Committee on Climate Change

8th October 2019

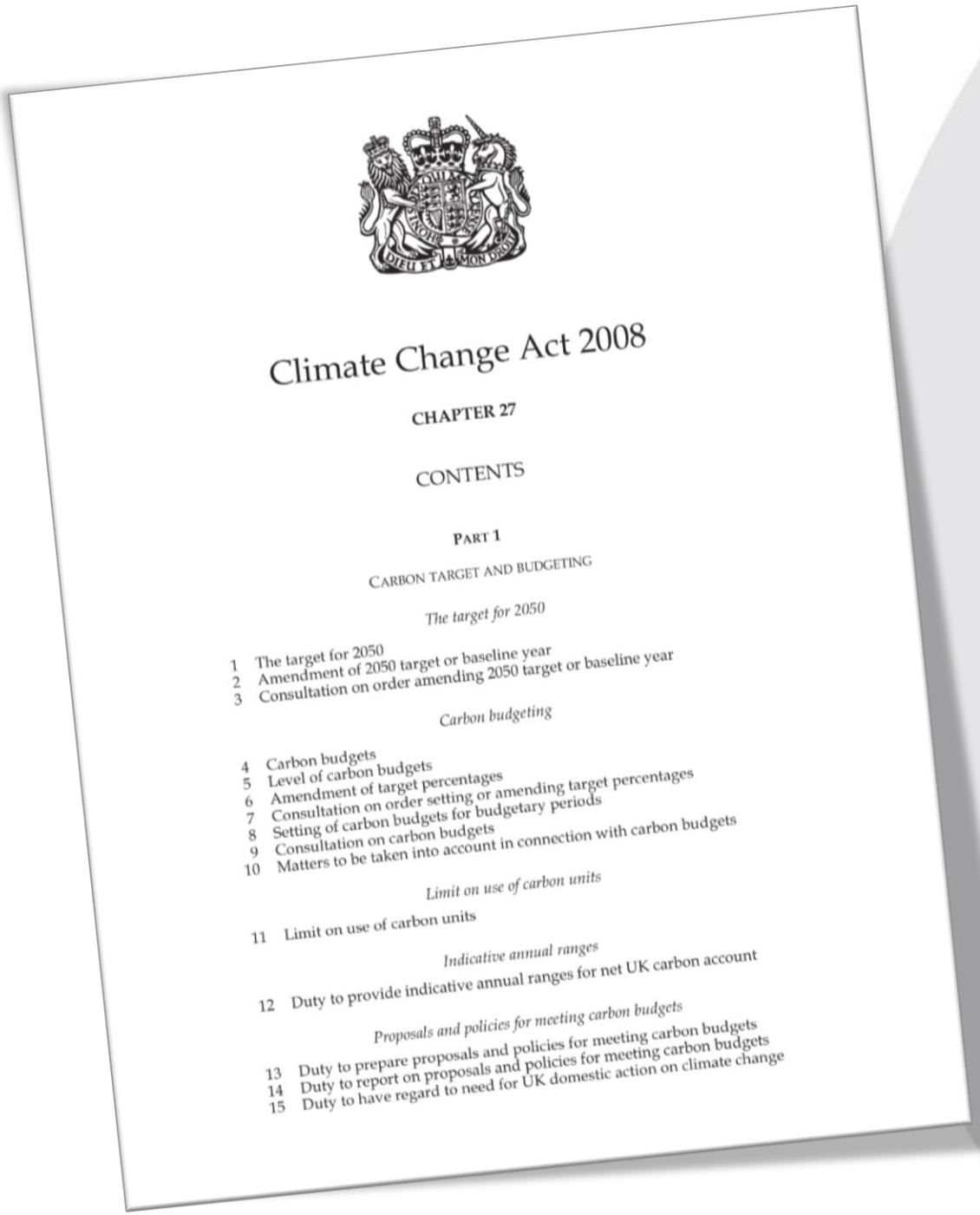
The UK's Commitment to Net Zero

The UK's contribution to stopping global warming

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

Committee on Climate Change

UK Climate Change Act 2008



Climate Change Act 2008

CHAPTER 27

CONTENTS

Committee on Climate Change

When: science and global imperative?

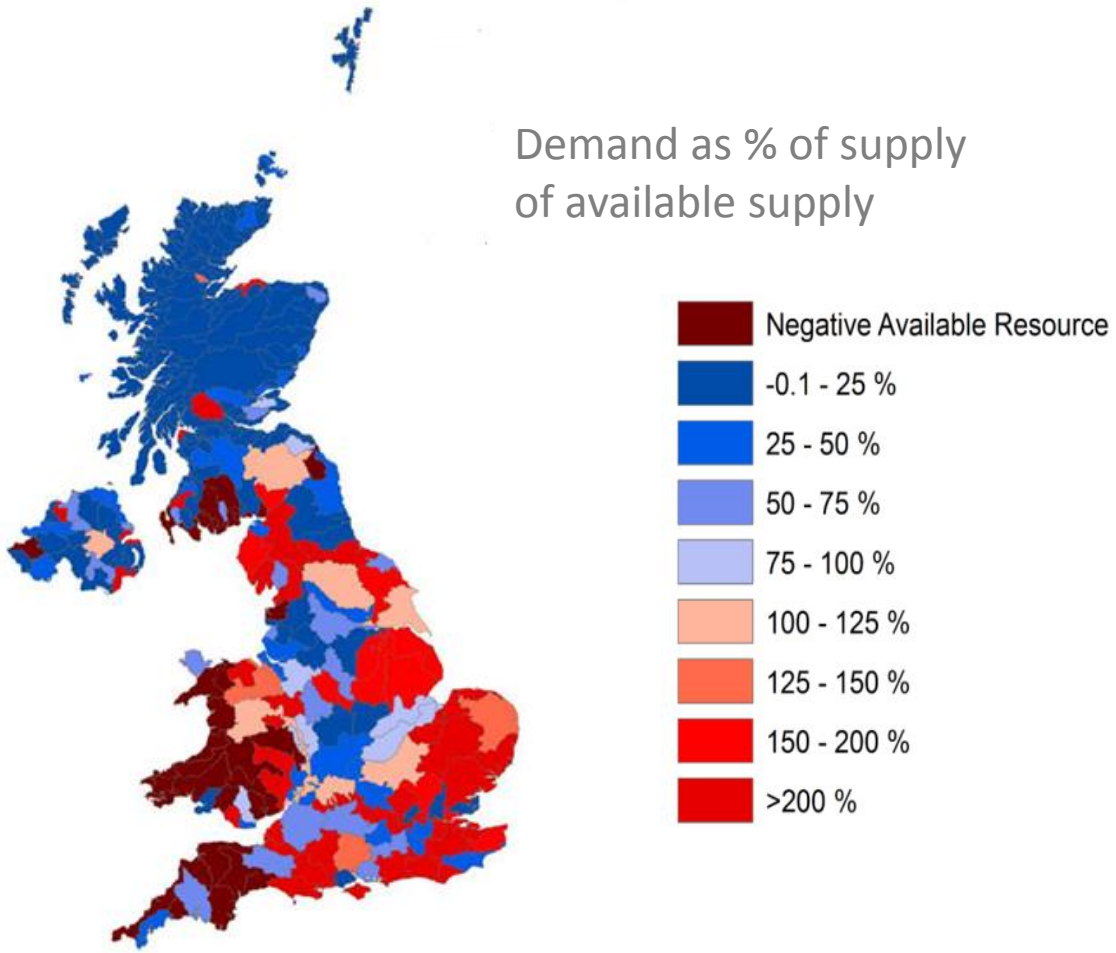
How: can it be done?

How much: what will it cost?

How big: the scale of the challenge?

Even in the UK the impacts of climate change are bleak

Water availability in the 2080s



Scenario:

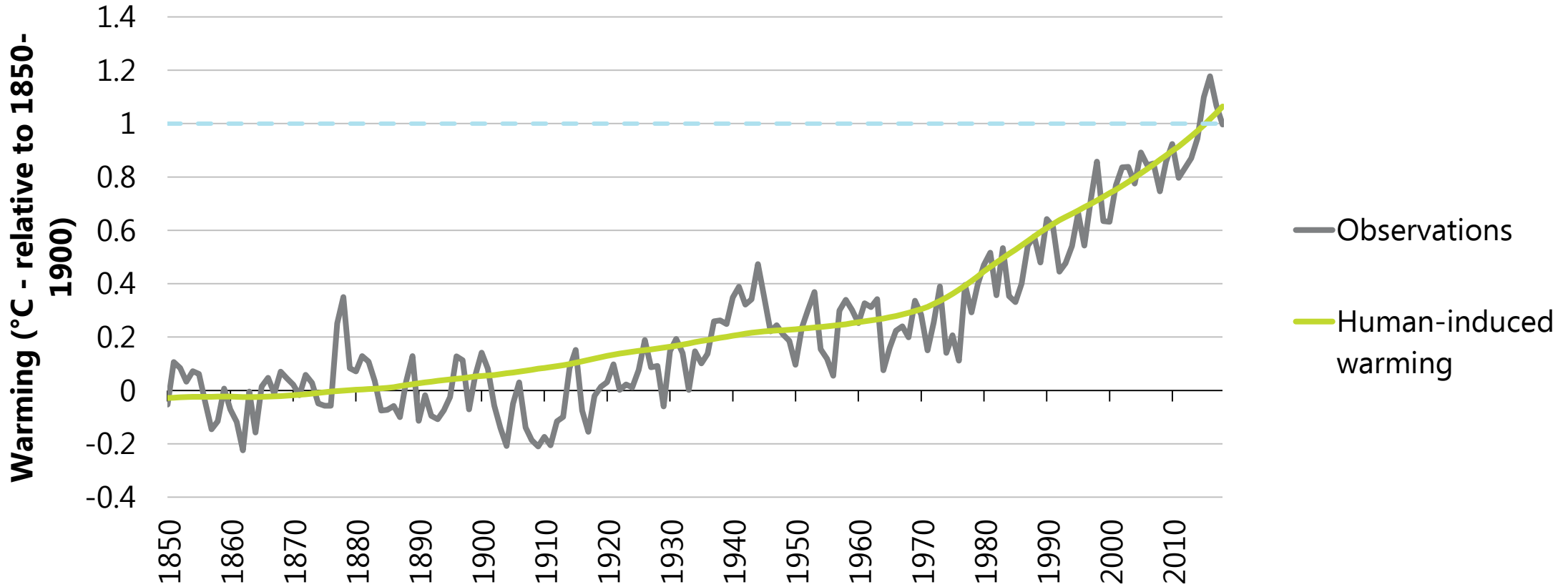
- 3.5°C
- low population growth
- high adaptation

In some areas (dark red) there is no water available for human use during periods of low flows, assuming the needs of the natural environment are met first.

Source: HR Wallingford (2015) for the ASC- *Updated projections of water availability in the UK*

Science and international context
Global emissions pathways consistent with Paris

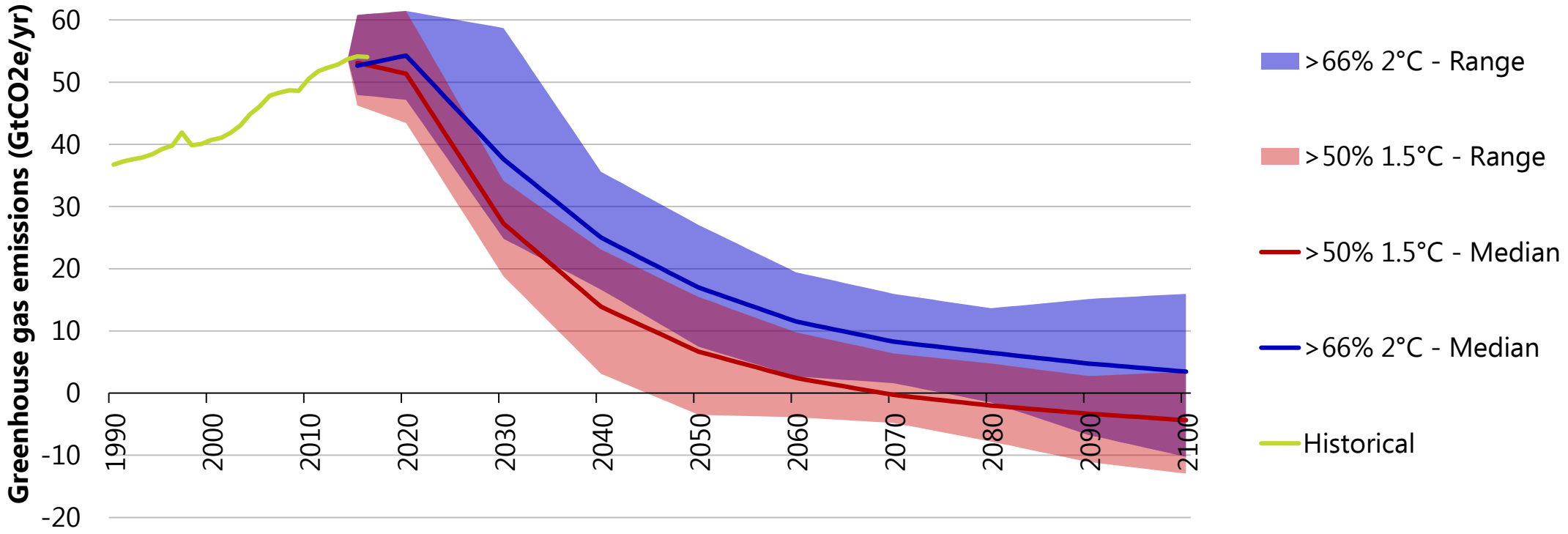
Observed and human-induced warming



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

Science and international context
Global emissions pathways consistent with Paris

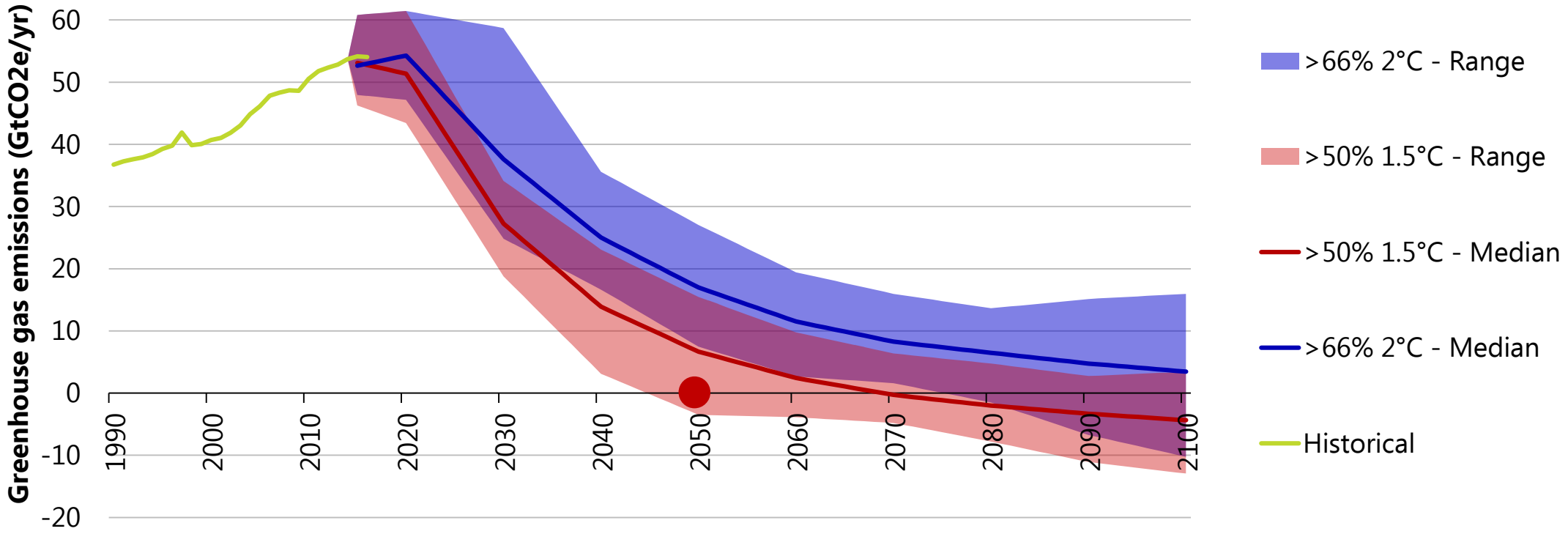
Global emissions pathways consistent with Paris



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

Science and international context
Global emissions pathways consistent with Paris

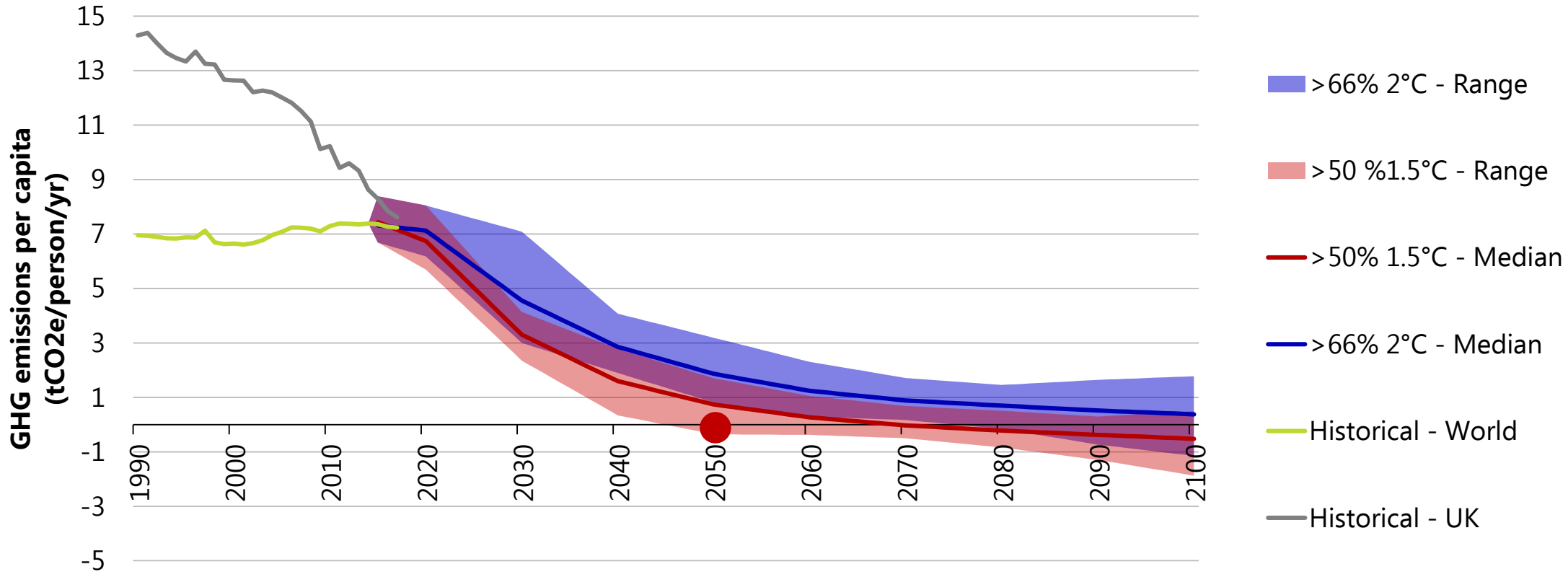
Global emissions pathways consistent with Paris



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

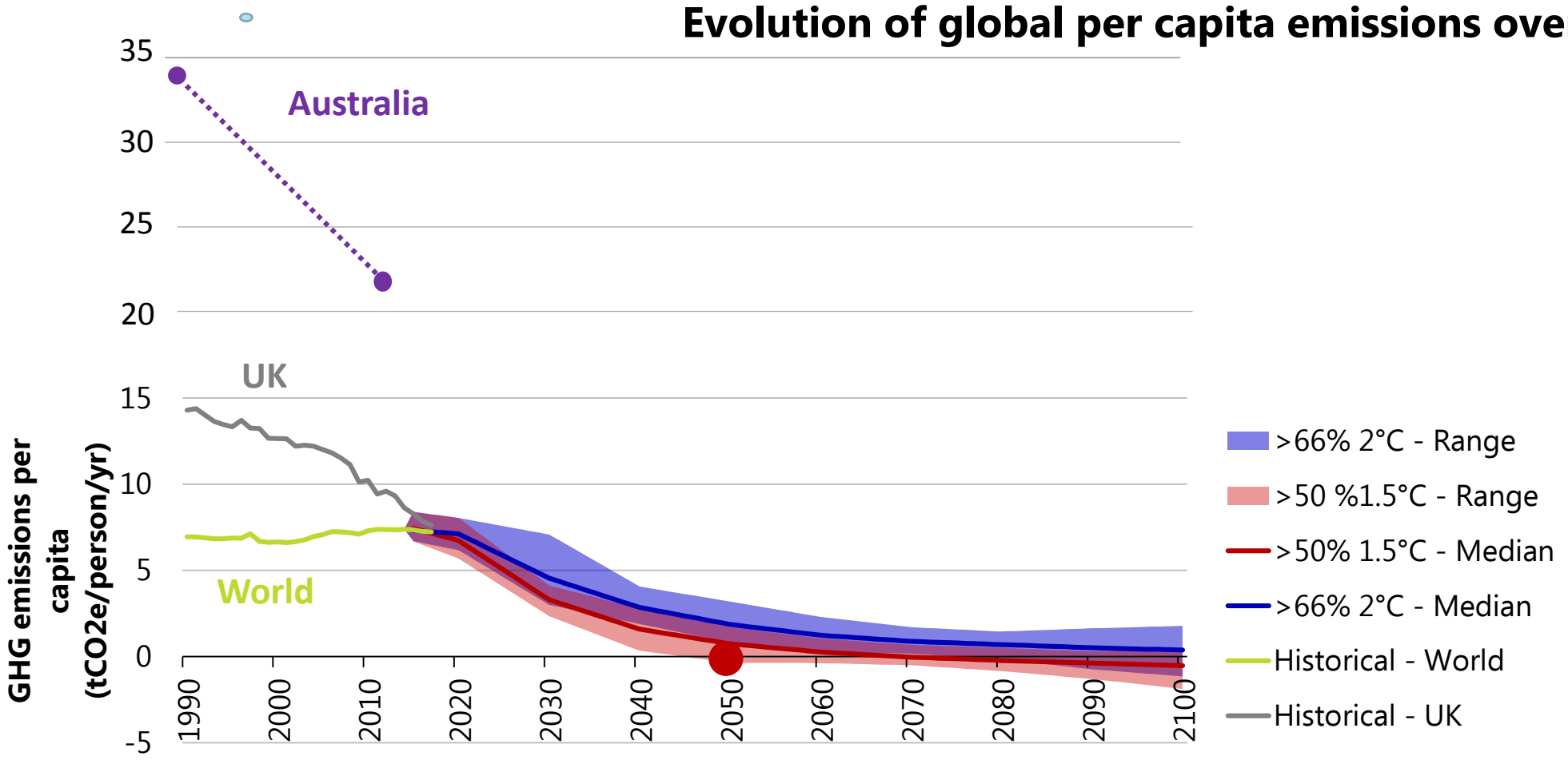
Science and international context
Global emissions pathways consistent with Paris

Evolution of global per capita emissions over time



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

Science and international context
Global emissions pathways consistent with Paris



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

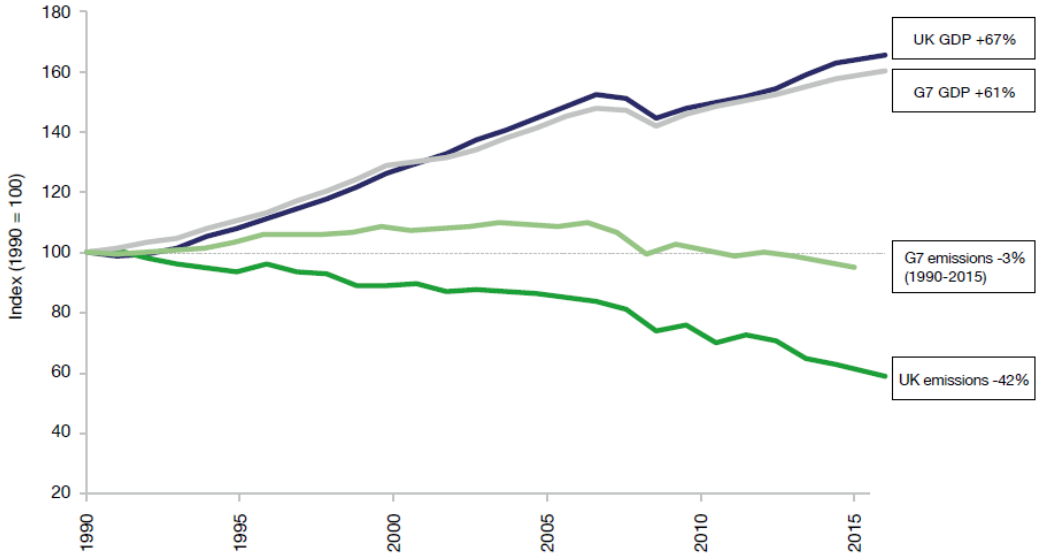
International context: Paris Agreement

- **Paris:**
  - Consistent with highest possible ambition
  - Fair and ambitious in the light of national circumstances
- **The UK should target net zero early:**
  - UK has the **capability** to be more ambitious than the world as a whole
    - Rapidly reduced emissions since 1990 – now at the global average per person
    - Has a stable and well supported framework: The Climate Change Act
  - Should contribute more on an **equity** basis
    - 80% from 1990 by 2050 in the Climate Change Act - equal per capita emissions basis
    - but the UK has a large historical contribution to climate change
    - and as a result is a rich economy
    - 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

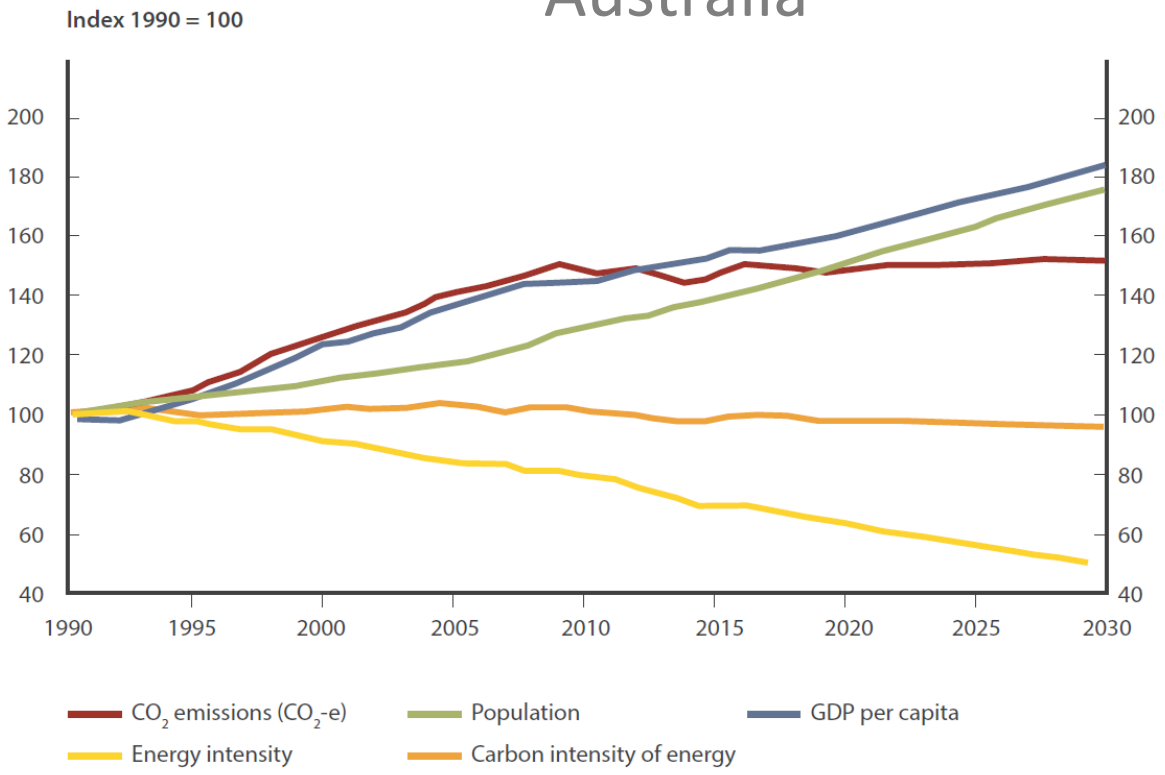
Committee on Climate Change

Progress in reducing emissions

UK



Australia

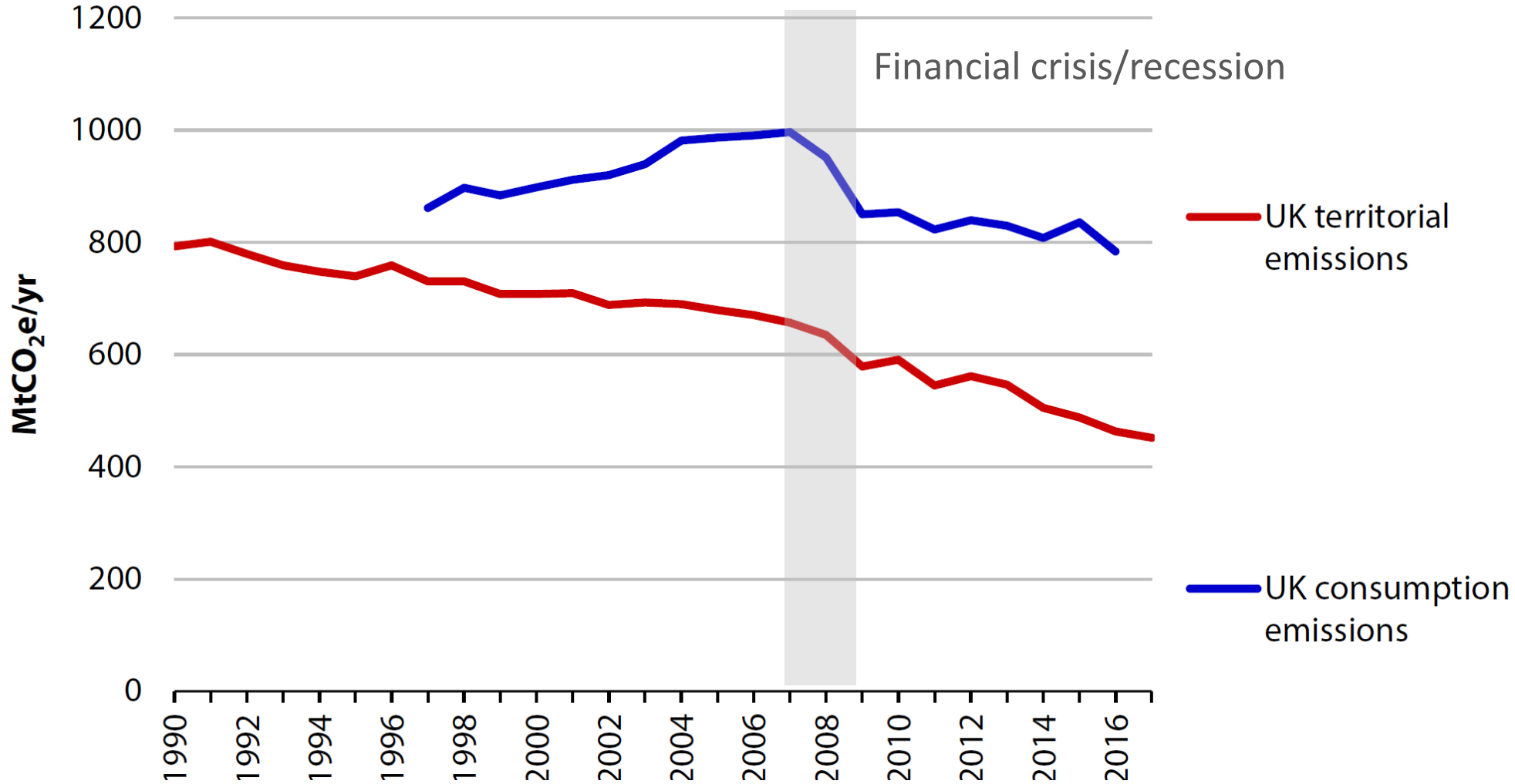


Source: Department of the Environment and Energy 2017; Department of the Environment and Energy analysis

International context: Paris Agreement

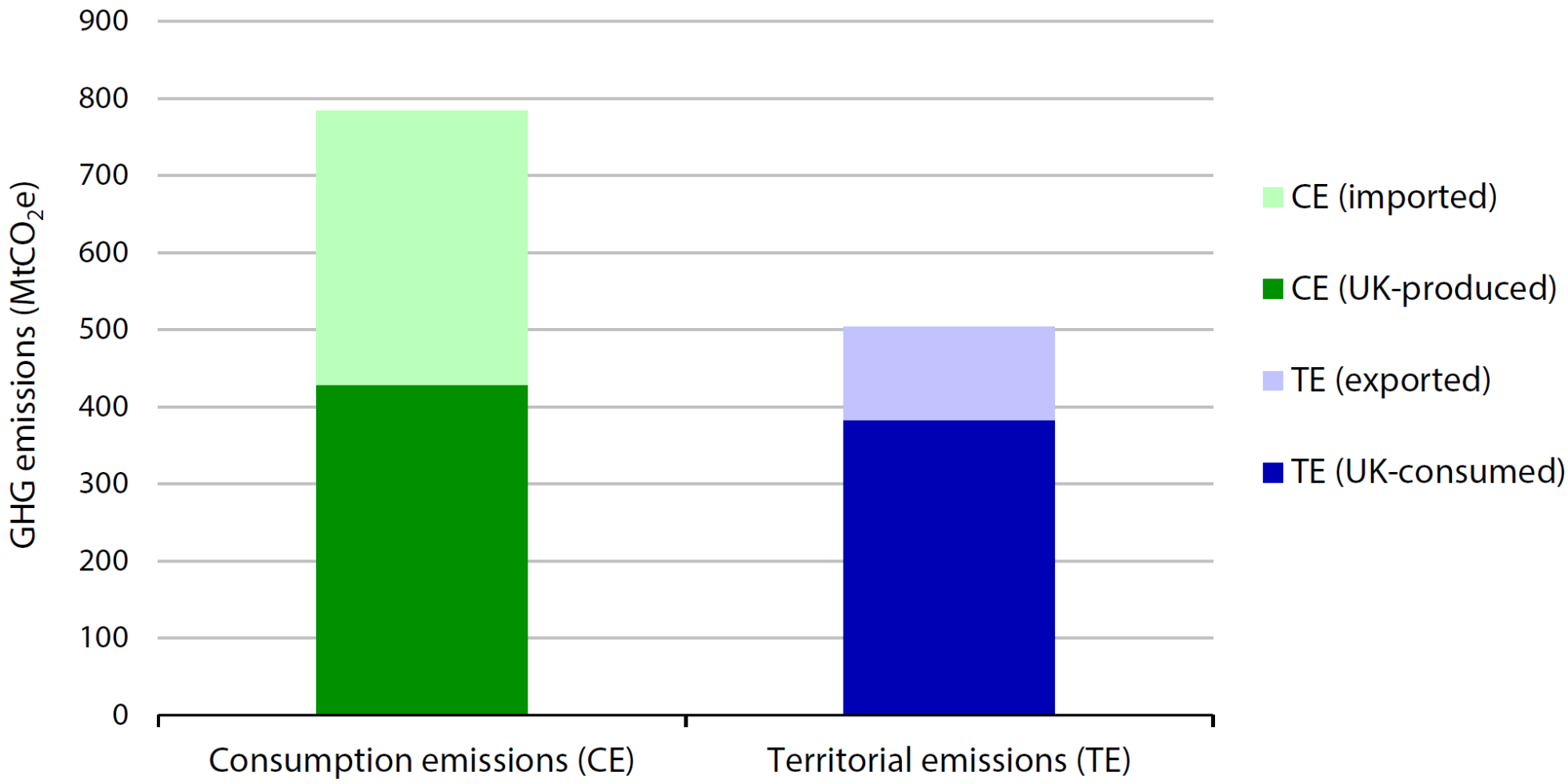
- **Paris:**
  - Consistent with highest possible ambition
  - Fair and ambitious in the light of national circumstances
- **The UK should target net zero early:**
  - UK has the **capability** to be more ambitious than the world as a whole
    - Rapidly reduced emissions since 1990 – now at the global average per person
    - Has a stable and well supported framework: The Climate Change Act
  - Should contribute more on an **equity** basis
    - 80% from 1990 by 2050 in the Climate Change Act - equal per capita emissions basis
    - but the UK has a large historical contribution to climate change
    - and as a result is a rich economy
    - 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

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



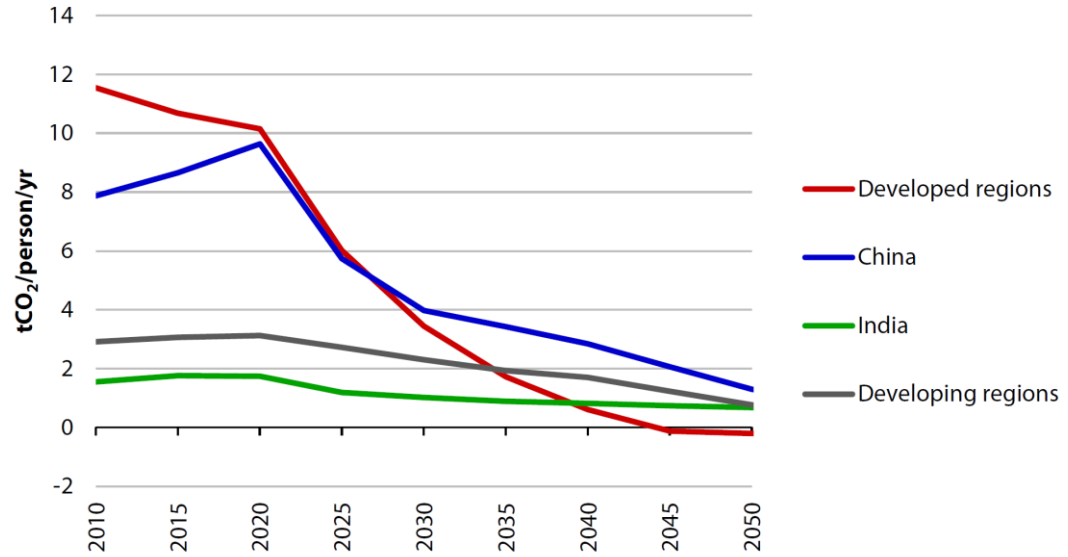
CCC Progress Report to Parliament 2019 includes international aviation and shipping

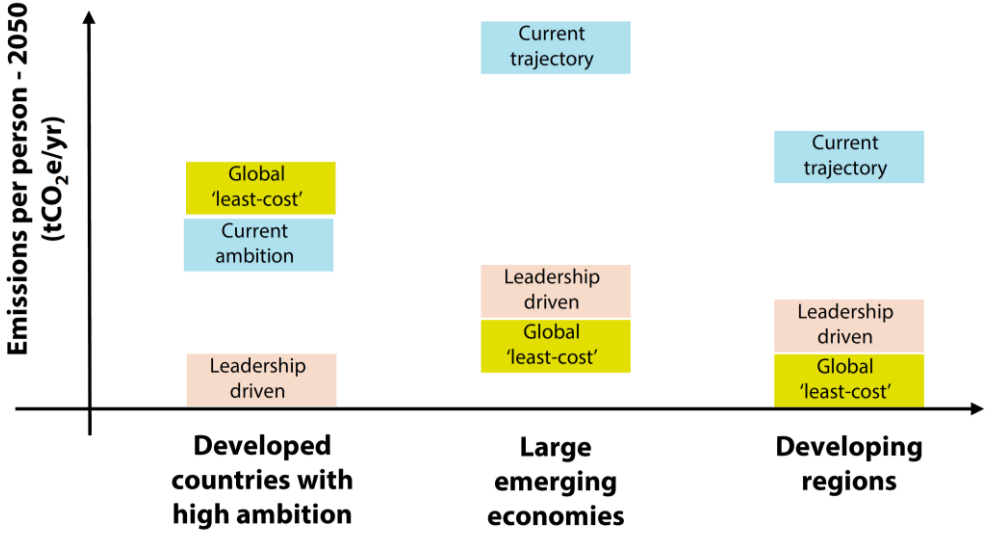
International context: Paris Agreement

- **Paris:**
  - Consistent with highest possible ambition
  - Fair and ambitious in the light of national circumstances
- **The UK should target net zero early:**
  - UK has the **capability** to be more ambitious than the world as a whole
    - Rapidly reduced emissions since 1990 – now at the global average per person
    - Has a stable and well supported framework: The Climate Change Act
  - Should contribute more on an **equity** basis
    - 80% from 1990 by 2050 in the Climate Change Act - equal per capita emissions basis
    - but the UK has a large historical contribution to climate change
    - and as a result is a rich economy
    - 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

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**



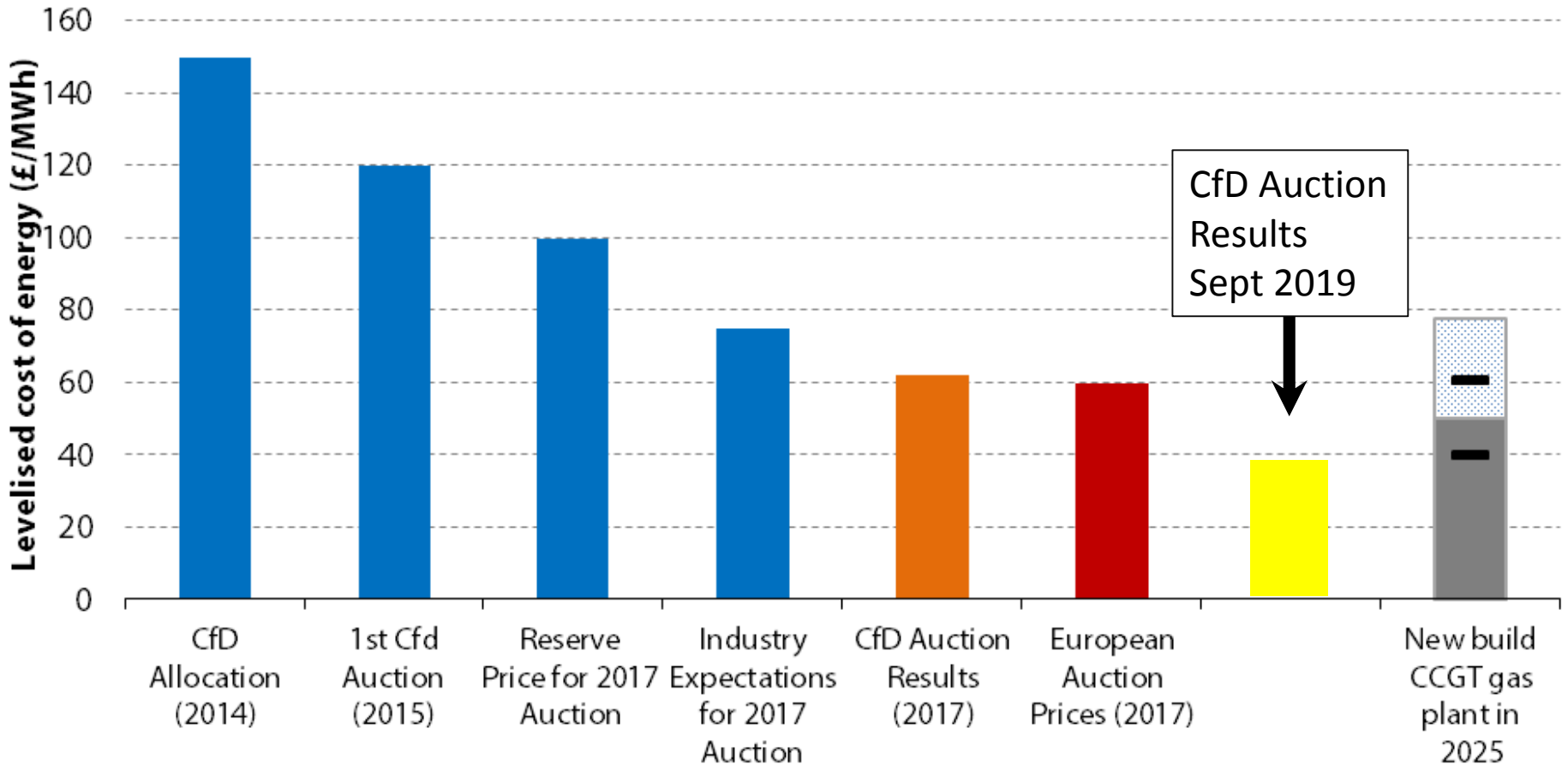


International context: Paris Agreement

- **Paris:**
  - Consistent with highest possible ambition
  - Fair and ambitious in the light of national circumstances
- **The UK should target net zero early:**
  - UK has the **capability** to be more ambitious than the world as a whole
    - Rapidly reduced emissions since 1990 – now at the global average per person
    - Has a stable and well supported framework: The Climate Change Act
  - Should contribute more on an **equity** basis
    - 80% from 1990 by 2050 in the Climate Change Act - equal per capita emissions basis
    - but the UK has a large historical contribution to climate change
    - and as a result is a rich economy
    - 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

Technology cost reduction: offshore wind

Latest Contracts for Difference auction prices



International context: Paris Agreement

- **Paris:**
  - Consistent with highest possible ambition
  - Fair and ambitious in the light of national circumstances
- **The UK should target net zero early:**
  - UK has the **capability** to be more ambitious than the world as a whole
    - Rapidly reduced emissions since 1990 – now at the global average per person
    - Has a stable and well supported framework: The Climate Change Act
  - Should contribute more on an **equity** basis
    - 80% from 1990 by 2050 in the Climate Change Act - equal per capita emissions basis
    - but the UK has a large historical contribution to climate change
    - and as a result is a rich economy
    - 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

Committee on Climate Change

When: science and global imperative?

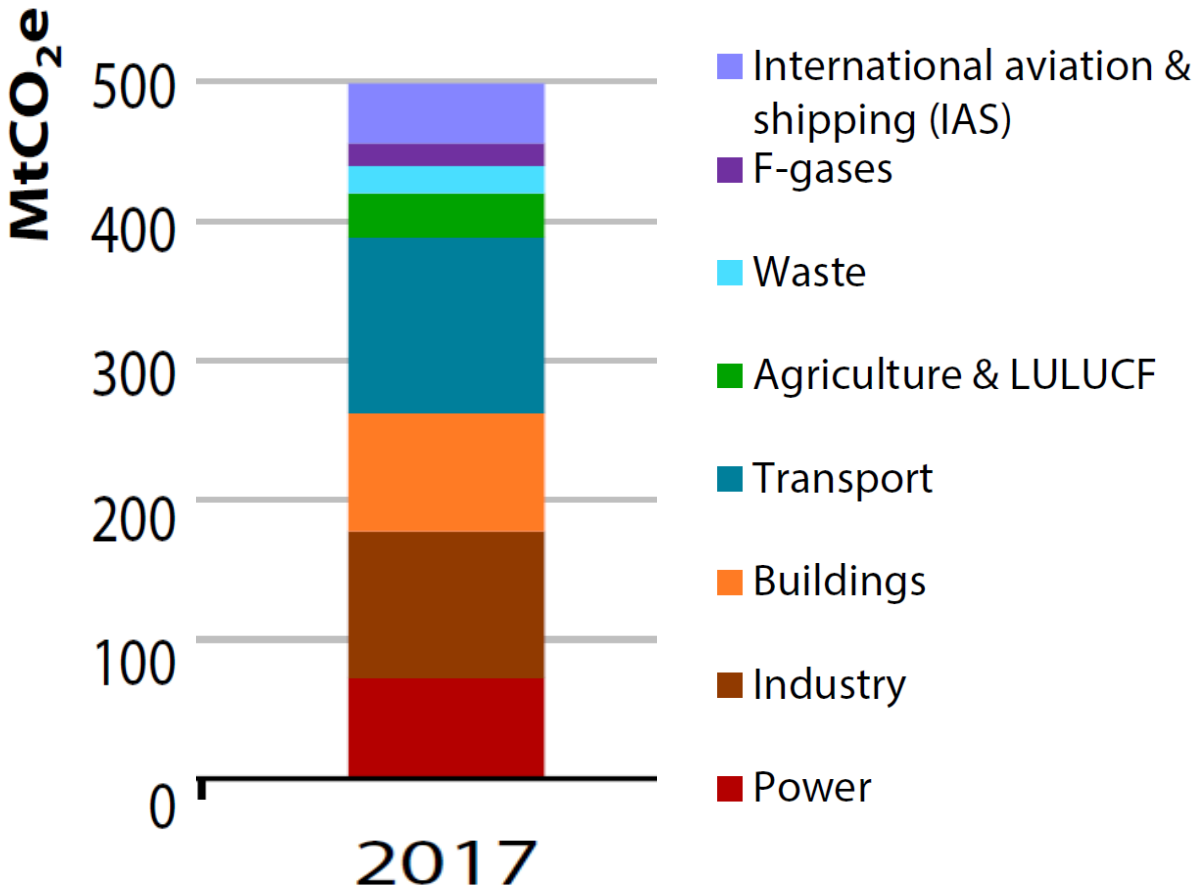
How: can it be done?

How much: what will it cost?

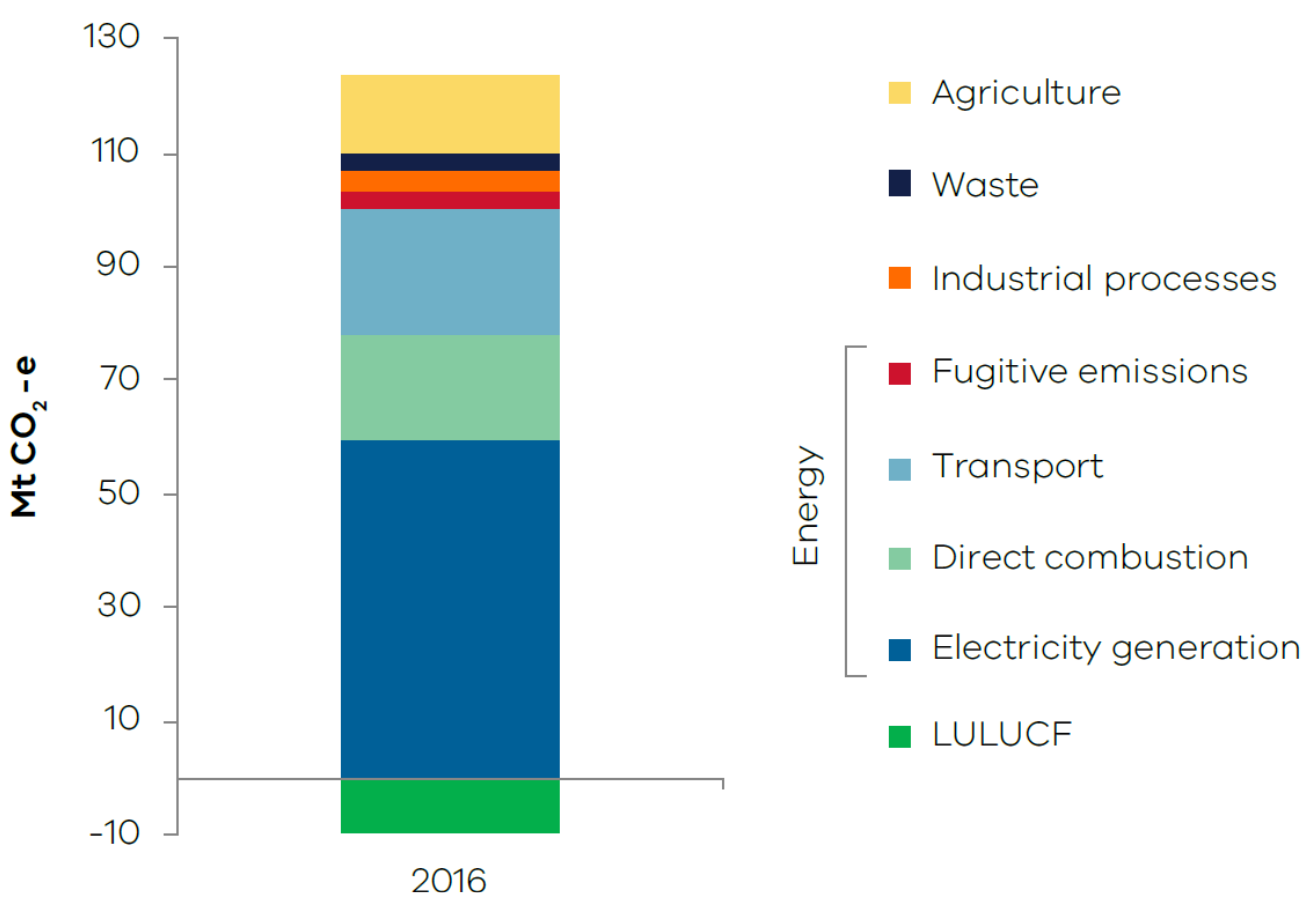
How big: the scale of the challenge?

Source of emissions: UK and Victoria

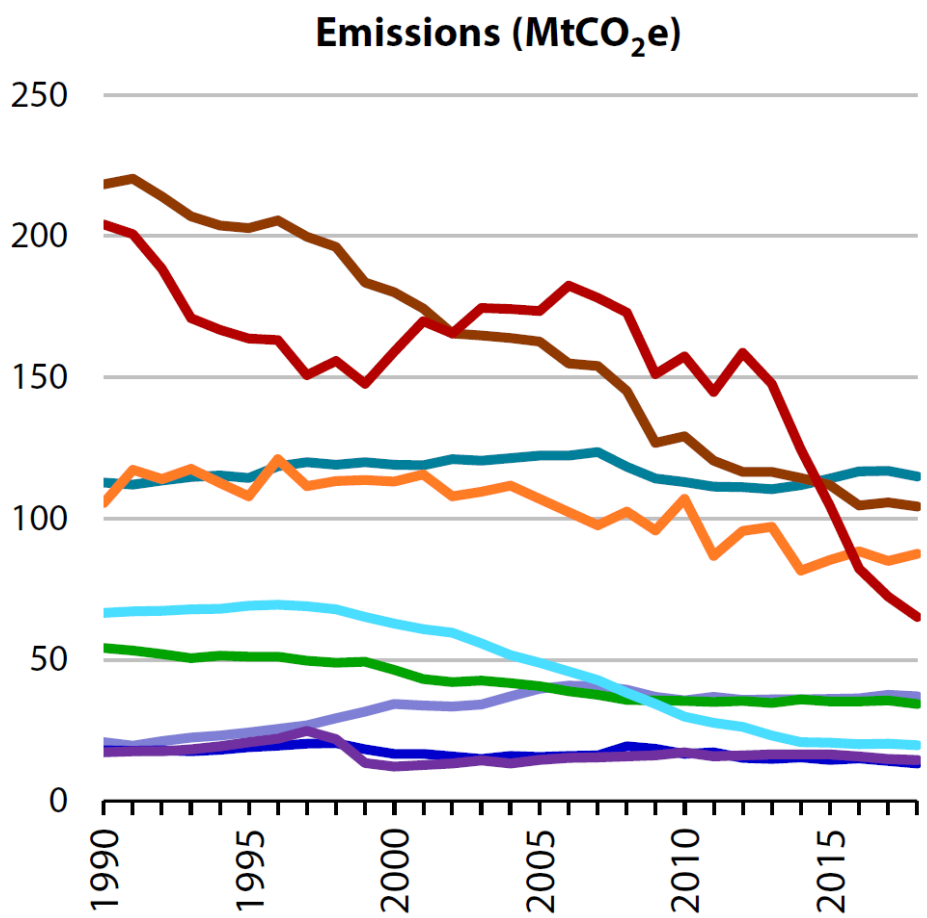
UK

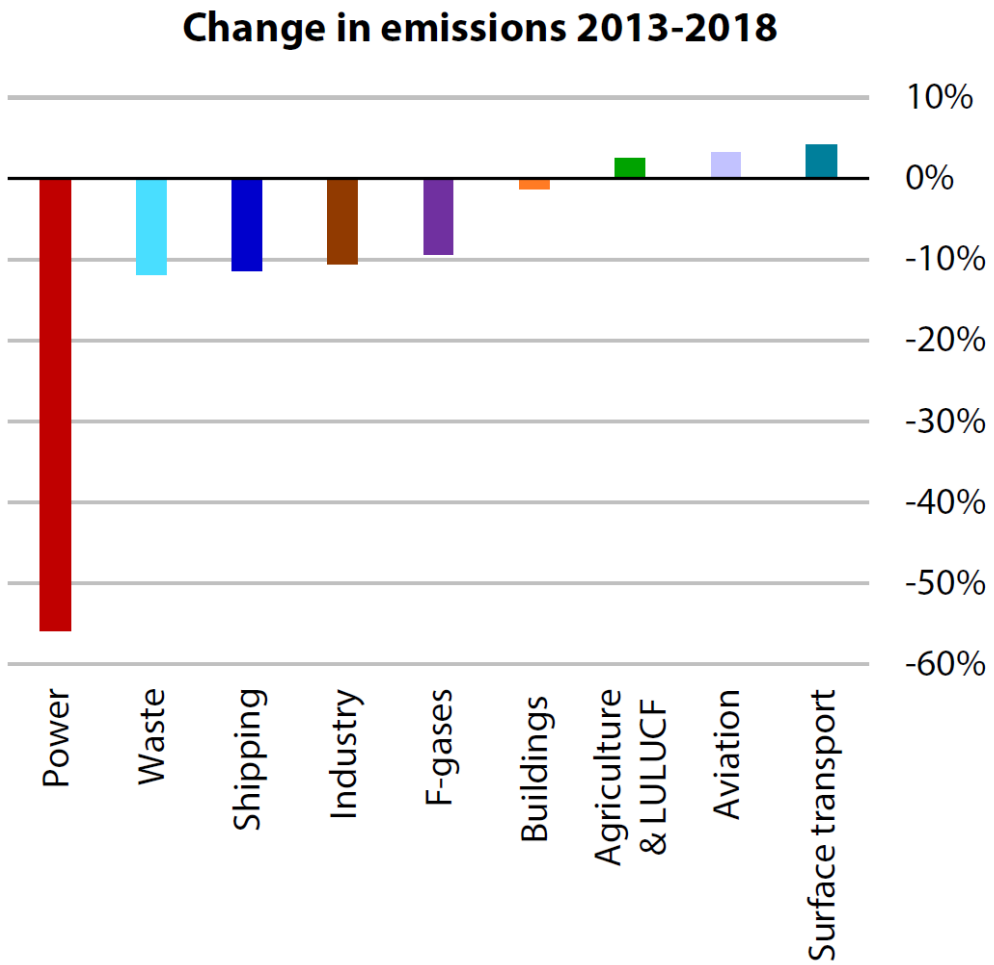


Victoria



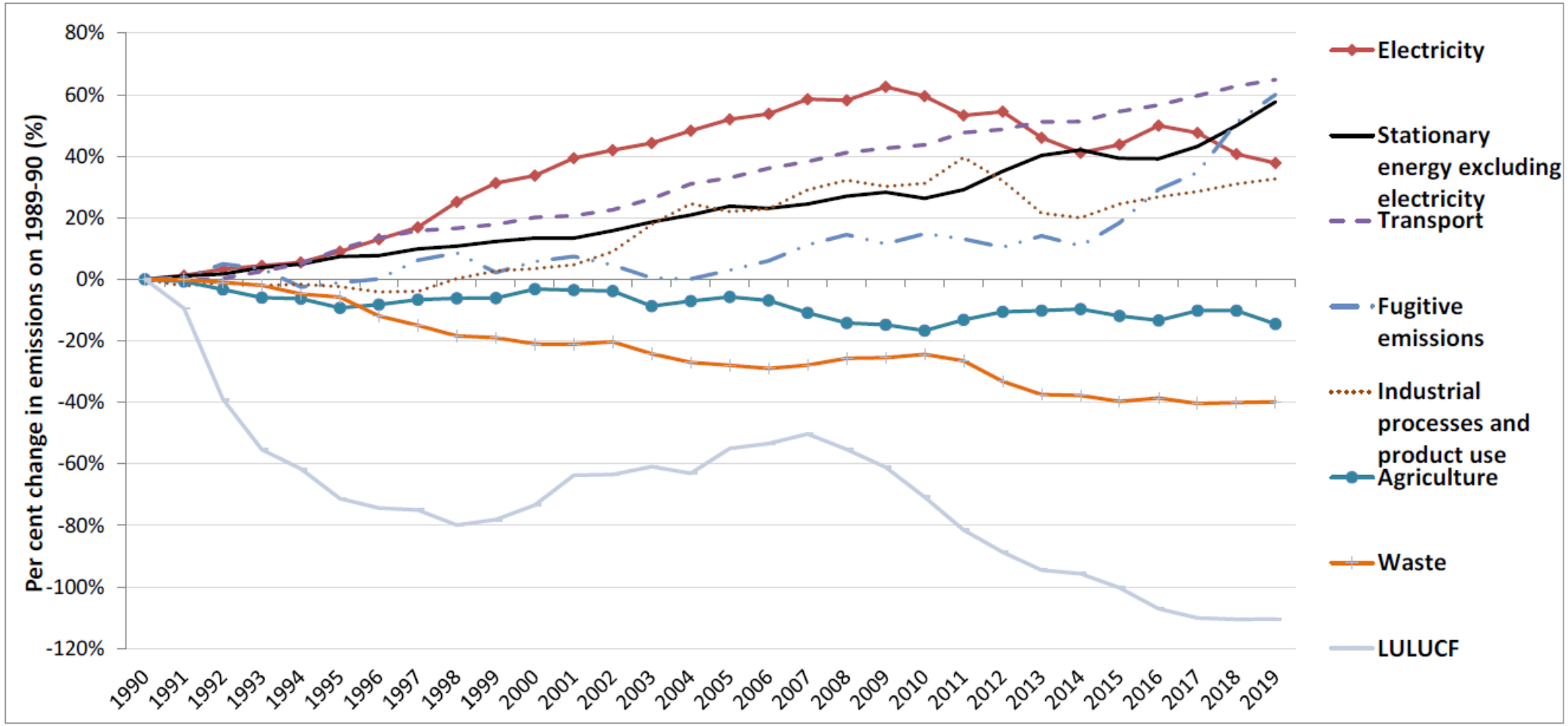
The journey so far





Committee on Climate Change

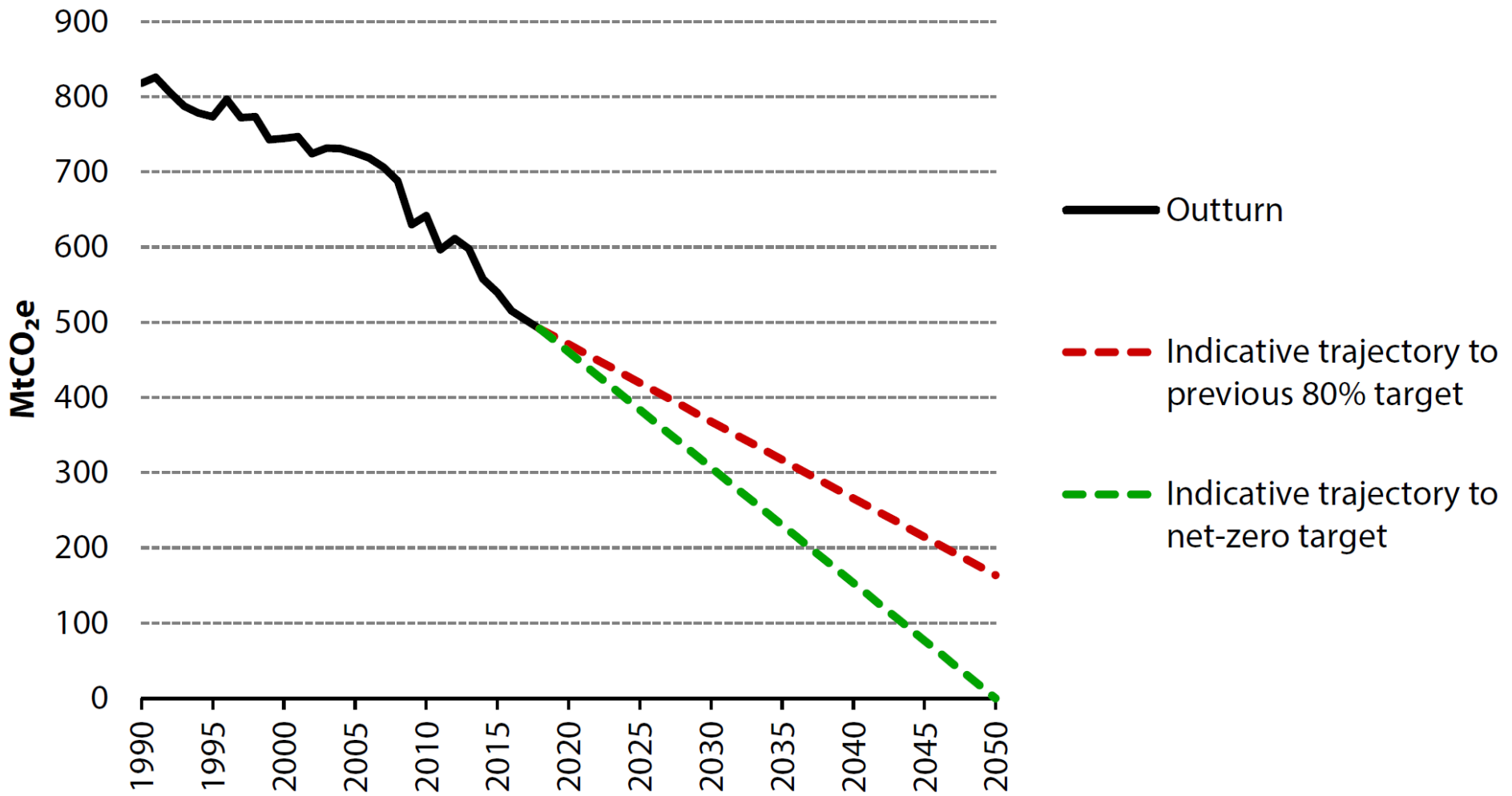
Australia: change in emissions by sector



Source: Department of the Environment and Energy

Committee on Climate Change

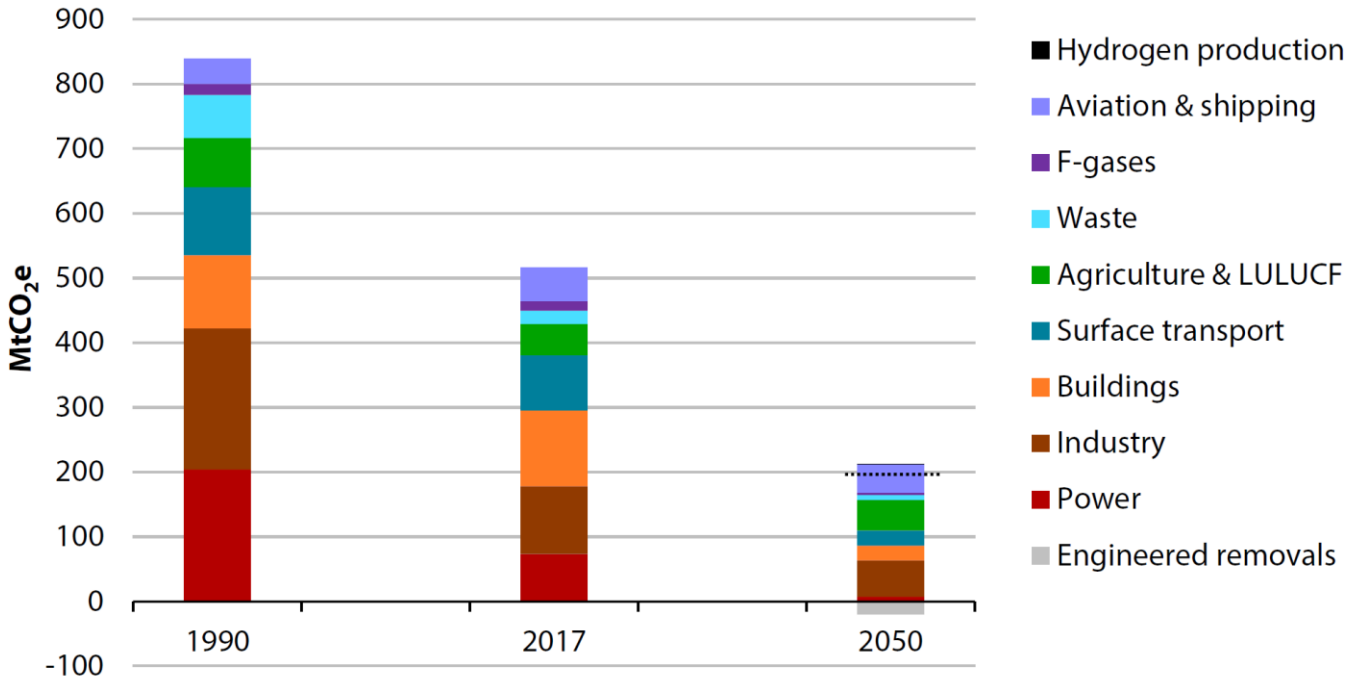
From 80% to 100%



Options to reduce emissions 1

Core options: to 77%

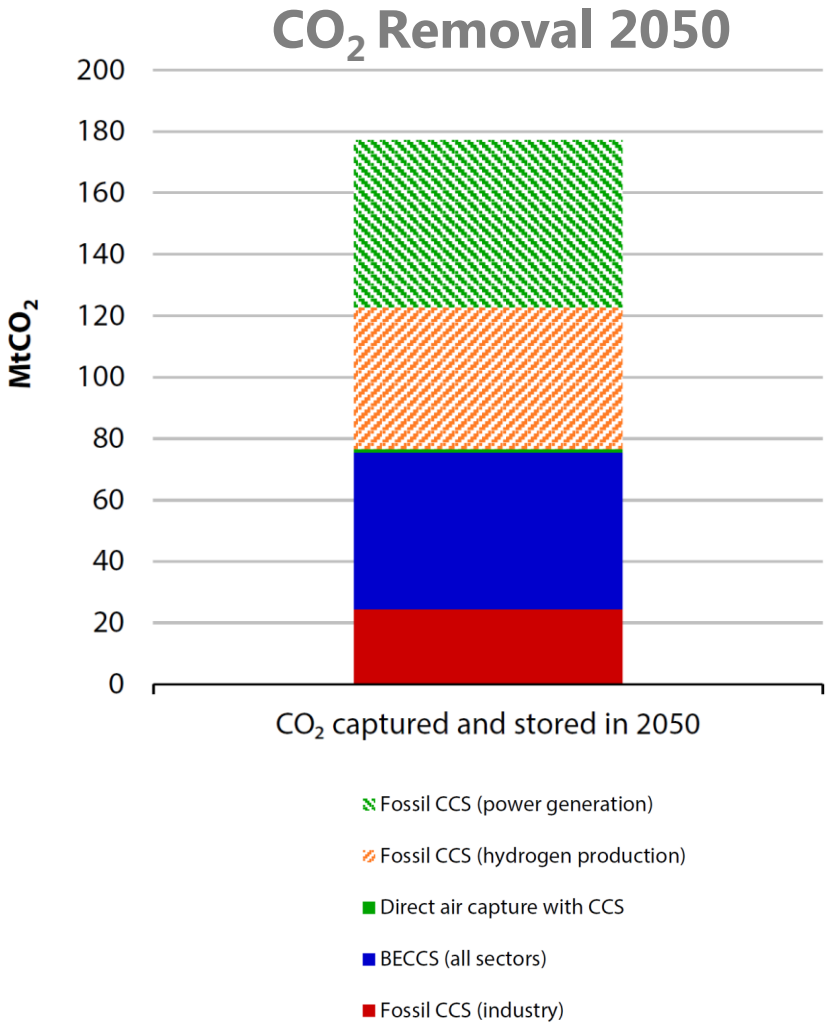
- Low cost, low regret, make sense under the current 80% target
- Broadly reflect Government's current ambition – but not necessarily policy implementation
- eg energy efficiency, phase out of conventionally fuelled vehicles by 2040, progress with zero carbon power generation, first industrial cluster by 2040, Carbon Capture, Utilisation and Storage action plan, 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



Options to reduce emissions 2

Further ambition: to 96%

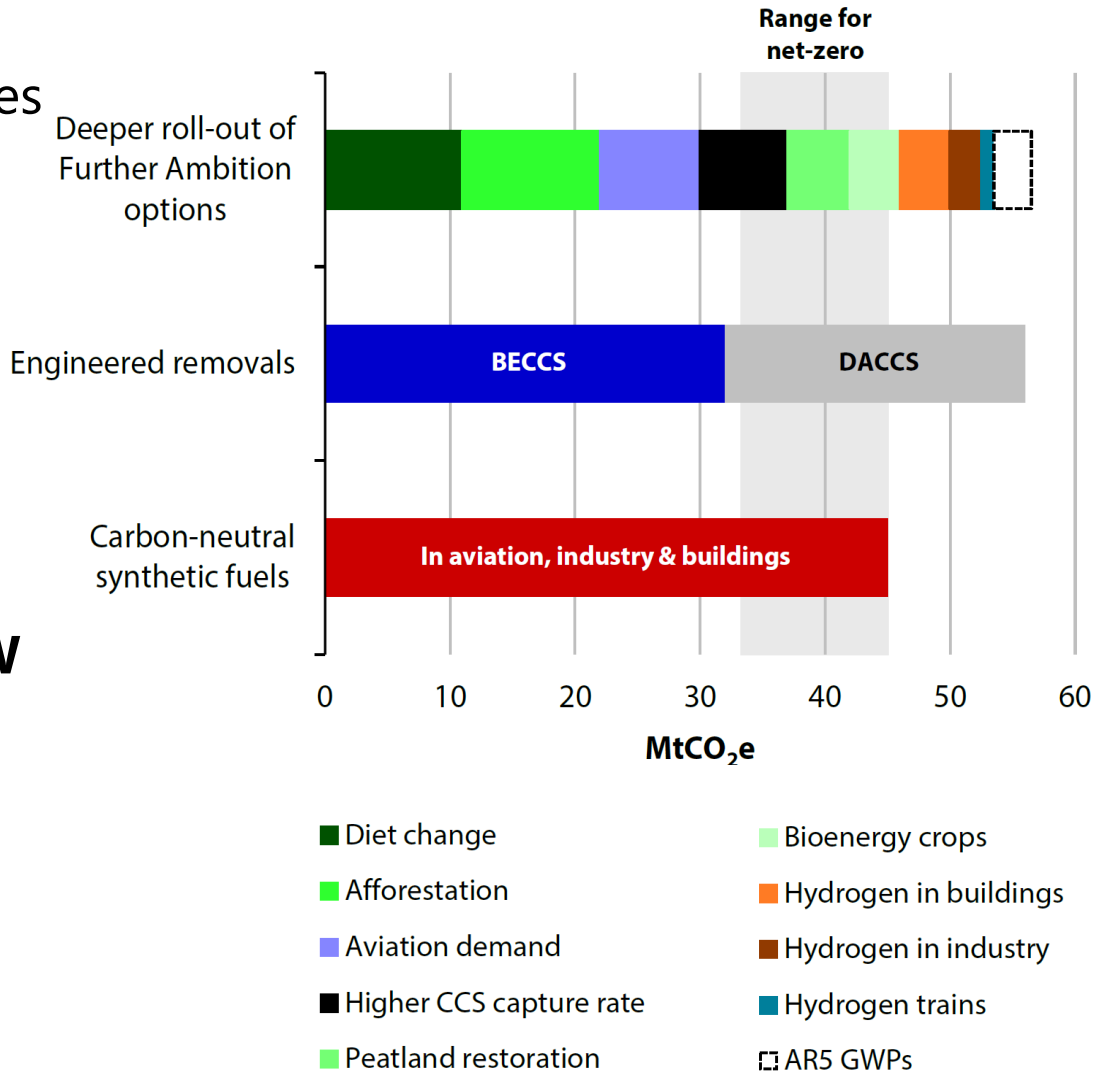
- More challenging, more costly, existing technologies
- Electricity 95% low carbon power, including **hydrogen**
- **Buildings** 90% low carbon heating including **hydrogen**
- All cars and vans electric by 2050; HGVs electric or **hydrogen**
- **Industry**: **CCS, hydrogen** and electrification
- Waste: 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



Options to reduce emissions 3

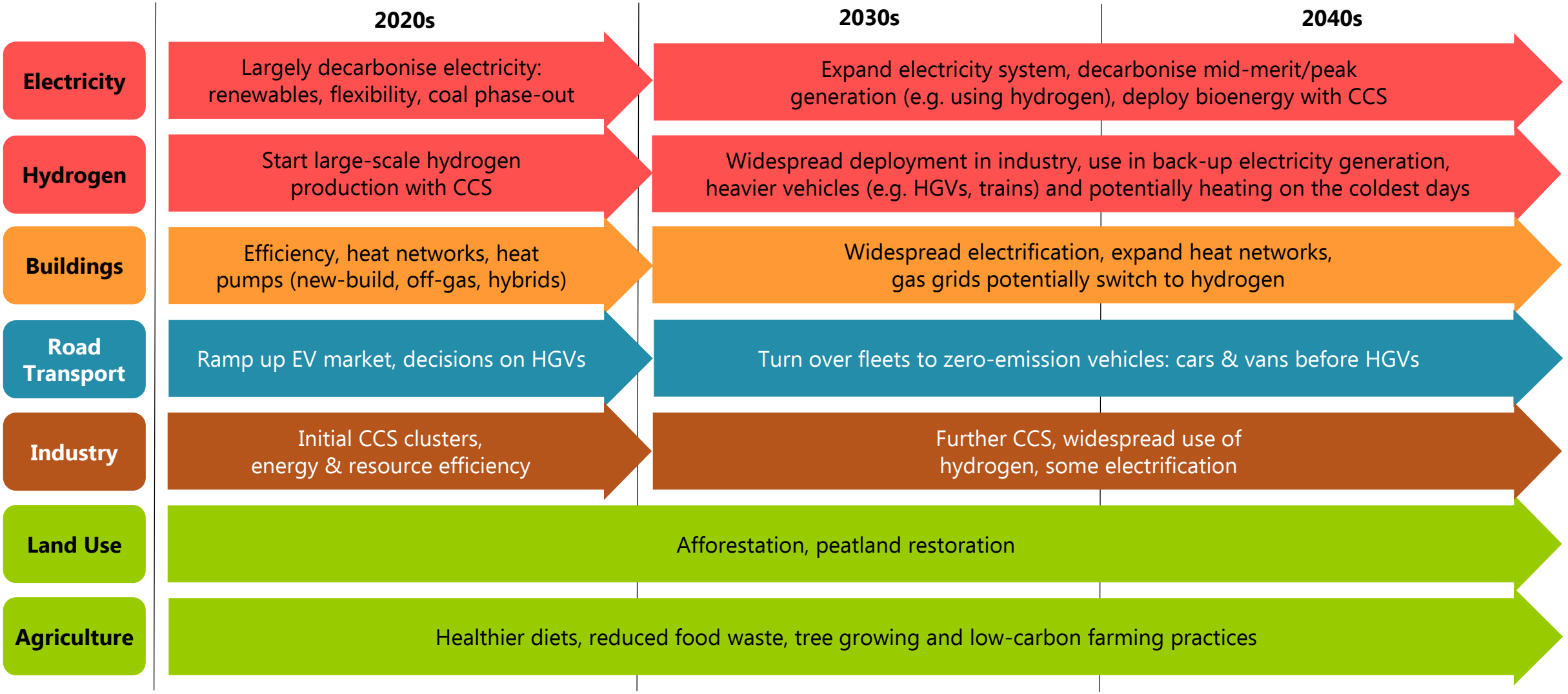
Speculative options: to 100%

- 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**



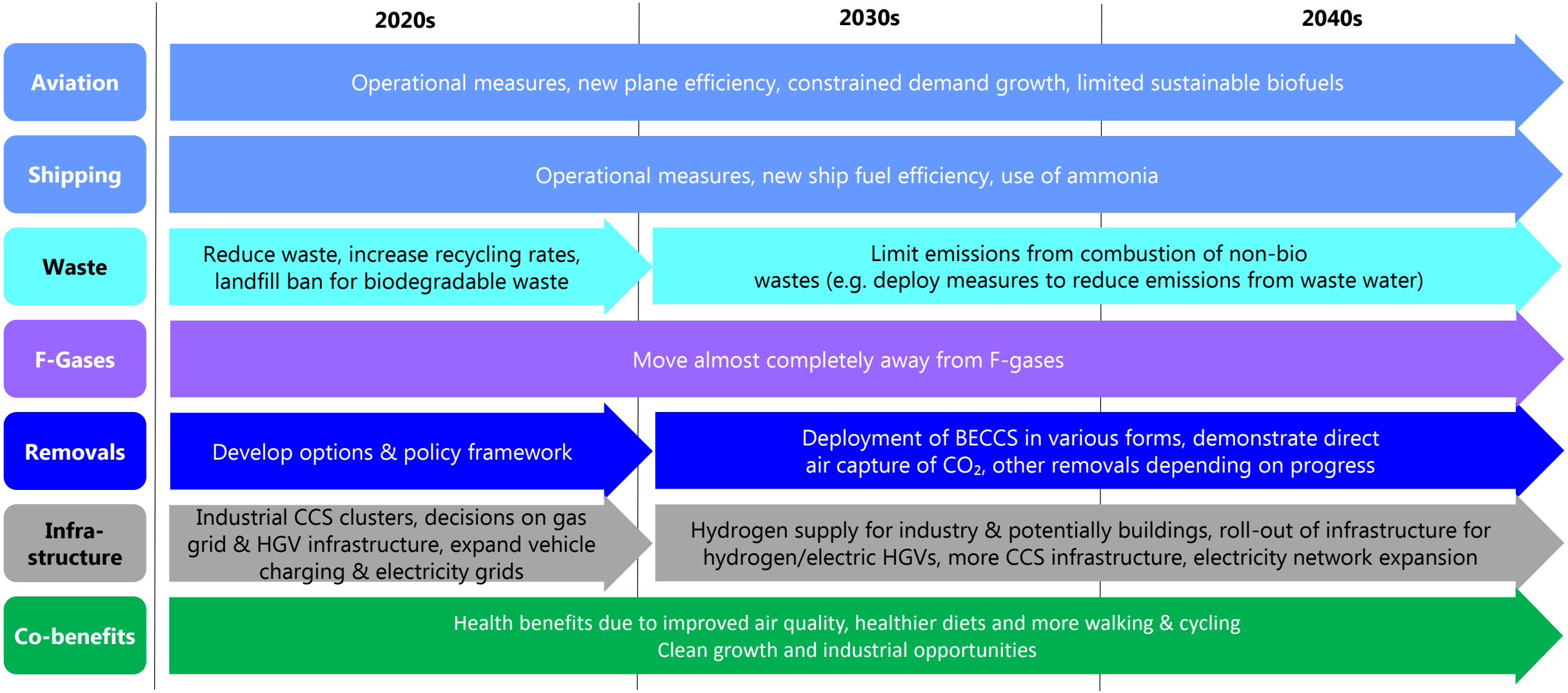
Committee on Climate Change

How UK net-zero scenarios can be delivered



Committee on Climate Change

How UK net-zero scenarios can be delivered



Committee on Climate Change

When: science and global imperative?

How: can it be done?

How much: what will it cost?

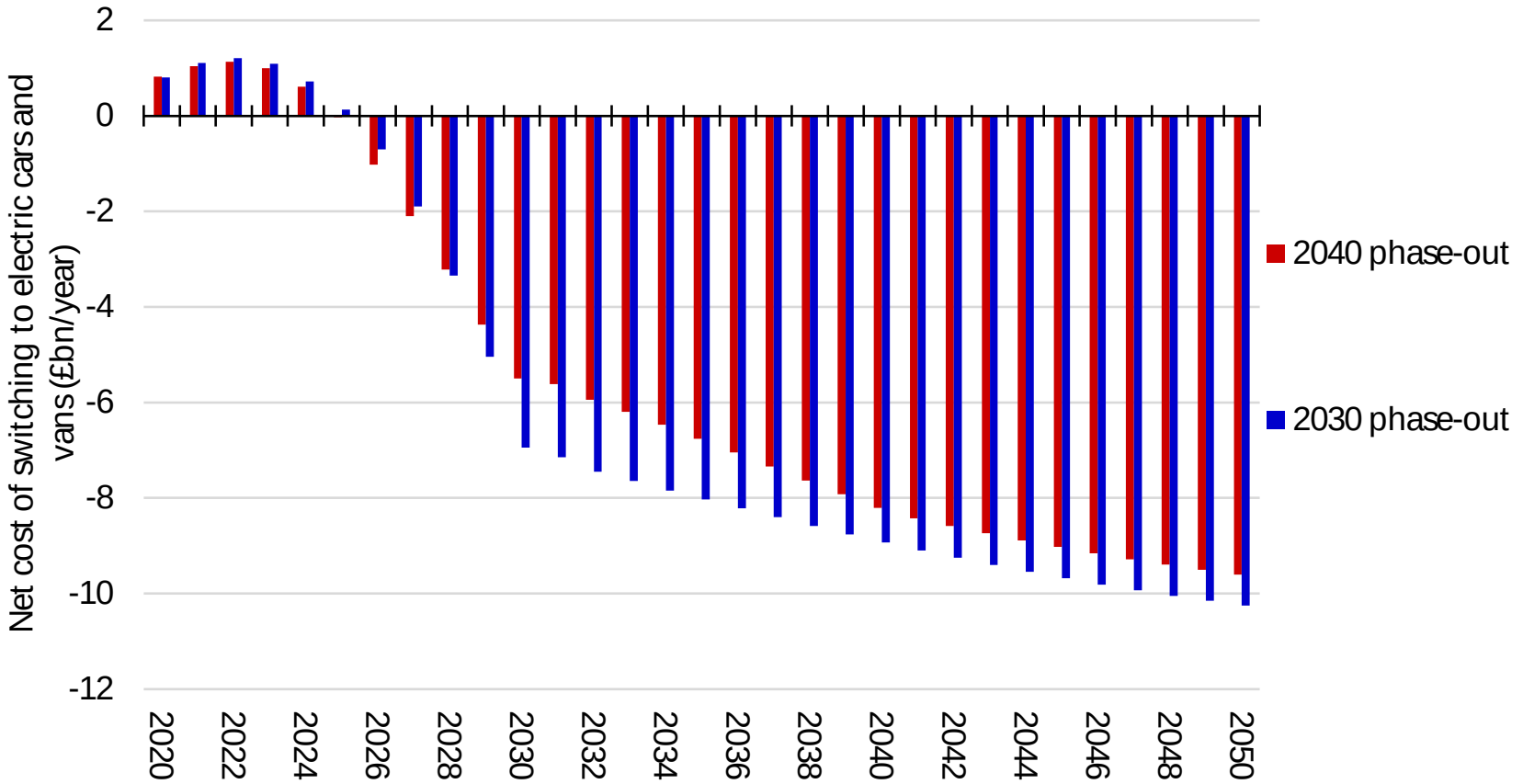
How big: the scale of the challenge?

Reaching net-zero emissions in the UK
Costs and benefits of meeting a UK net-zero target

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, migration…
  - £££££££££££££££££££££££££££££££

- **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…

Committee on Climate Change

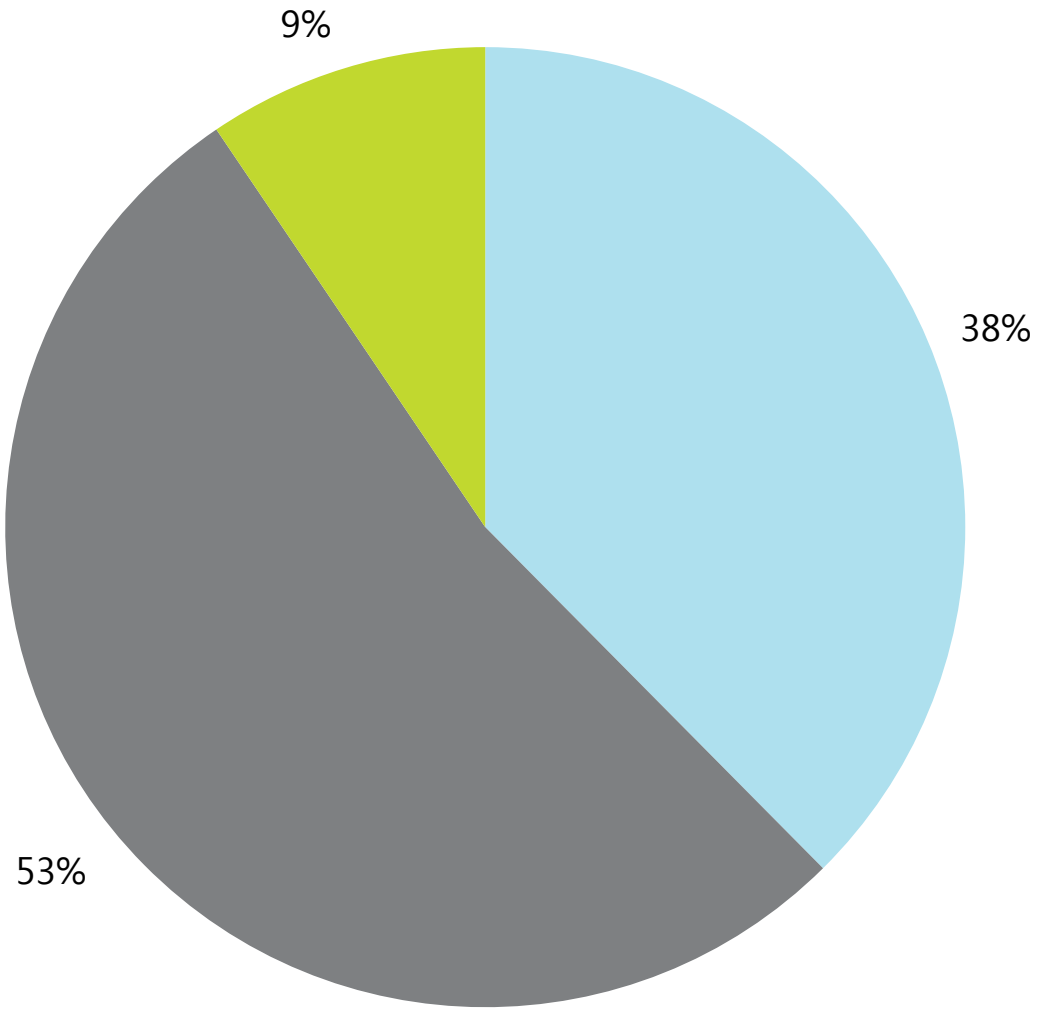
When: science and global imperative?

How: can it be done?

How much: what will it cost?

How big: the scale of the challenge?

Societal/behavioural change needed



Source: CCC analysis

Committee on Climate Change

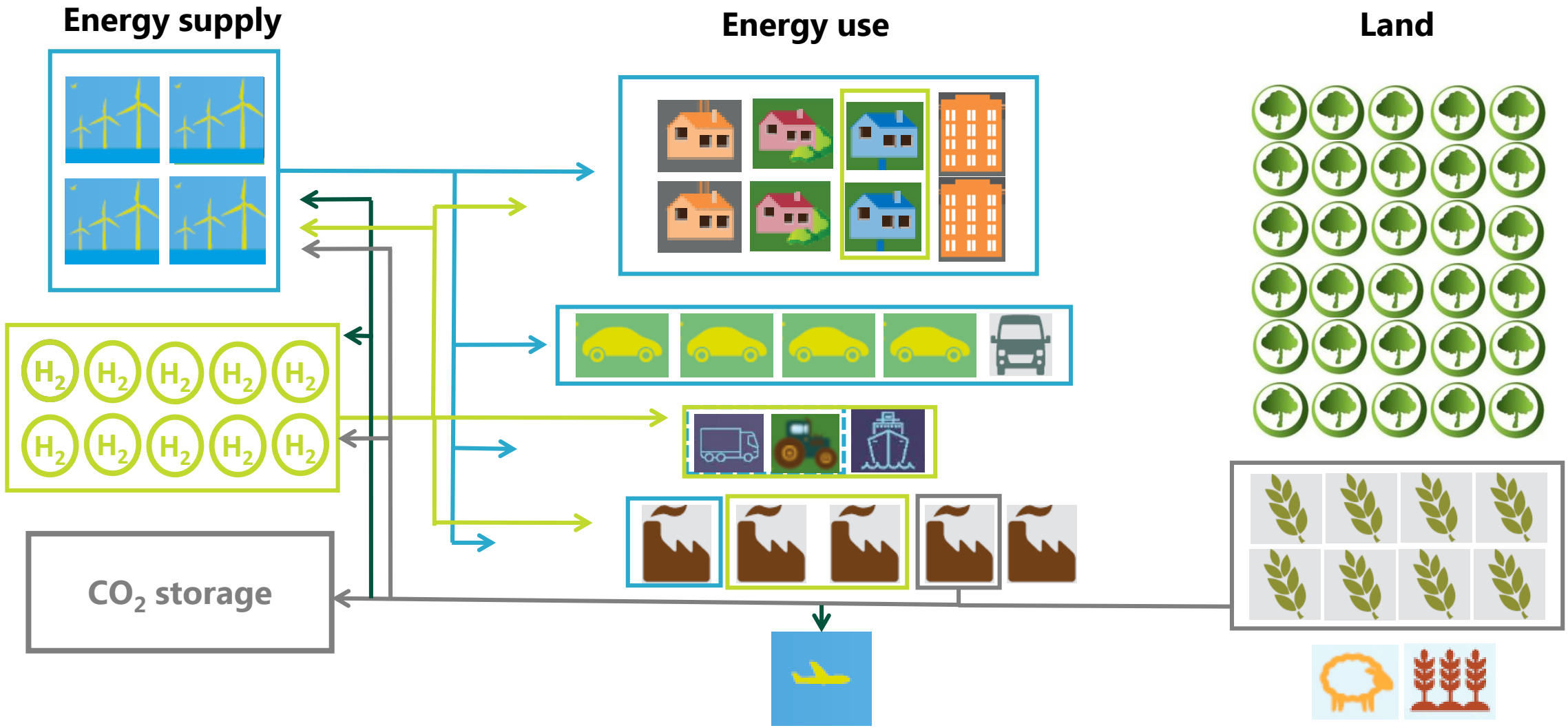
How big? In the next 30 years…

- Electricity system x2 to x4
- Offshore wind 10 GW to 75 - 100GW
- Hydrogen production 27TWh to 350TWh
- 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

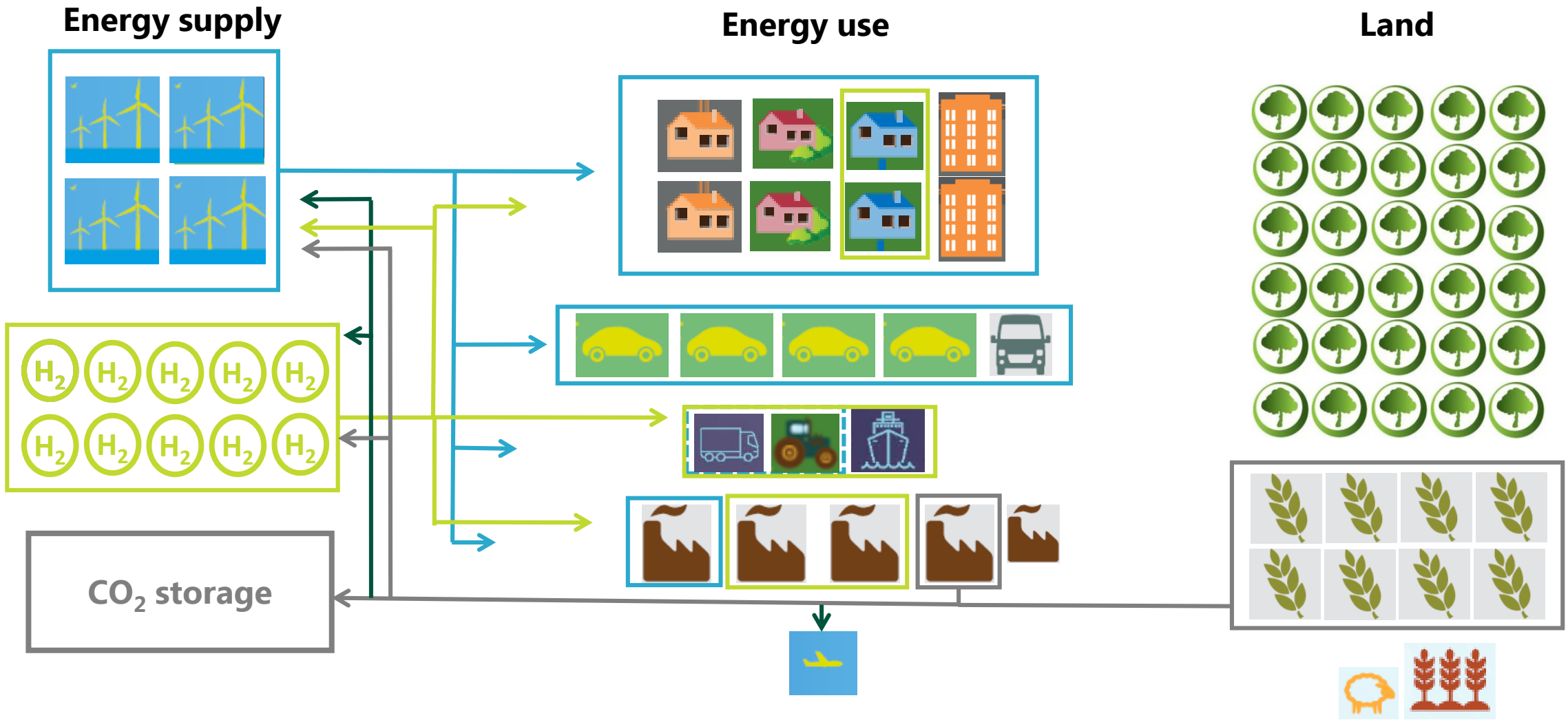
Committee on Climate Change

How UK net-zero scenarios can be delivered



Committee on Climate Change

How UK net-zero scenarios can be delivered

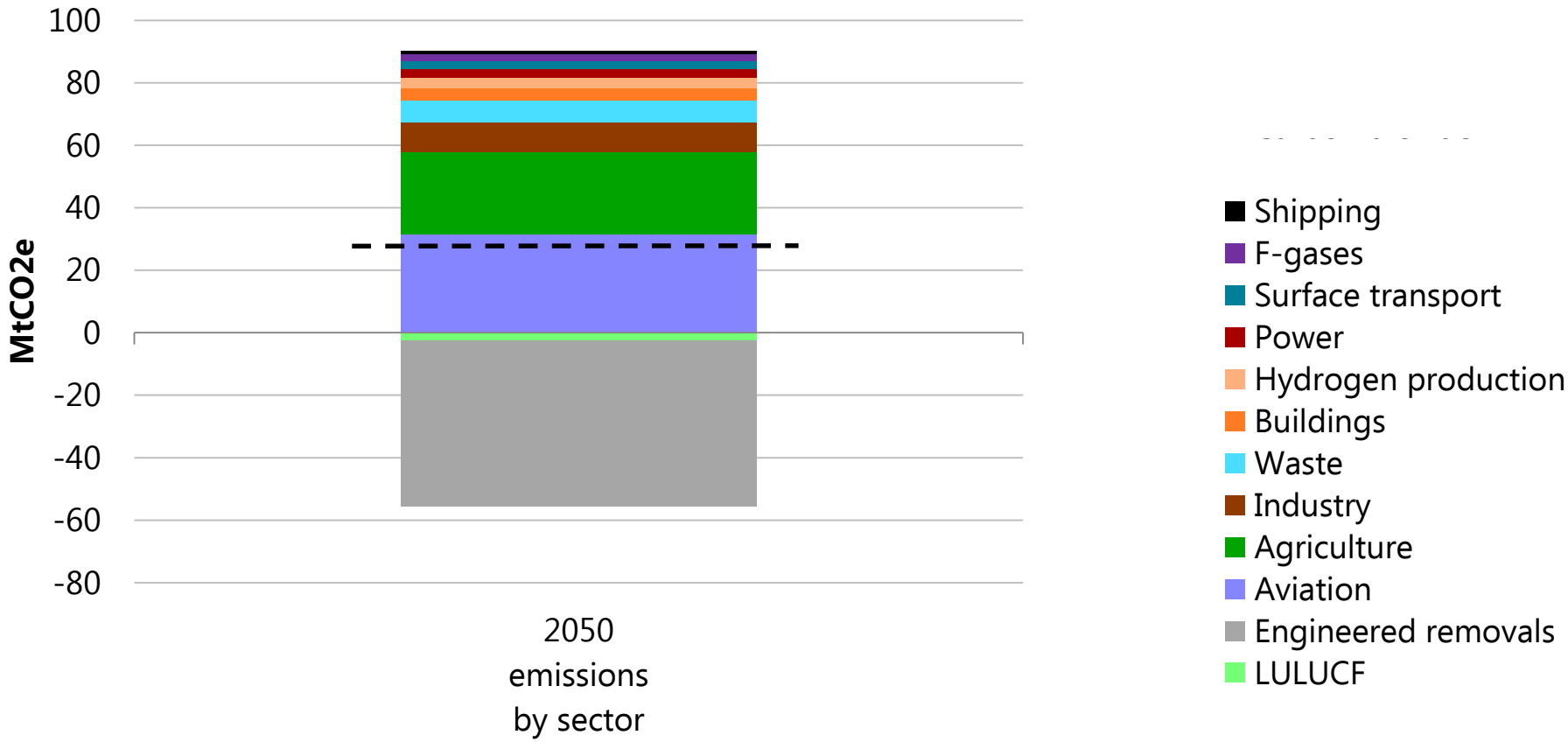


Committee on Climate Change

A few final reflections

We don't have all the answers

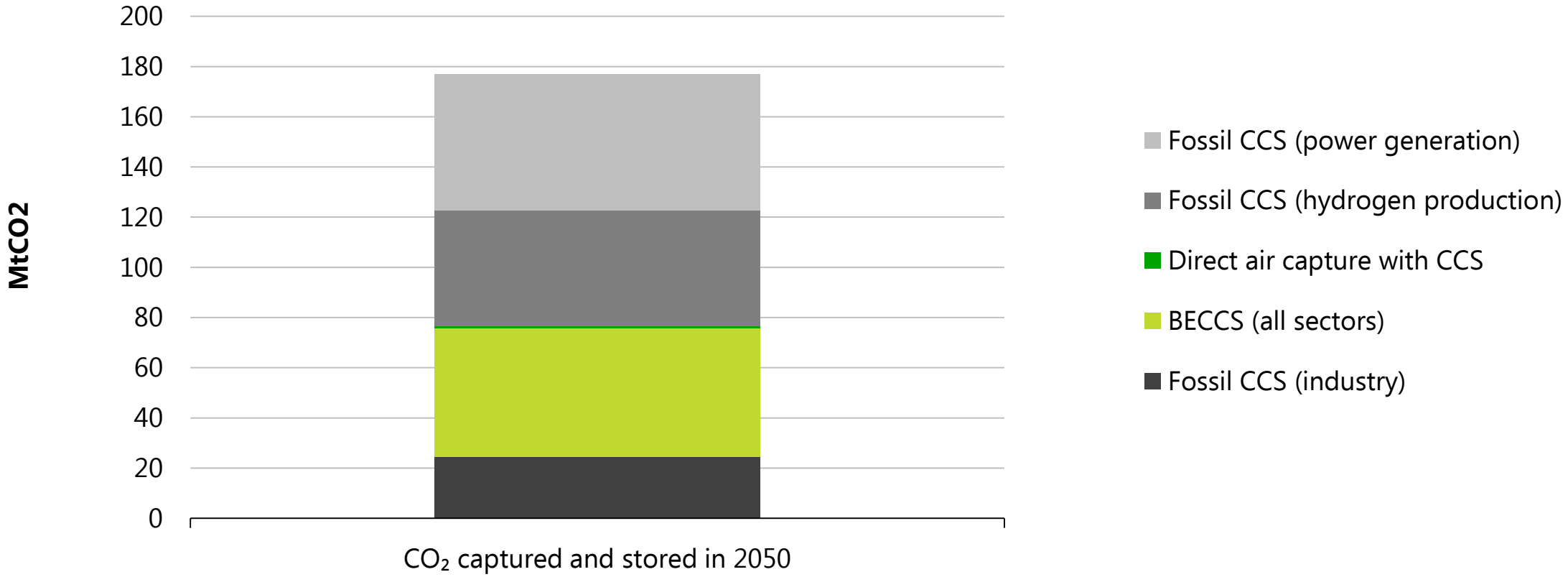
Remaining emissions in the 96% 'Further Ambition' scenario



Source: CCC analysis

Fossil fuel use continues

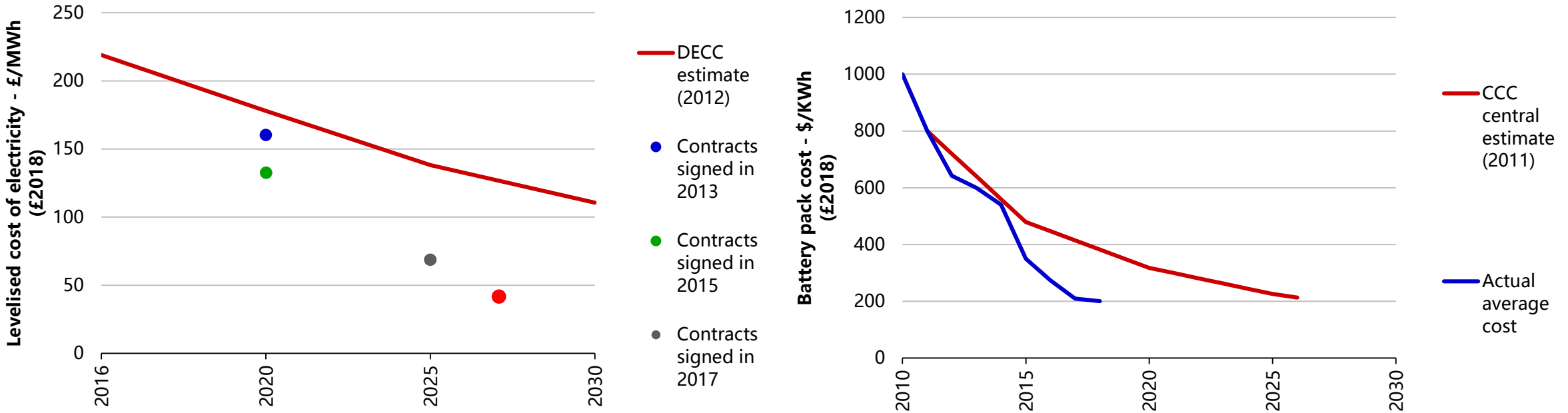
Total CO_2 captured and stored due to Further Ambition options in 2050



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

Committee on Climate Change

We need to get going...

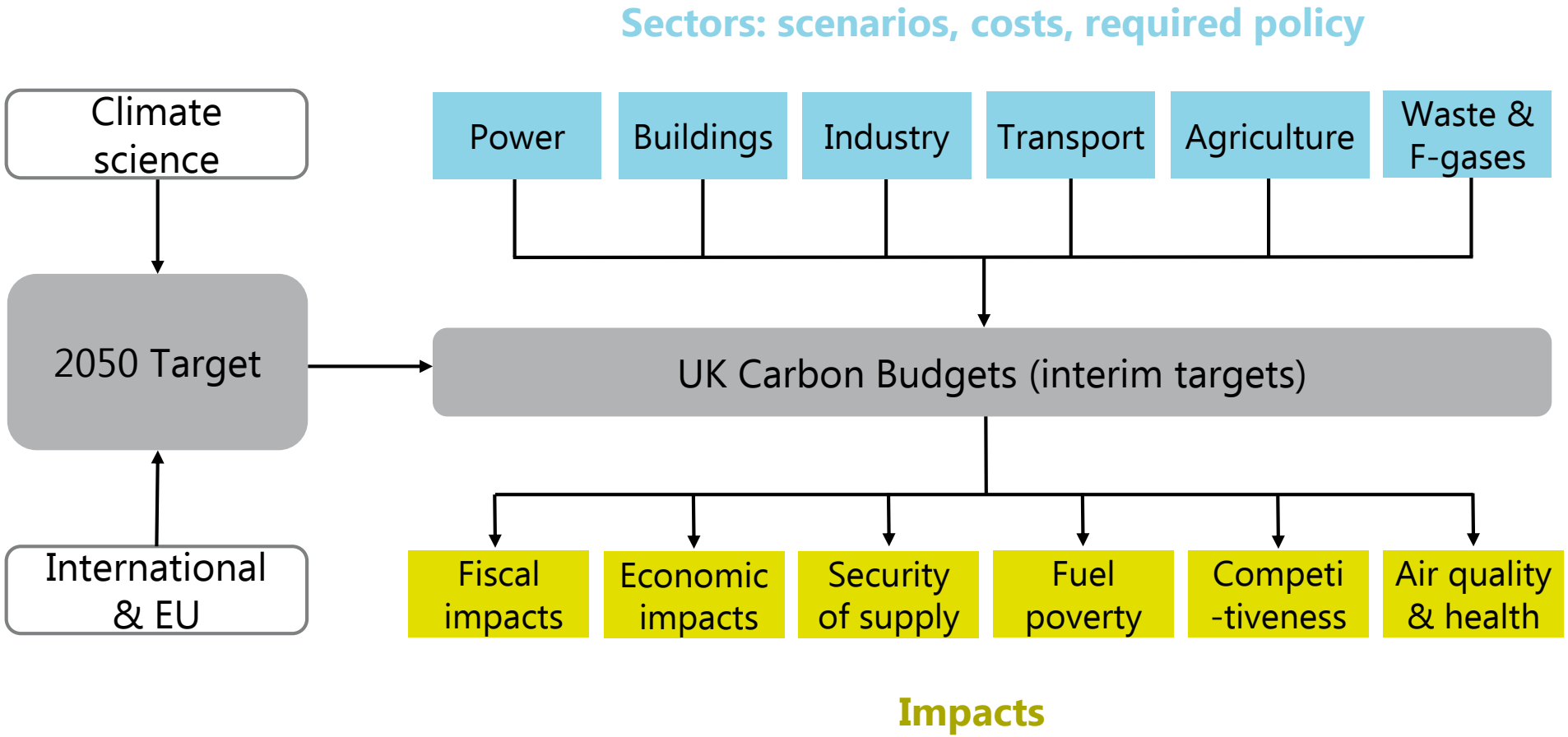

Greta Thunberg
"This needs Cathedral Thinking.
We can build the foundations without knowing exactly how we will complete the roof"

Committee on Climate Change

Thank you!

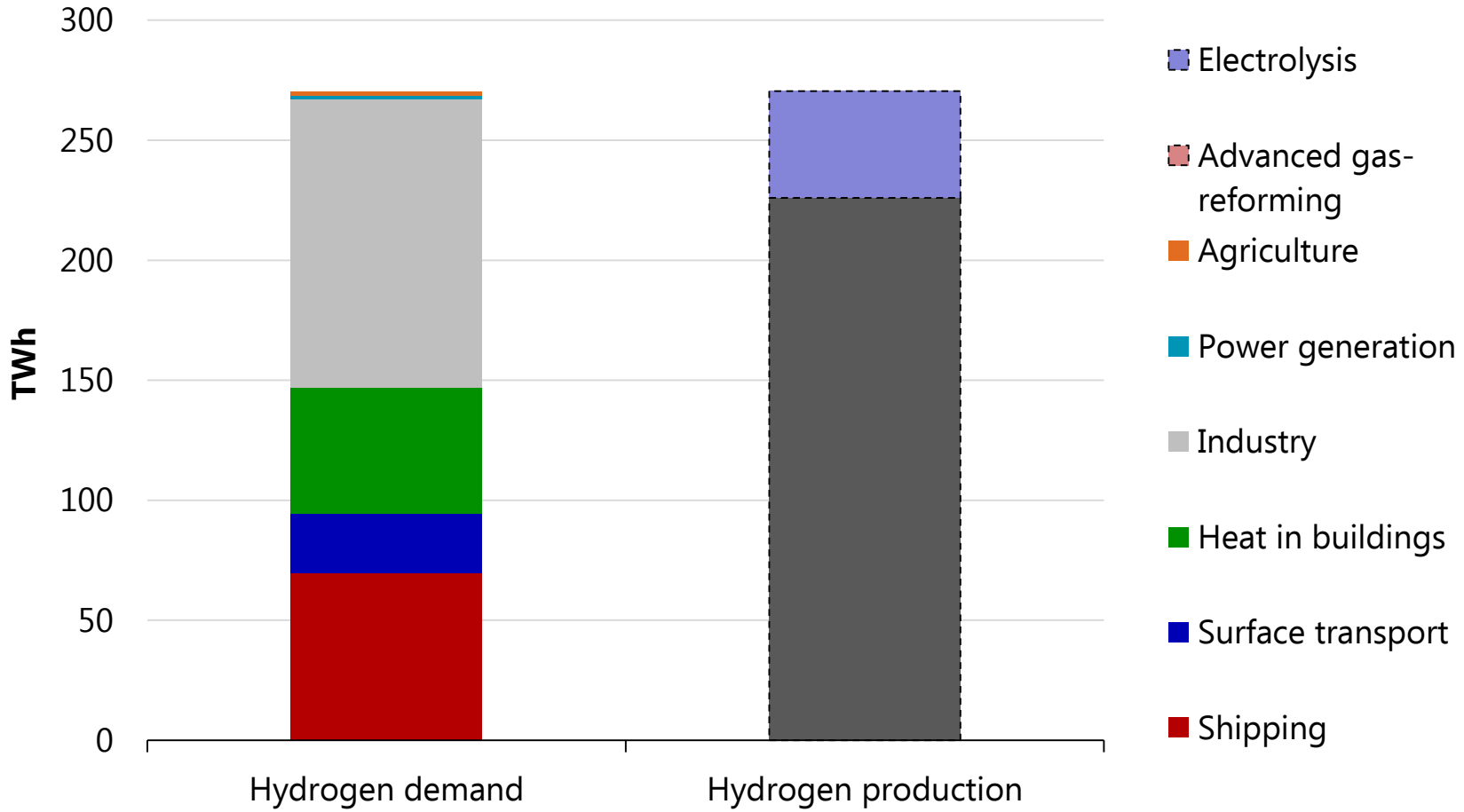
www.theccc.org.uk

Our approach to forecasting



Fossil fuel use continues

Use and production of Hydrogen in 2050



Source: CCC analysis

Summary recommendations

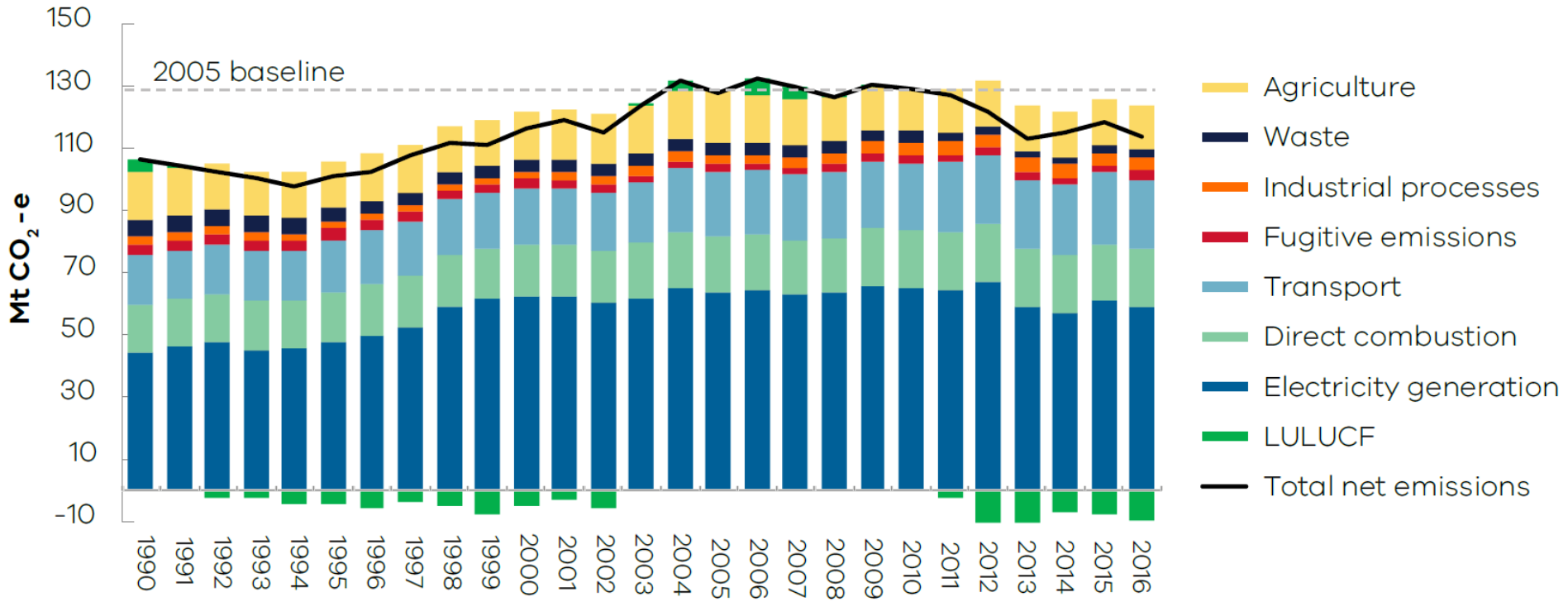
- **Net zero target is only credible if policy to reduce emissions ramps up significantly**
  - The target can only be delivered with a strengthening of policy to deliver emissions reductions across all levels and departments of government. This will require strong leadership at the heart of Government. Delivery must progress with far greater urgency.
  - Policies must be designed with businesses and consumers in mind. They must be stable, long-term and investable. The public must be engaged, and other key barriers such as low availability of necessary skills must be addressed.
  - Report emphasises previous CCC recommendations for: Heating buildings; CCS; Electric vehicles; Agriculture; Waste; Low Carbon Power.
  - With new recommendations for stronger approaches to: Industry; land use; HGVs; aviation and shipping; and GHG removals.
- **Overall costs are manageable, but must be fairly distributed.** Rapid cost reductions during mass deployment for key technologies mean that net zero can be met an annual resource cost of up to 1-2% of GDP to 2050, the same cost as the previous expectation for an 80% reduction from 1990.
- **HM Treasury should undertake a review of how the transition will be funded and where the costs will fall**. It should develop a strategy to ensure this is, and is perceived to be, fair. A broader strategy will also be needed to ensure a '**just transition'** across society, with vulnerable workers and consumers protected.

CCC recommendations to Government 2nd May 2019

- **The UK should legislate as soon as possible to reach net-zero greenhouse gas emissions by 2050**. The target can be legislated as a 100% reduction in greenhouse gases (GHGs) from 1990 using the existing Climate Change Act procedures.
- The target should cover **all sectors of the economy, including international aviation and shipping**.
- The aim should be to meet the target **through UK domestic effort**, without relying on international carbon units (or 'credits').
- Now is the right time to set a net zero target. It is **technically possible, based on current consumer behaviours and known technologies**, with prudent assumptions over cost reduction.
- **An earlier date should not be set at this stage**. Some sectors could reach net zero earlier, but for most sectors 2050 appears to be the earliest credible date, to give time to develop speculative options as alternatives for any shortfalls. Avoiding the need for early capital scrappage or punitive policies.
- **The target is an appropriate contribution to the Paris Agreement**. The UK can benefit from the international influence of setting this bold target, using it as an opportunity for further positive international collaboration.
- **Wales should set a target for a 95% reduction in emissions by 2050 relative to 1990.** Wales has less opportunity for CO_2 storage and relatively high agricultural emissions that are hard to reduce. On current understanding it could not credibly reach net-zero GHGs by 2050.
- **Scotland should aim for net-zero greenhouse gas emissions by 2045.** Scotland has proportionately greater potential for emissions removal than the UK overall and can credibly adopt a more ambitious target. Interim targets should be set for Scottish emissions reductions (relative to 1990) of 70% by 2030 and 90% by 2040.

Victoria's emissions 1990 - 2016

Figure 6.1 Victoria's emissions from 1990 to 2016, by sector

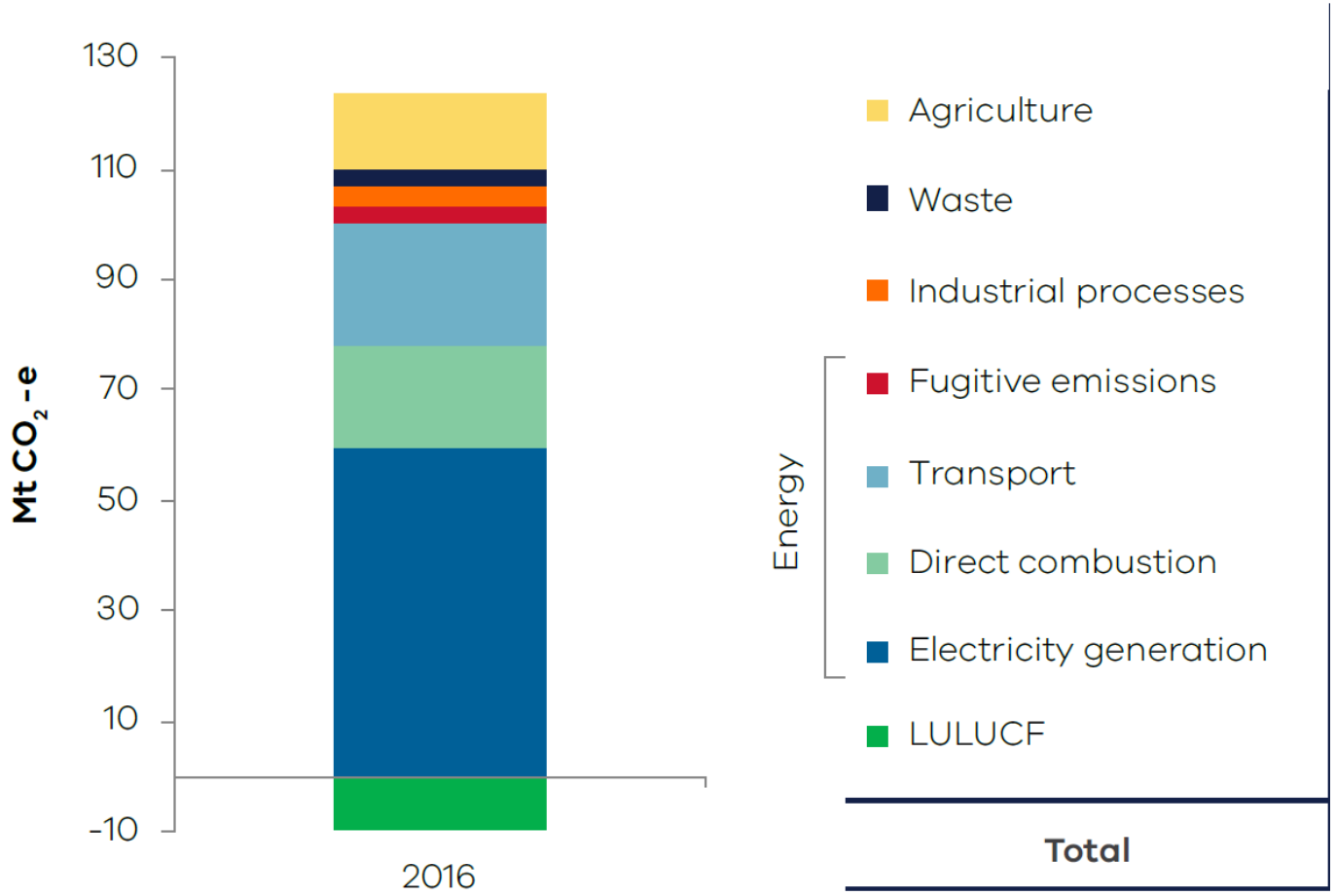


Note: At the time of the finalisation of this report, 2016 is the most recent year for which economy-wide greenhouse gas emissions data is available.

Source: Victorian Greenhouse Gas Emissions Report 2018.

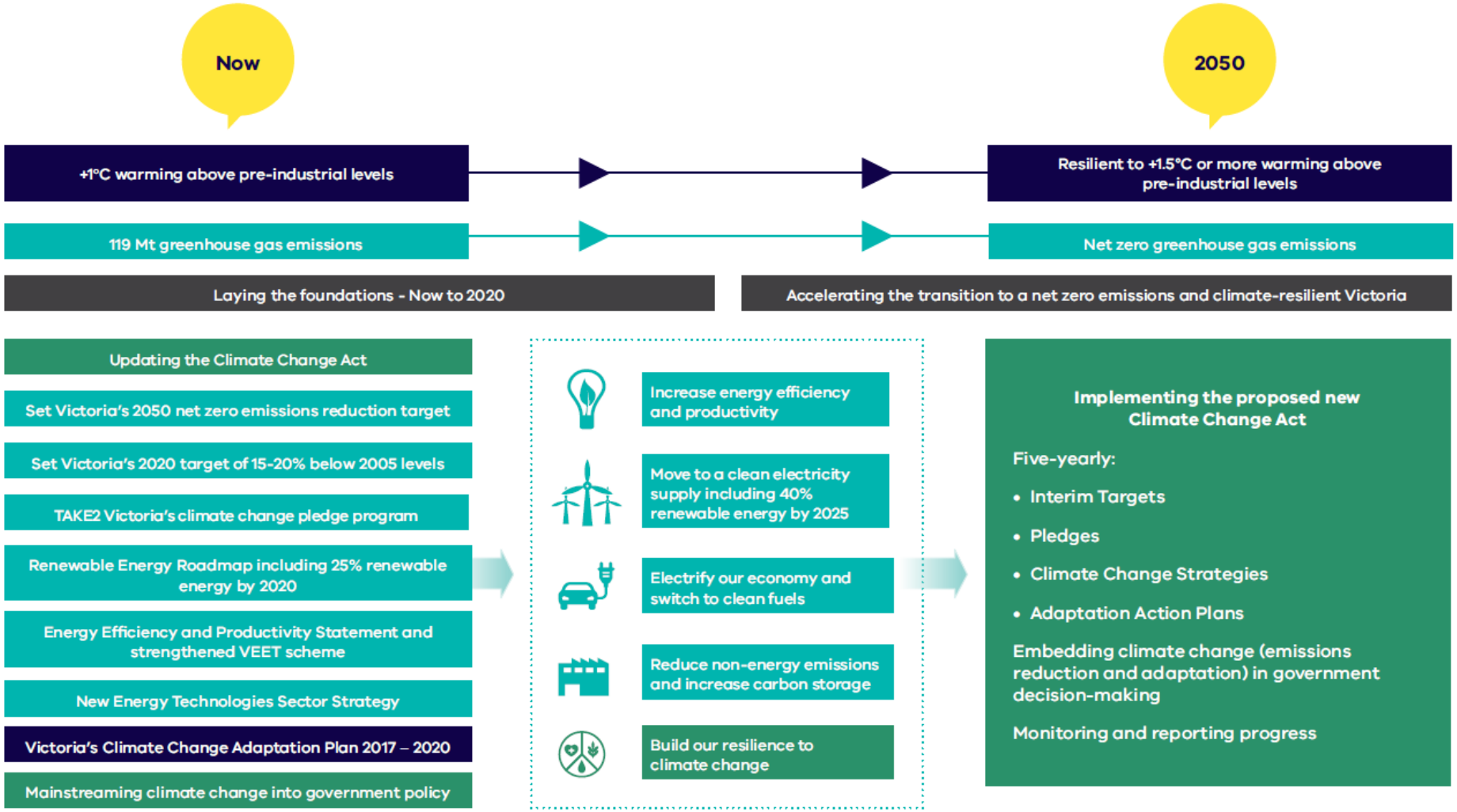
Committee on Climate Change

Victoria's emissions by sector 2016



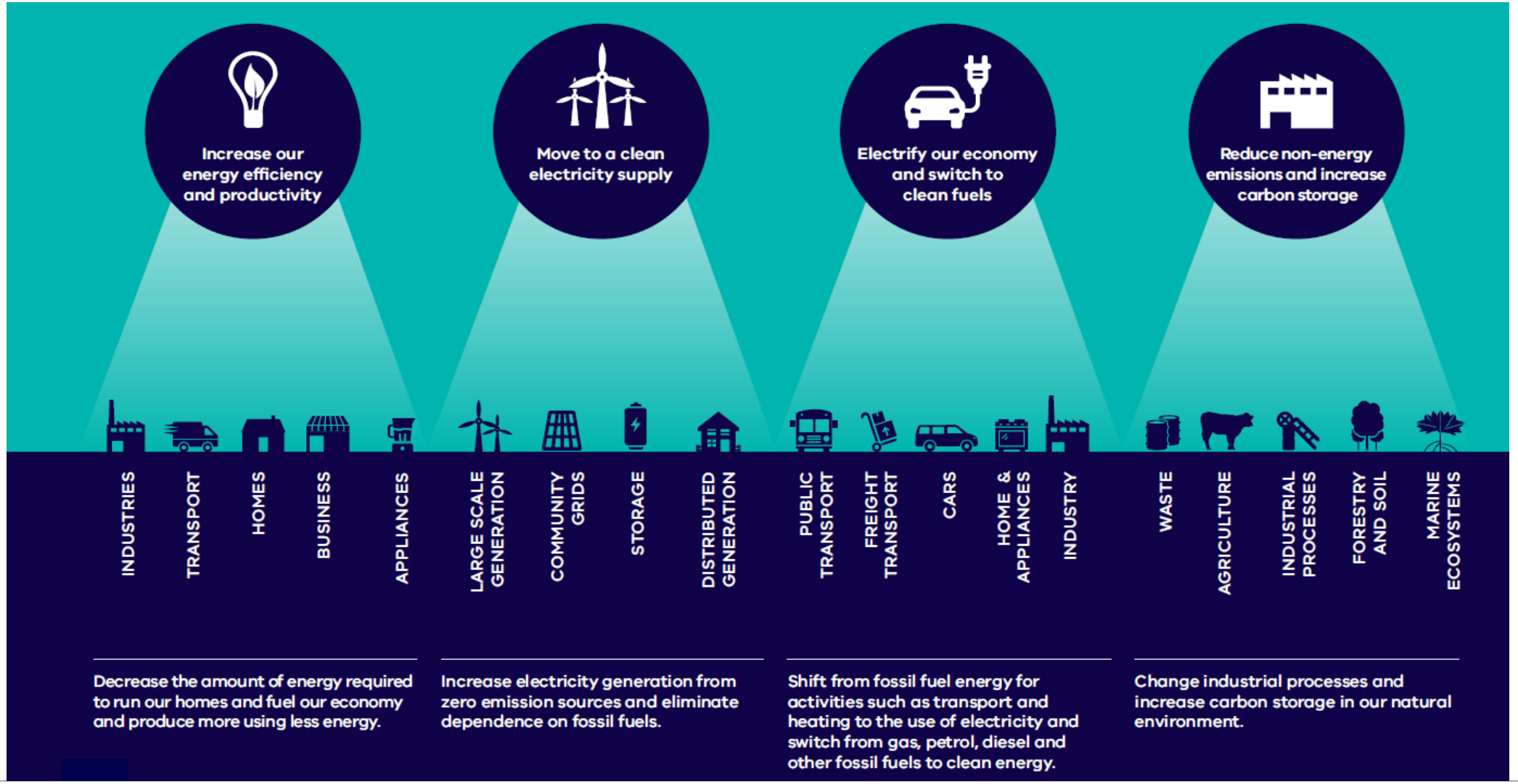
Committee on Climate Change

Victoria's climate change framework



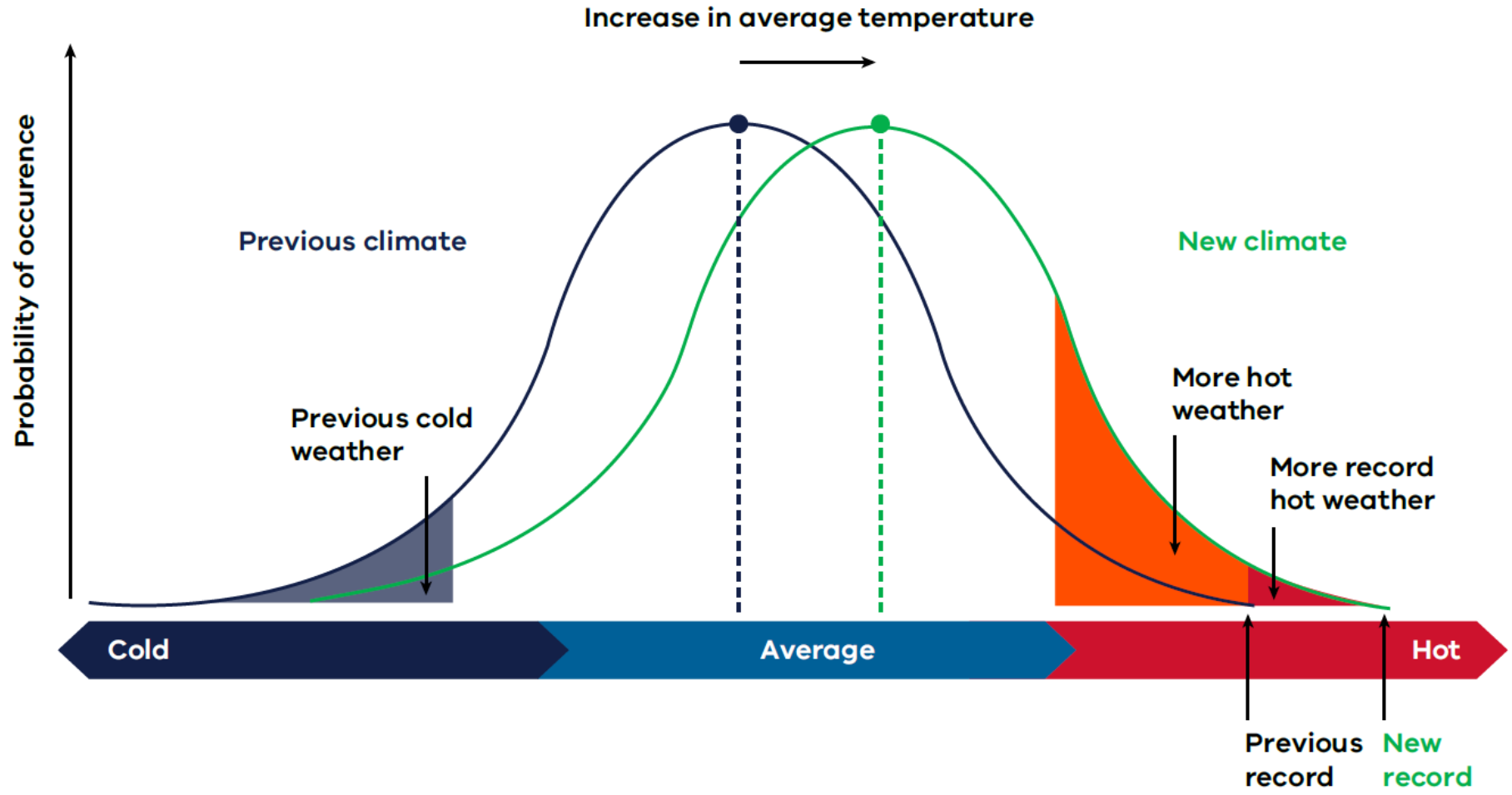
Committee on Climate Change

Victoria's four pillars for emissions reduction



Committee on Climate Change

Relationship between hot weather and averages



Committee on Climate Change

Electricity generation mix in Victoria 2014

84% BROWN COAL

4% GAS

3% HYDROELECTRICITY

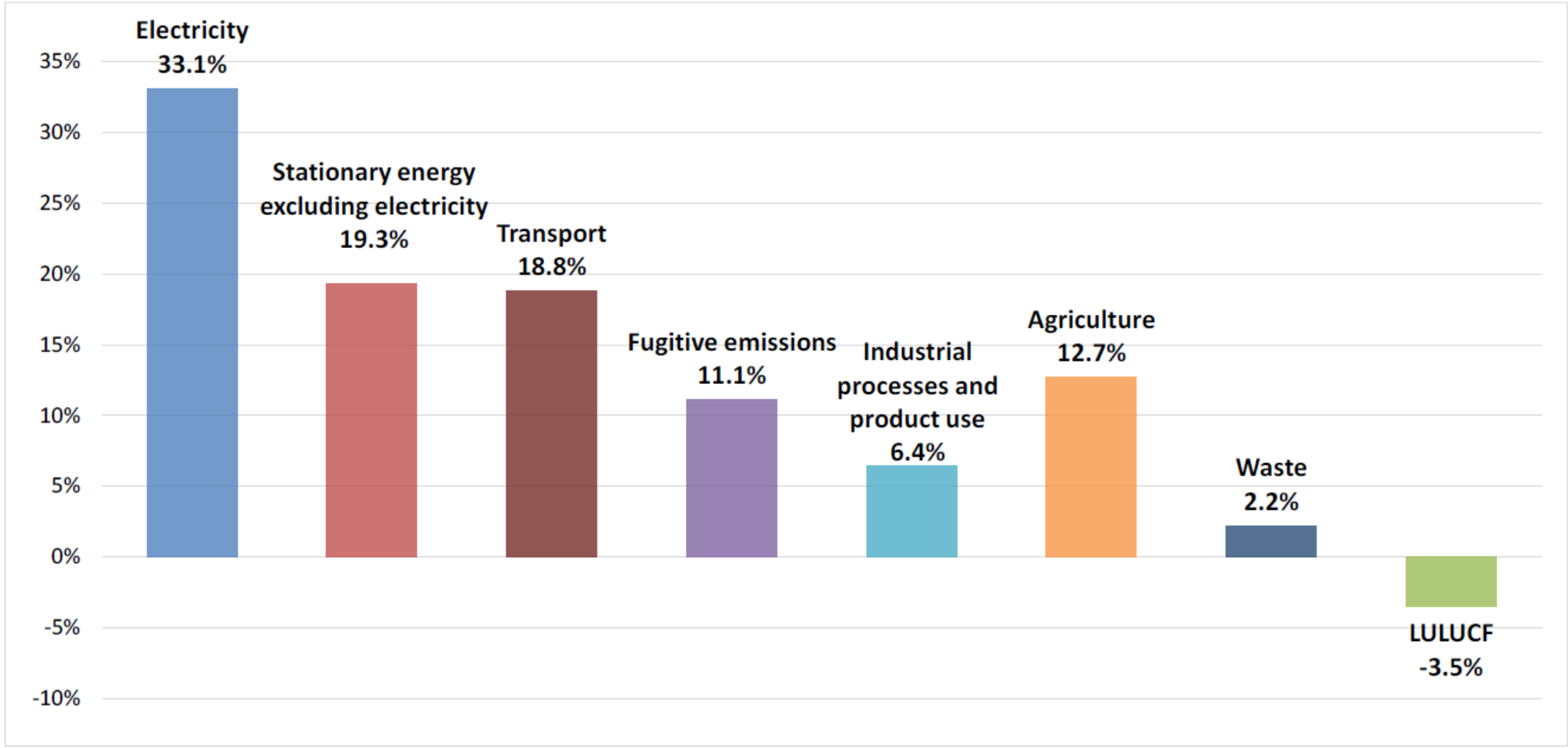
5% WIND

2% SOLAR

2% BIOENERGY

Committee on Climate Change

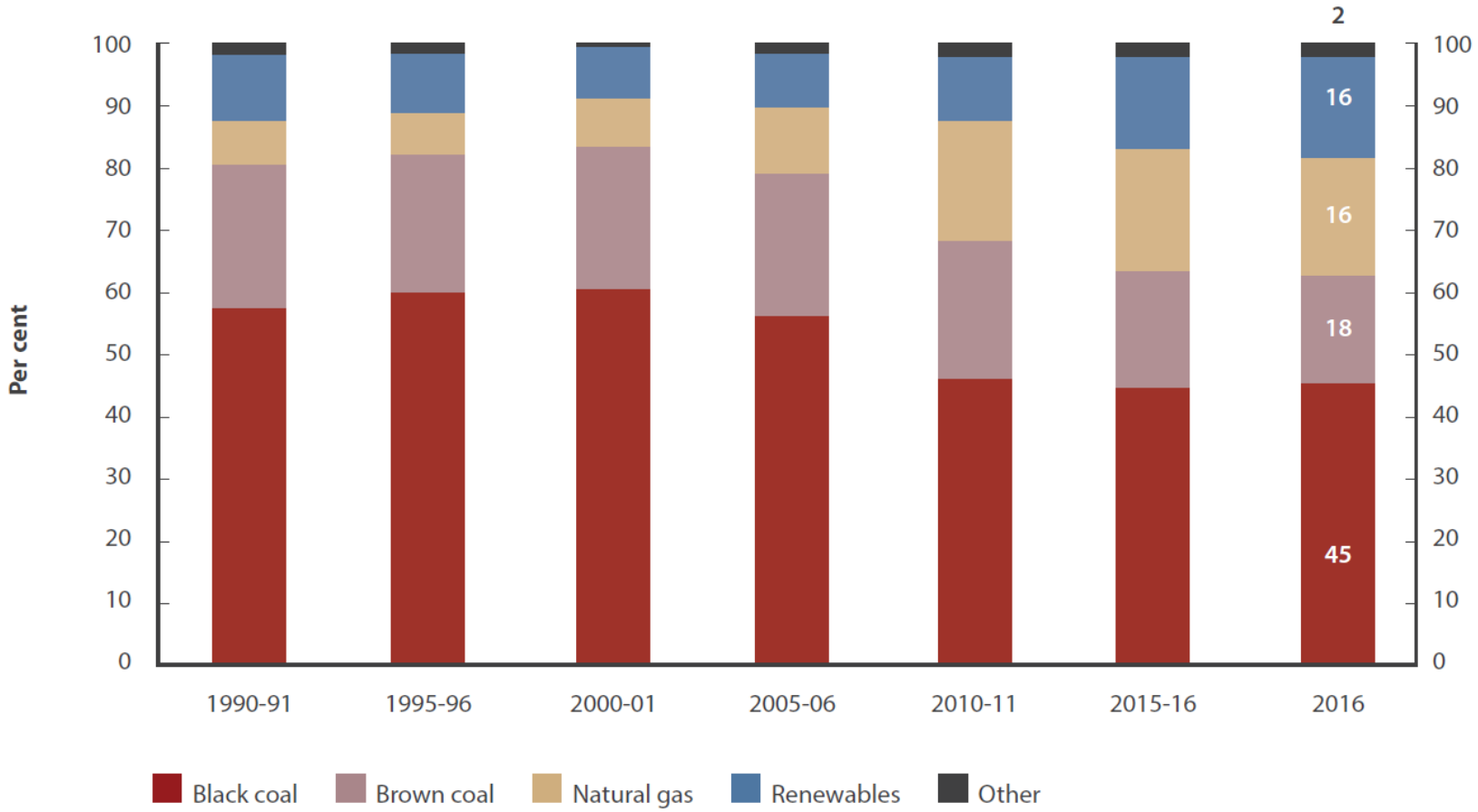
Australia 2018/19 emissions by sector



Source: Department of the Environment and Energy

Committee on Climate Change

Australia: electricity generation



Source: Australian Energy Statistics, Table O1. Australian electricity generation, by fuel type, physical units, Australian Energy Update 2017