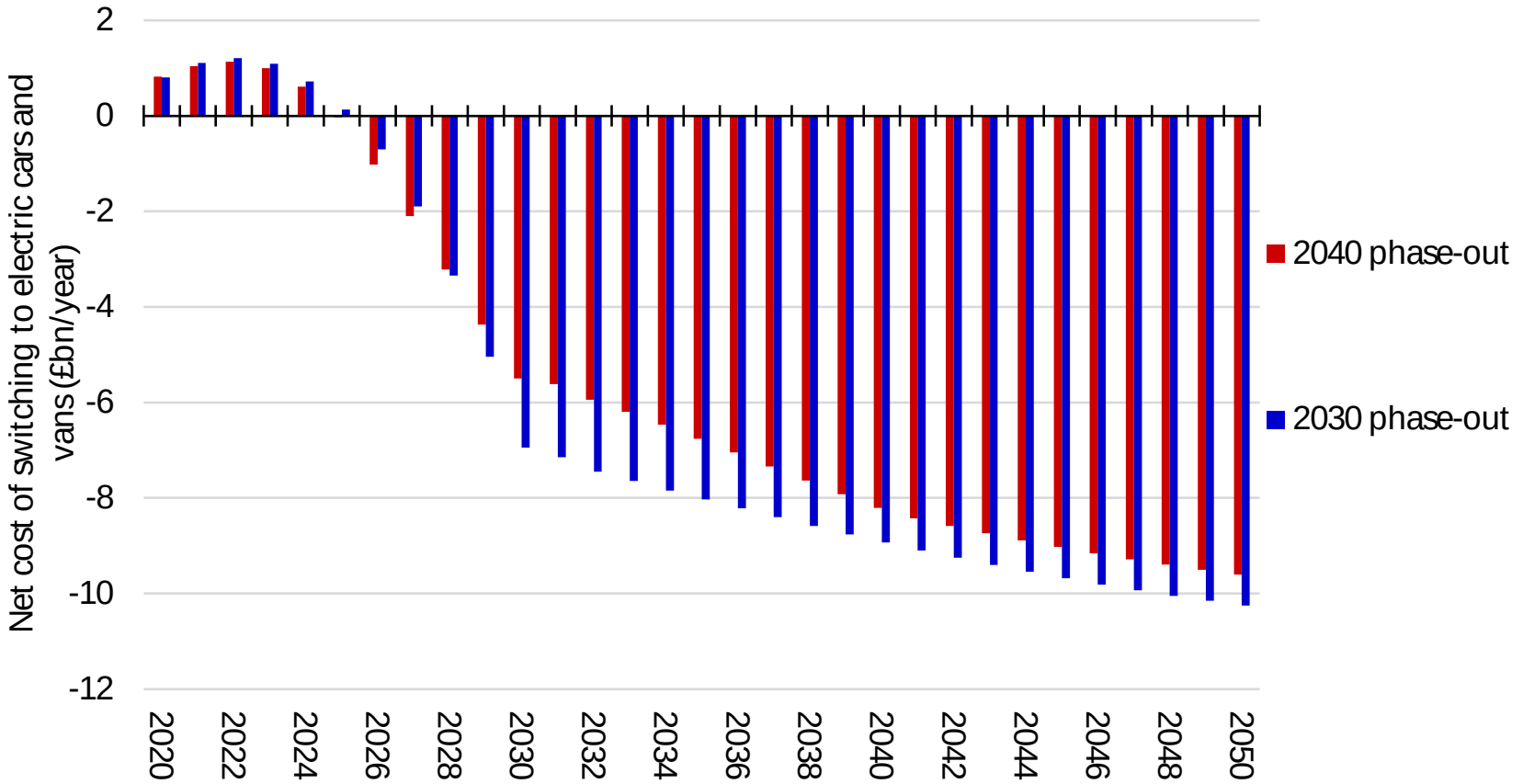
How much: what will it cost?

How big: the scale of the challenge?

Innovation and falling technology costs are reducing the cost of meeting the target

Changes in cost estimates for long-term emissions goals		
GHG emissions reduction target (relative to 1990)	**Year and report**	**Cost range estimated for 2050**
60% reduction in CO_2 (~55% reduction in GHG)	2003 - *Energy White Paper*	0.5-2.0% of GDP
80% reduction in GHG	2008 - *Building a low-carbon economy – the UK's contribution to tackling climate change*	1-2% of GDP
100% reduction in GHG	**2019 – Net Zero report**	**1-2% of GDP**

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



Source: CCC analysis

Benefits

- **Reducing the impacts of climate change**
  - Flooding, heatwaves, crop failures, migrants…
  - £££££££££££££££££££££££££££££££

- **Economic opportunities**
  - Clean growth; fastest growing sector of UK economy
- **Health benefits ~ 1.3% GDP**
  - More exercise, cleaner air, noise reduction, healthier diets, healthier homes
- **Environment**
  - More woodlands, hedgerows, wildlife, recreation, water and soil quality…

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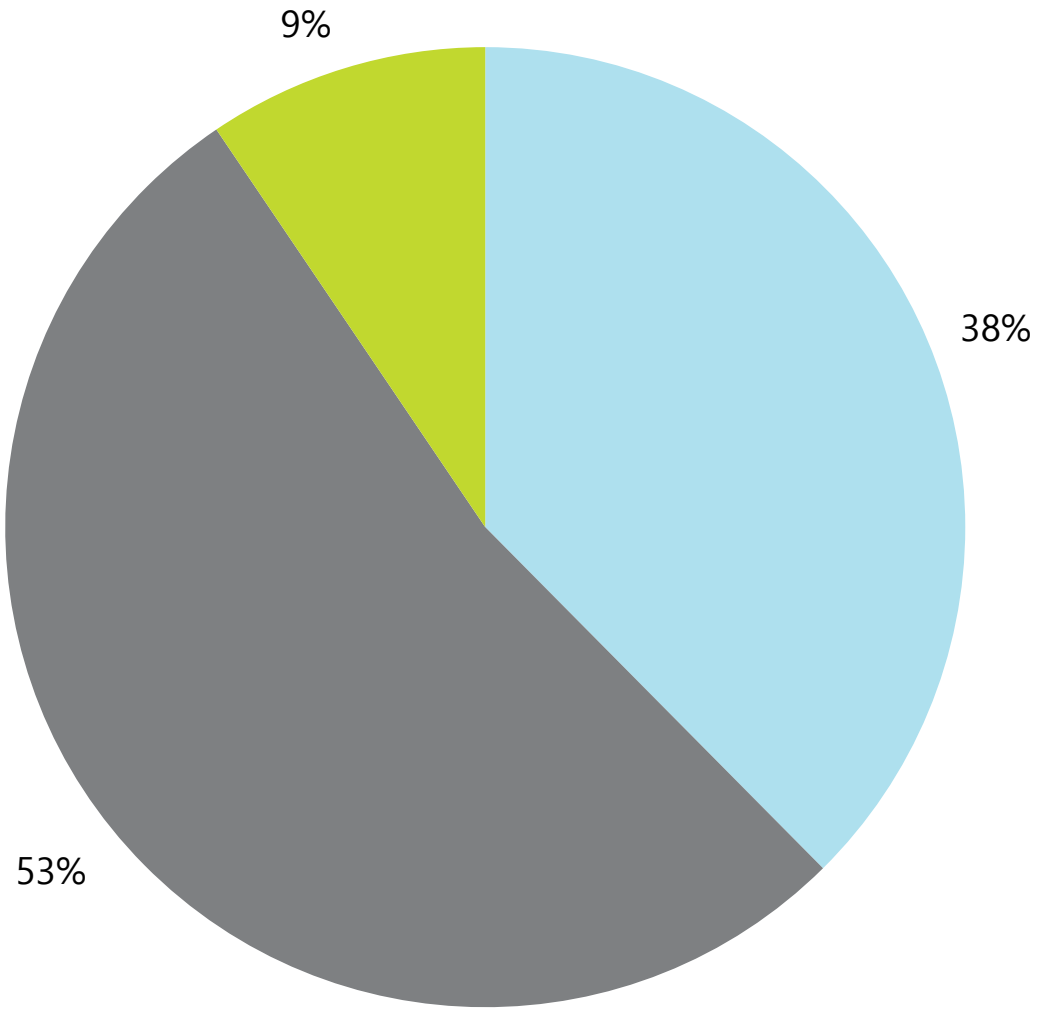
Societal/behavioural change needed



Source: CCC analysis

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How big? In the next 30 years…

- Electricity system x2 to x4
- Offshore wind 10 GW to 75 - 100GW
- Hydrogen production 27TWh to 370TWh
- CCS 0 to 180 Mt CO_2
- Afforestation 10,000 to 50,000 hectares pa
- 29 million existing homes installed with low carbon heat
- Zero carbon cars 100,000 to 35 million
- Major changes in agriculture and land use
- Major changes to diet: beef, lamb and dairy consumption halved

All at the same time

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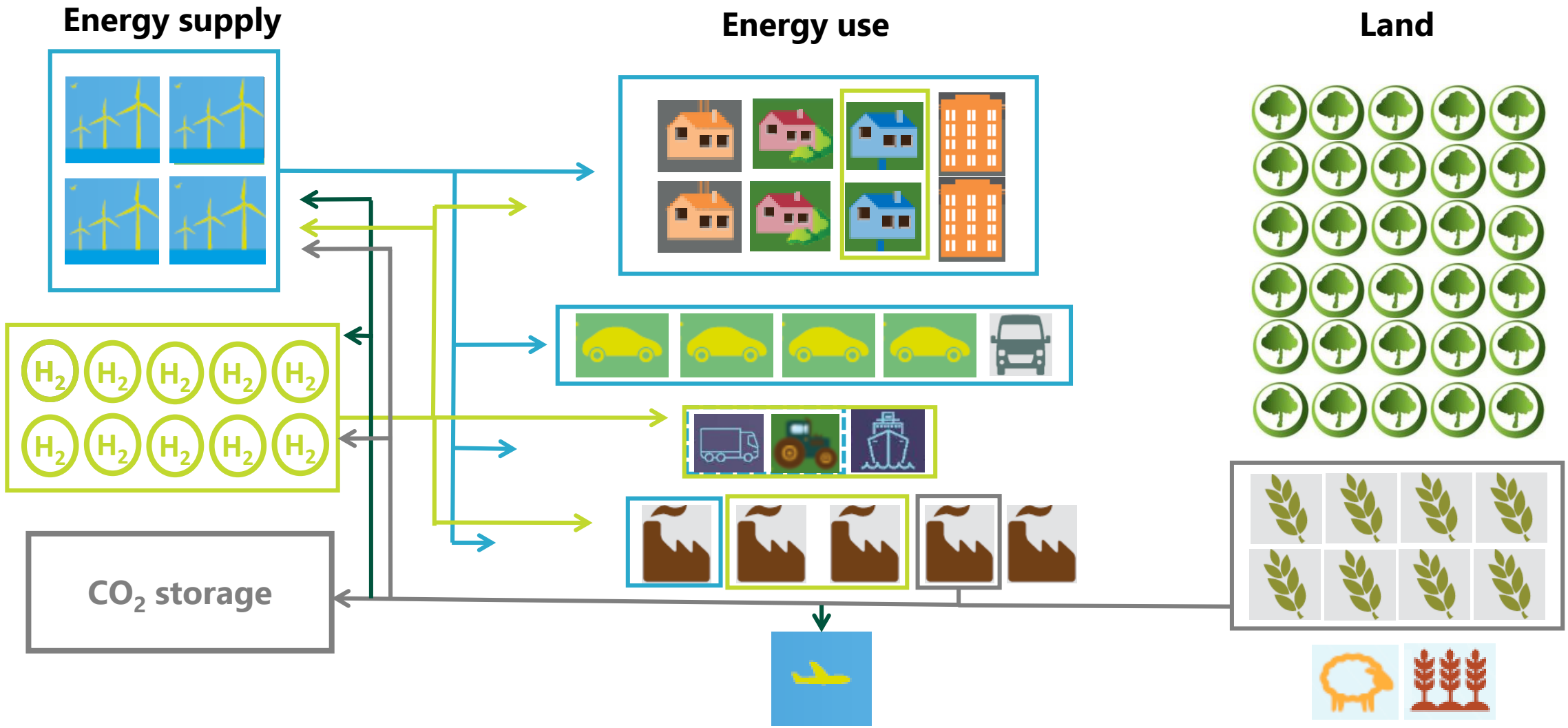
How UK net-zero scenarios can be delivered



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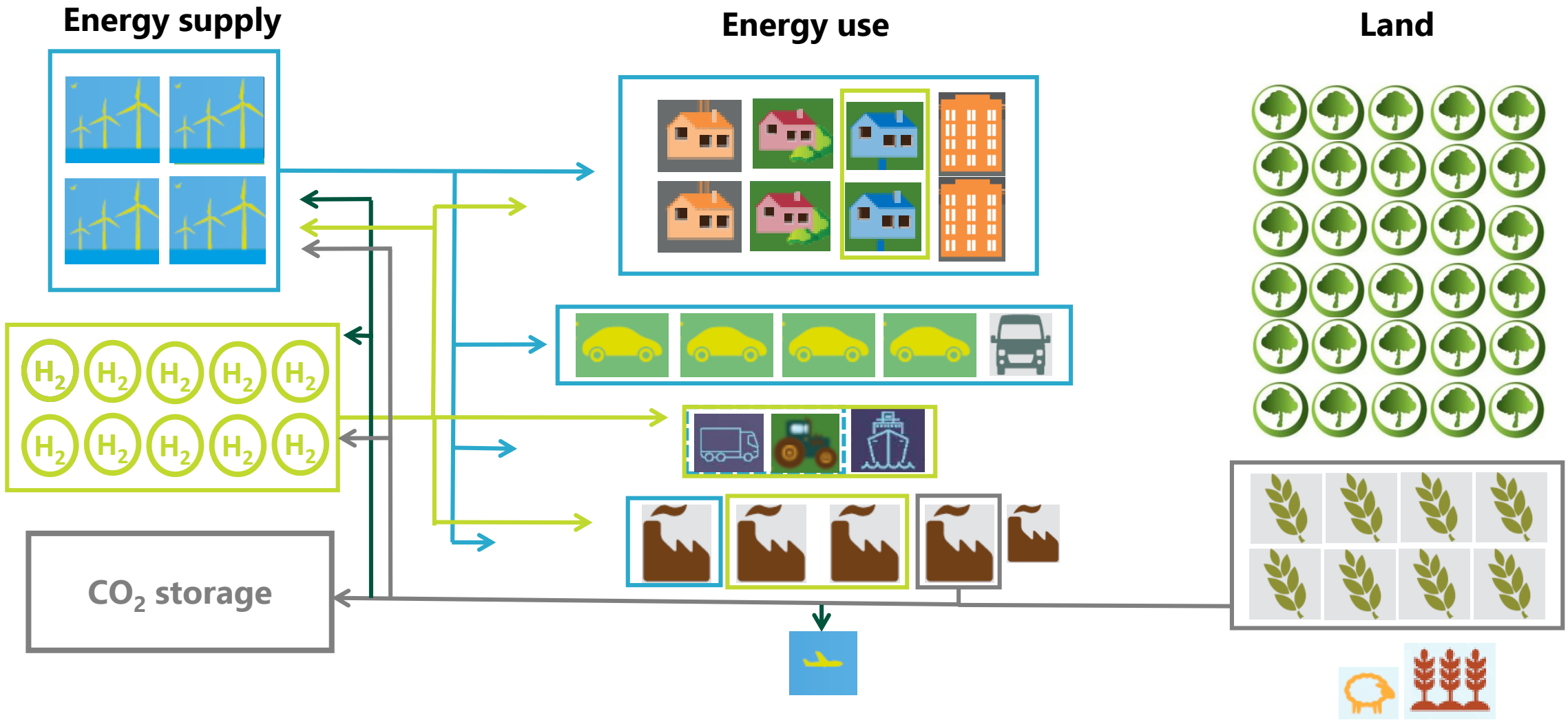

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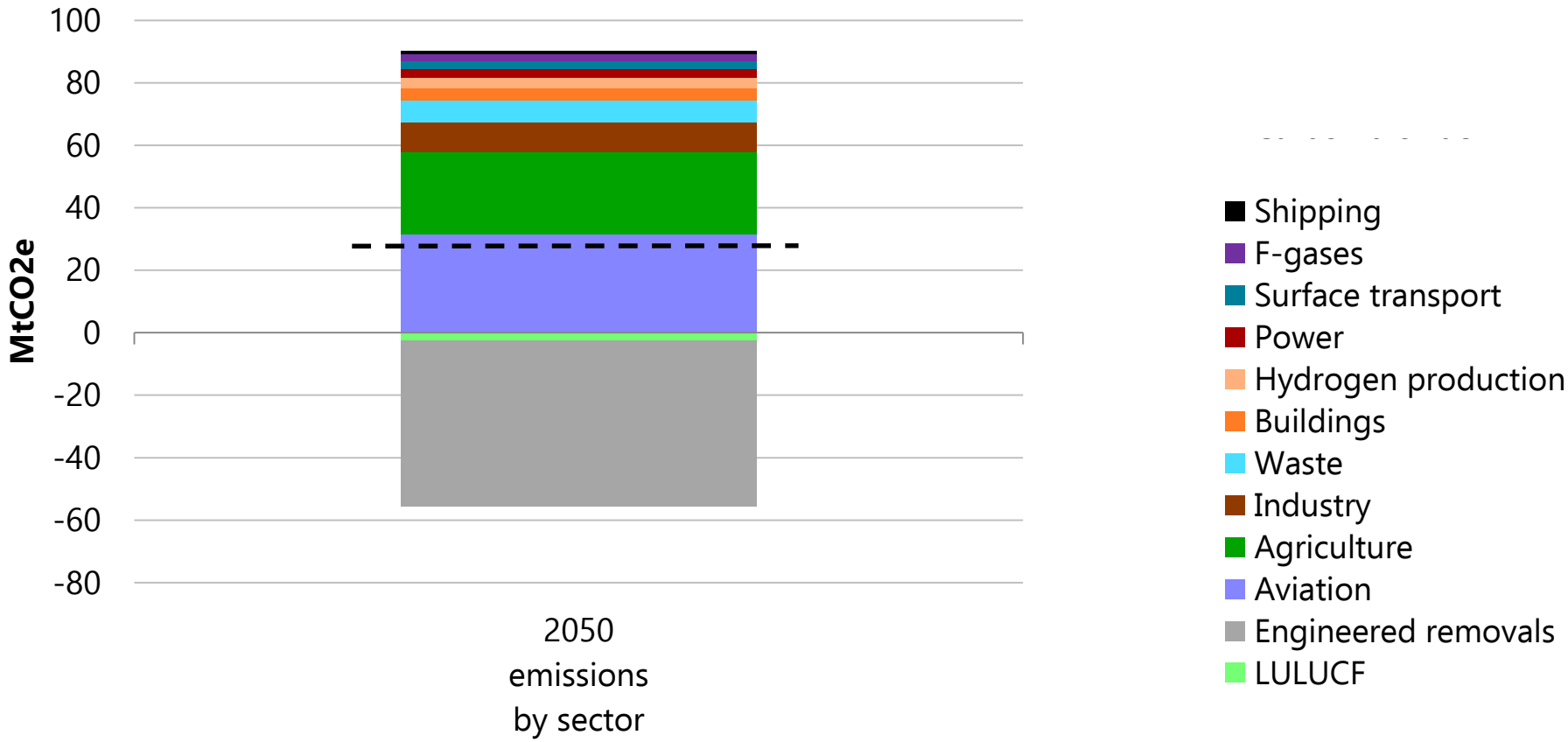
A few final reflections

We don't have all the answers

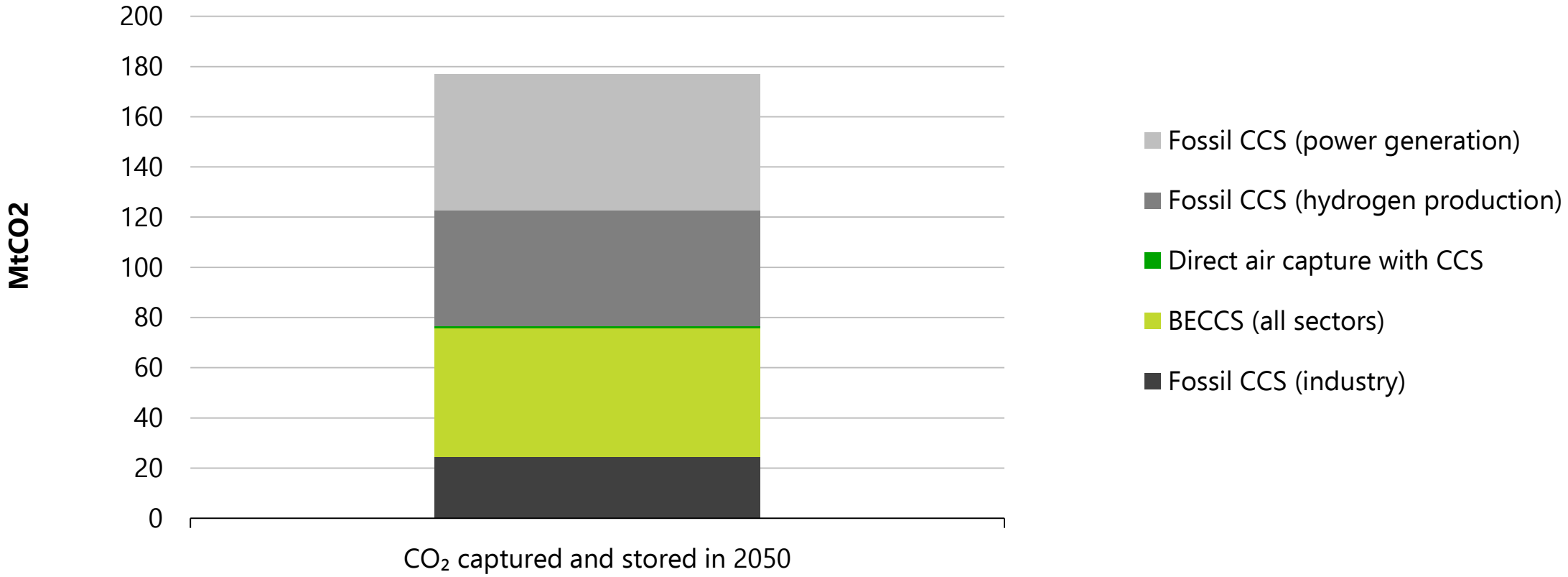
Remaining emissions in the 96% 'Further Ambition' scenario



Source: CCC analysis

Fossil fuel use continues

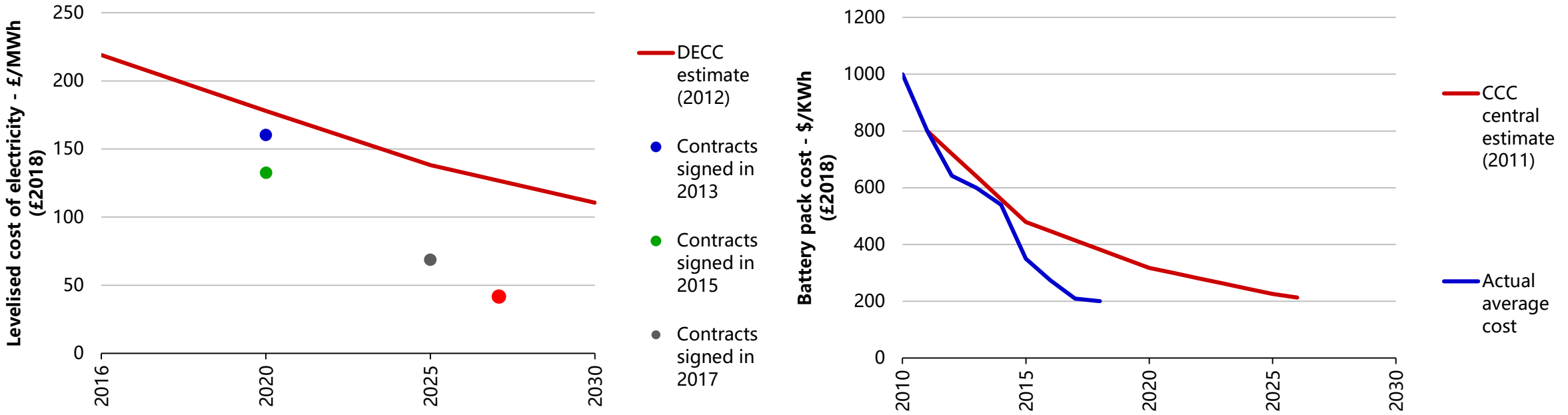
Total CO_2 captured and stored due to Further Ambition options in 2050



Source: CCC analysis

Innovation has moved the dial

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



Source: Offshore wind costs, CCC analysis based on DECC (2012) Electricity generation costs and LCCC (2019) CfD register. Battery forecasts, CCC (2015) Sectoral scenarios for the 5th Carbon Budget, outturn costs from BNEF (2018) Electric cars to reach price parity by 2022

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We need to get going...


Greta Thunberg
"This needs Cathedral Thinking.
We can build the foundations without knowing exactly how we will complete the roof"

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Thank you!

www.theccc.org.uk