

Net Zero:

Why is it so important and how do we get there?

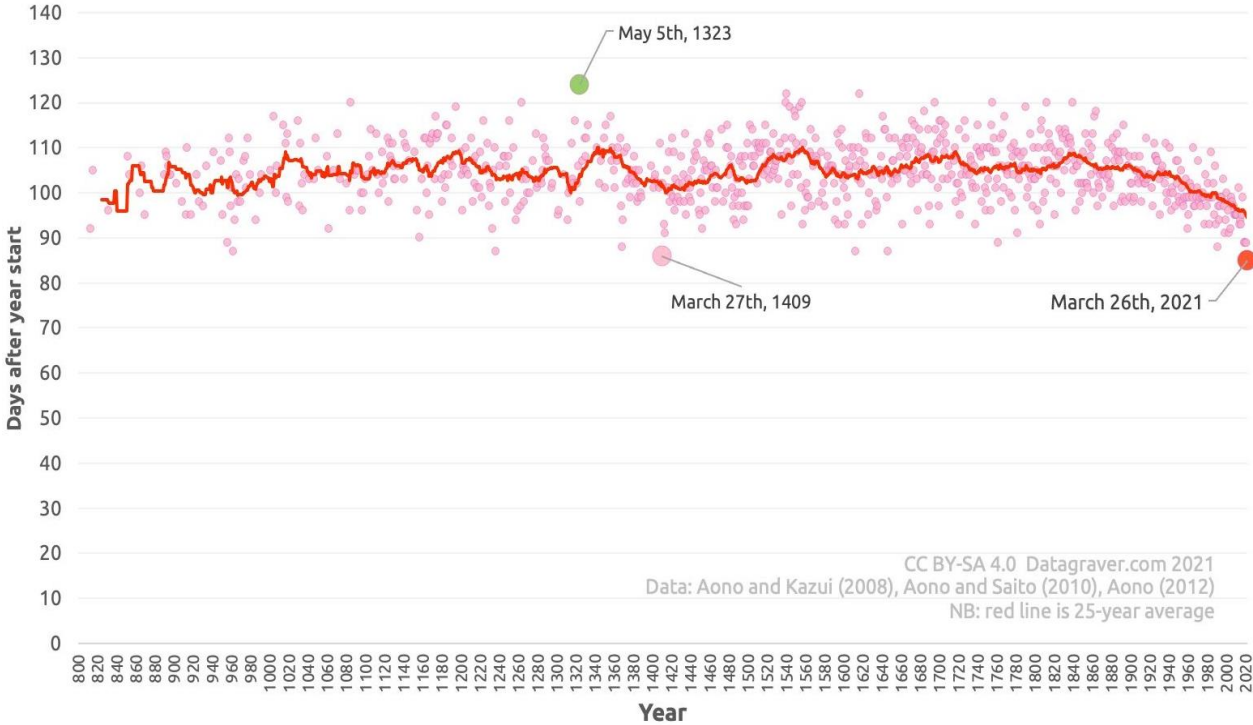
Julia King, Baroness Brown of Cambridge FEng FRS
Chair, Adaptation Committee, UK Climate Change Committee

Zienkiewicz Lecture Swansea University 24th November 2021

The climate is changing

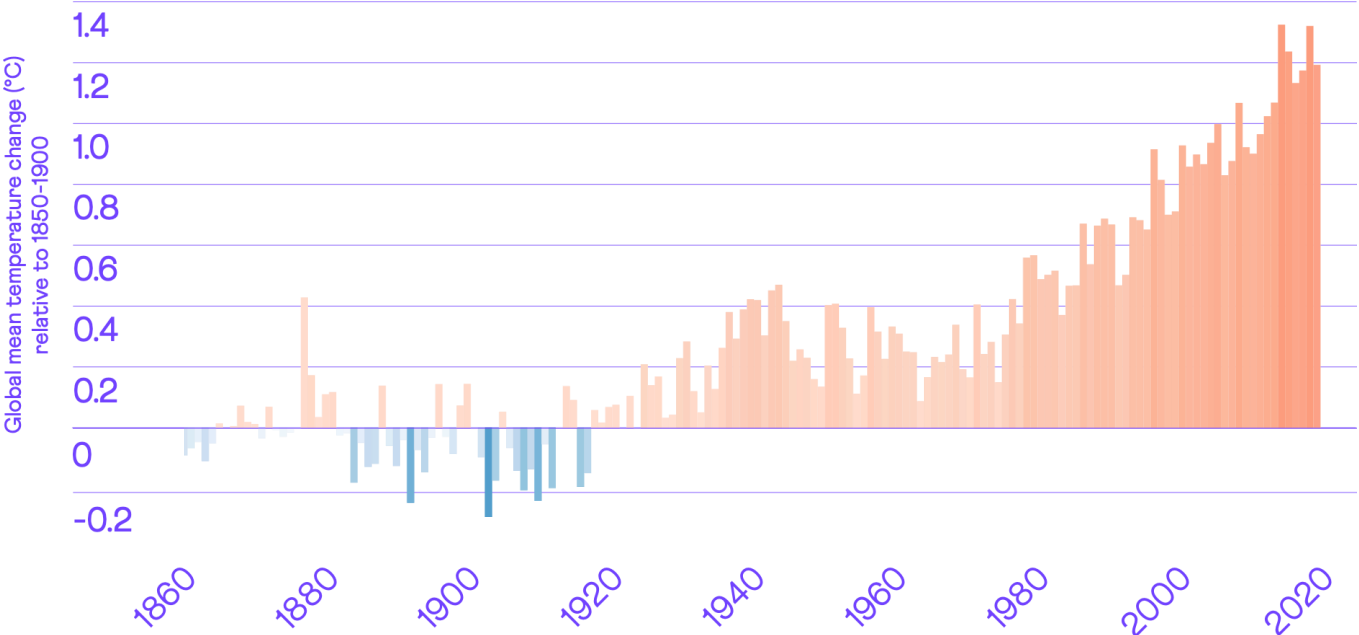
A wide variety of indicators

Full-flowering cherry blossom day, Kyoto



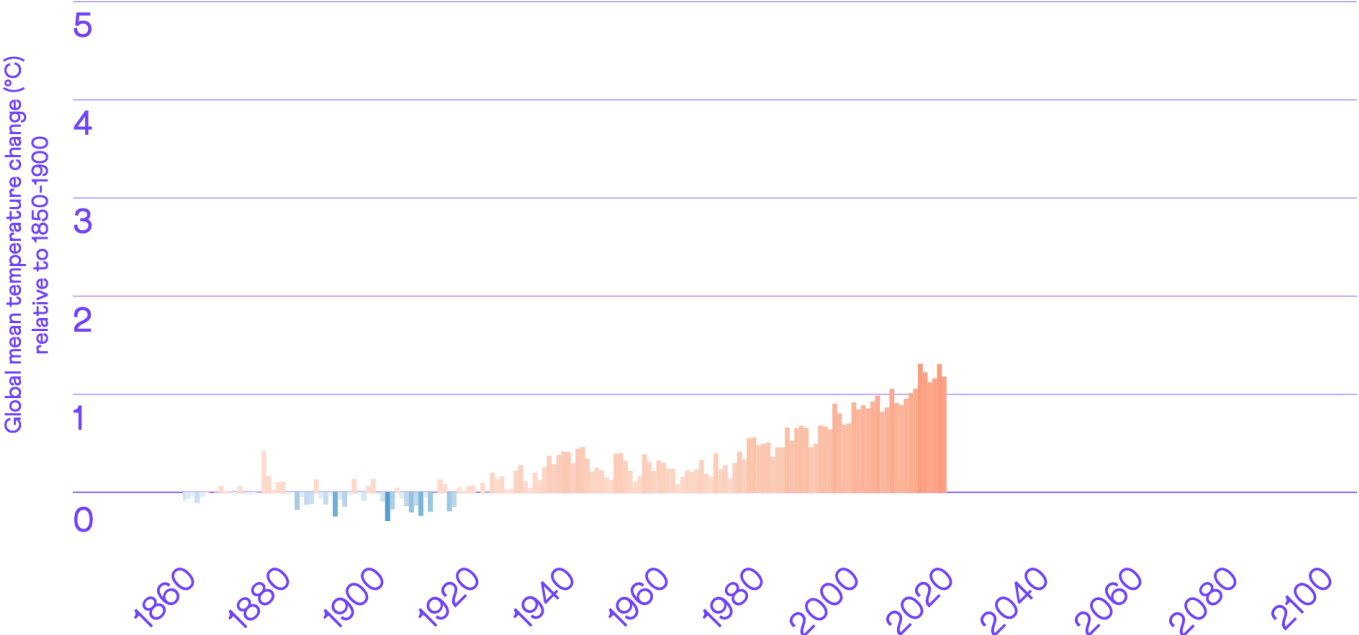
Our changing climate

Global temperature changes since 1860



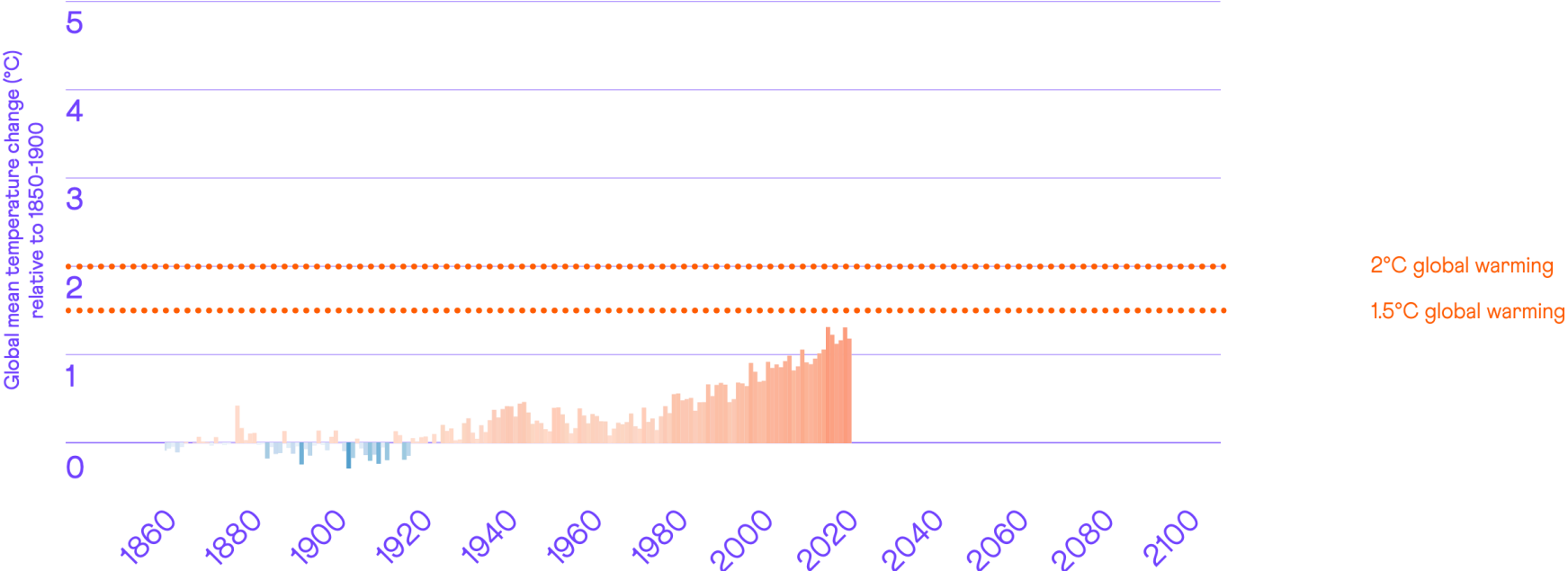
Our changing climate

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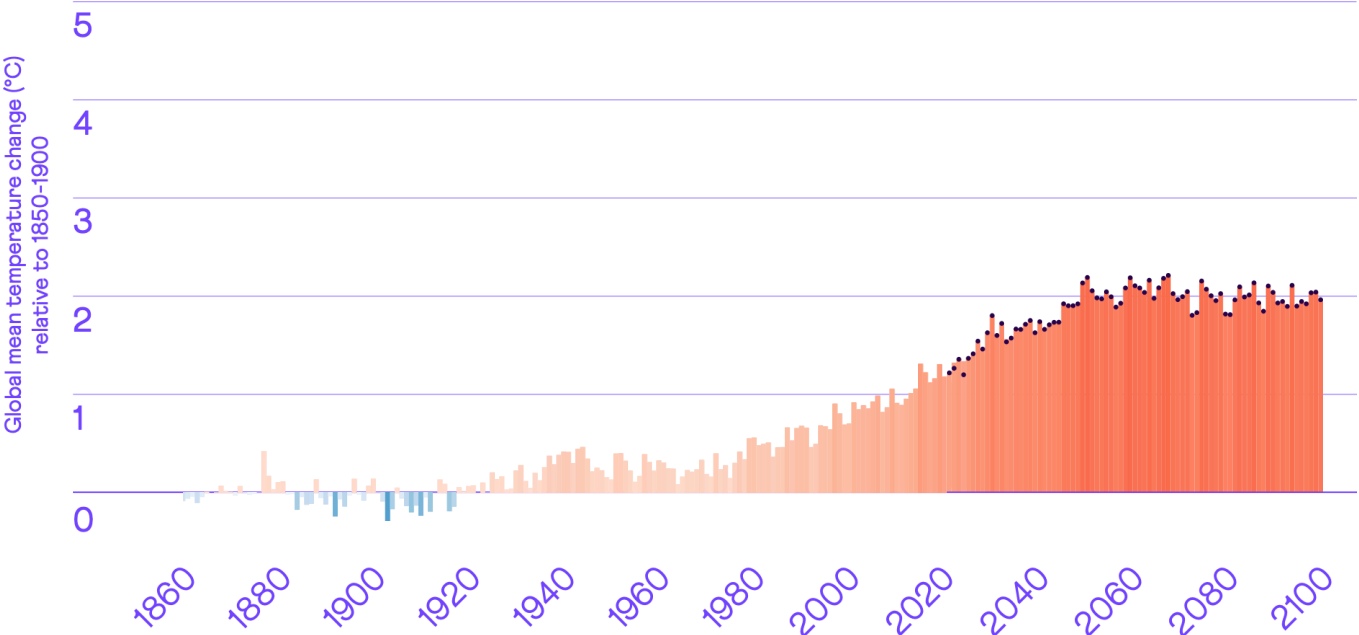
Our changing climate

Global temperature changes since 1860



Our changing climate

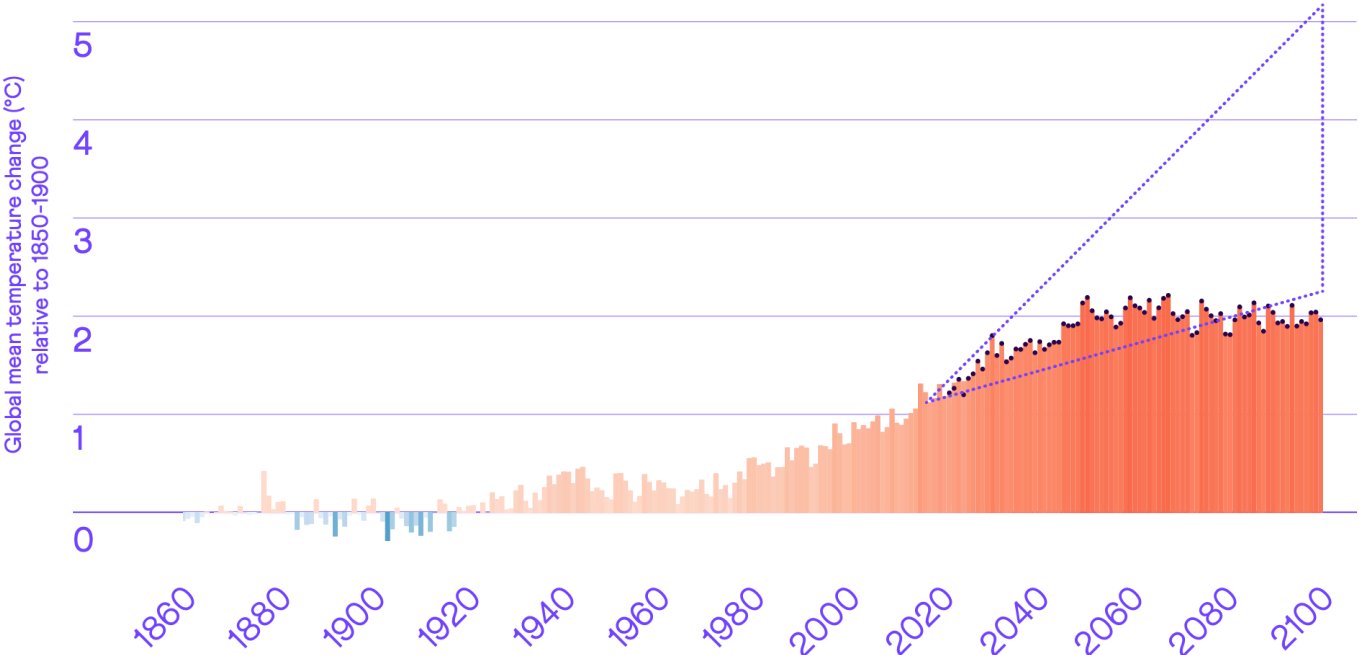
Global temperature changes since 1860



Example climate future with global warming limited to 2°C by 2100

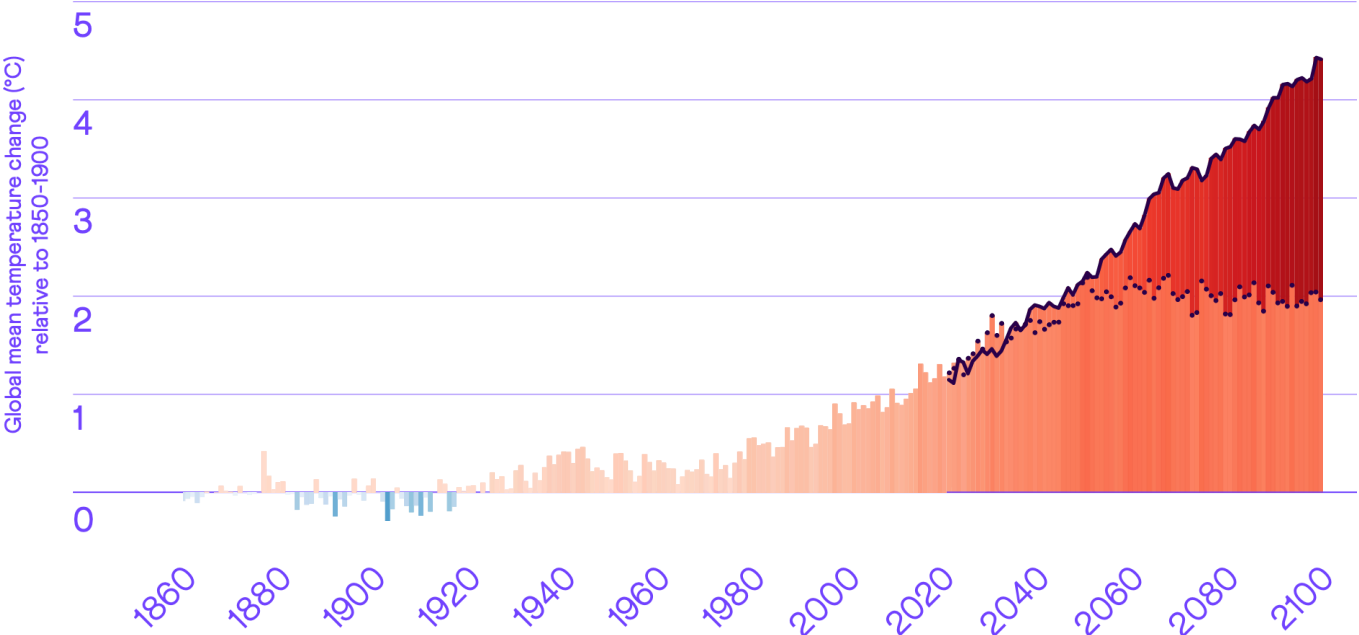
Our changing climate

Global temperature changes since 1860



Our changing climate

Global temperature changes since 1860



Example climate future possible with current worldwide policies

The world today

2021 is sending world leaders a message

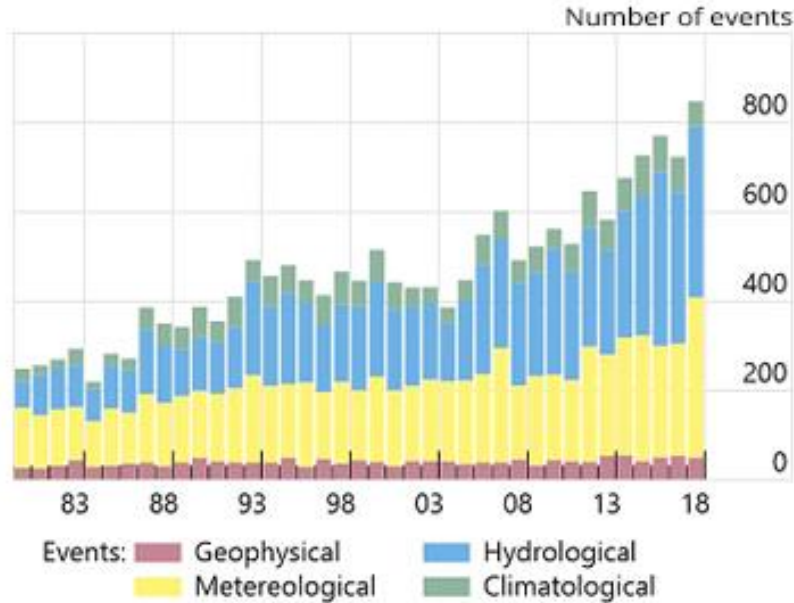
- Flooding in Europe, China, Kenya, London, New York
- 50°C temperatures in North America
- Wildfires in Greece, Turkey, California, Oregon...
- Drought in Argentina, Brazil, Madagascar, California, India
- ...



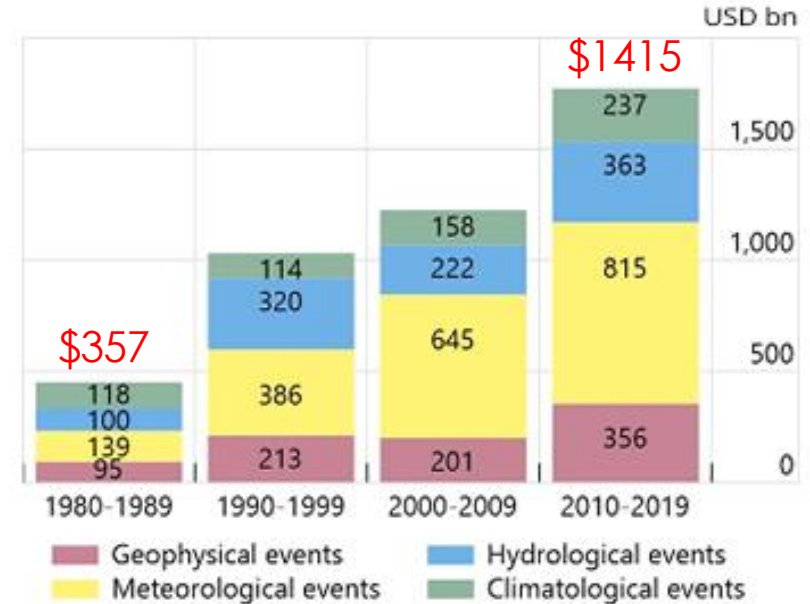
Impact of climate risks on the global economy

The cost of damage is increasing: we are not adapting fast enough

Number of natural loss events



Estimated global economic loss from natural catastrophe events

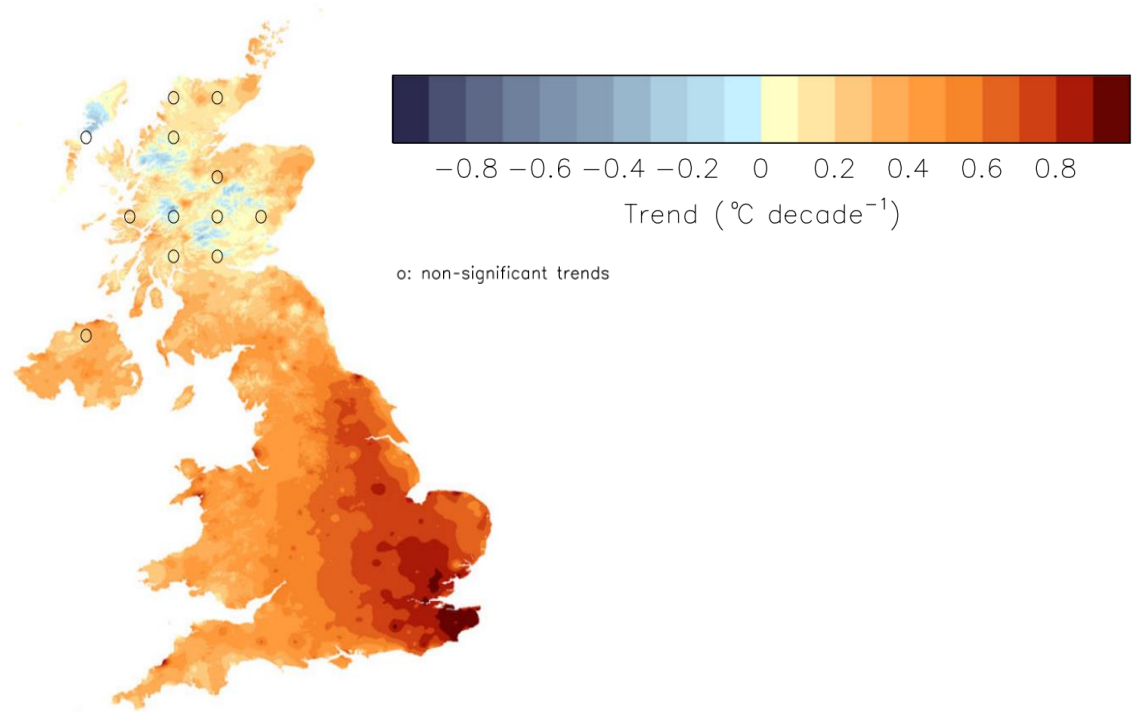


Recent UK experience

Hottest 10 years.....

- 2018 heatwave summer typical by 2050
- Record UK temperature in Cambridge 38.7° July 2019
- 40°C temperatures by 2050

Rate of increase in hottest daytime temperatures (1960 to 2019)



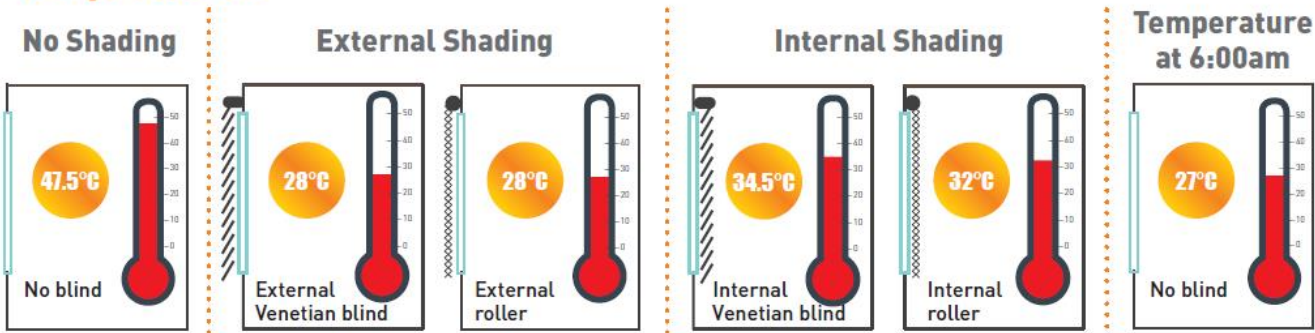
Uninhabitable homes

Indoor temperatures in the unshaded flat of 47.5°C in September 2018



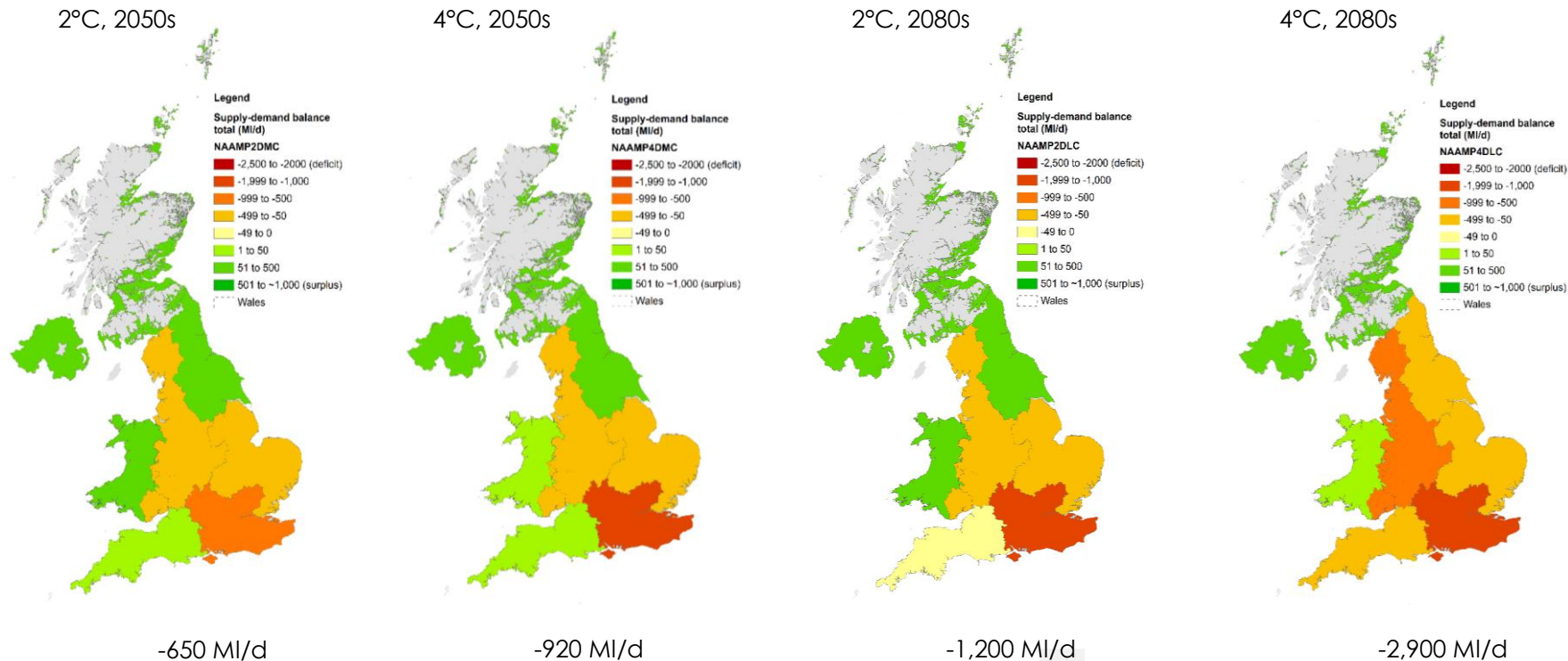
London office building converted to apartments. Fitted with new double glazing with a U-value of 1.1

Temperatures



Growing water shortages

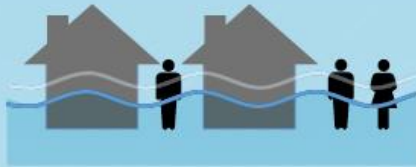
UK water deficits on 2° and 4° warming pathways



Homes at significant flood risk

7 of the UK's ten **wettest years** since 1998, 2014 and 2016 two wettest on record

Current



1.8 million people in the UK are living in areas at significant risk of flooding.

2050s



The number of people at risk is projected to rise to **2.6 million** in a 2°C global warming scenario.



Maybury Hill 2016

'Germany's forests are sick' – German Agriculture Minister Feb 2021

Already with us too...

- German Forest Report 2020
- Climate change damage from:
 - Increased winter rainfall
 - Summer drought and heat
 - Bark beetle
- Affecting almost all trees:
 - 79% of spruce
 - 80% of pines
 - 80% of oaks
 - 89% of beeches



© Jochen Taatz/dpa/picture alliance

- €1.5bn funding for clearing and replanting

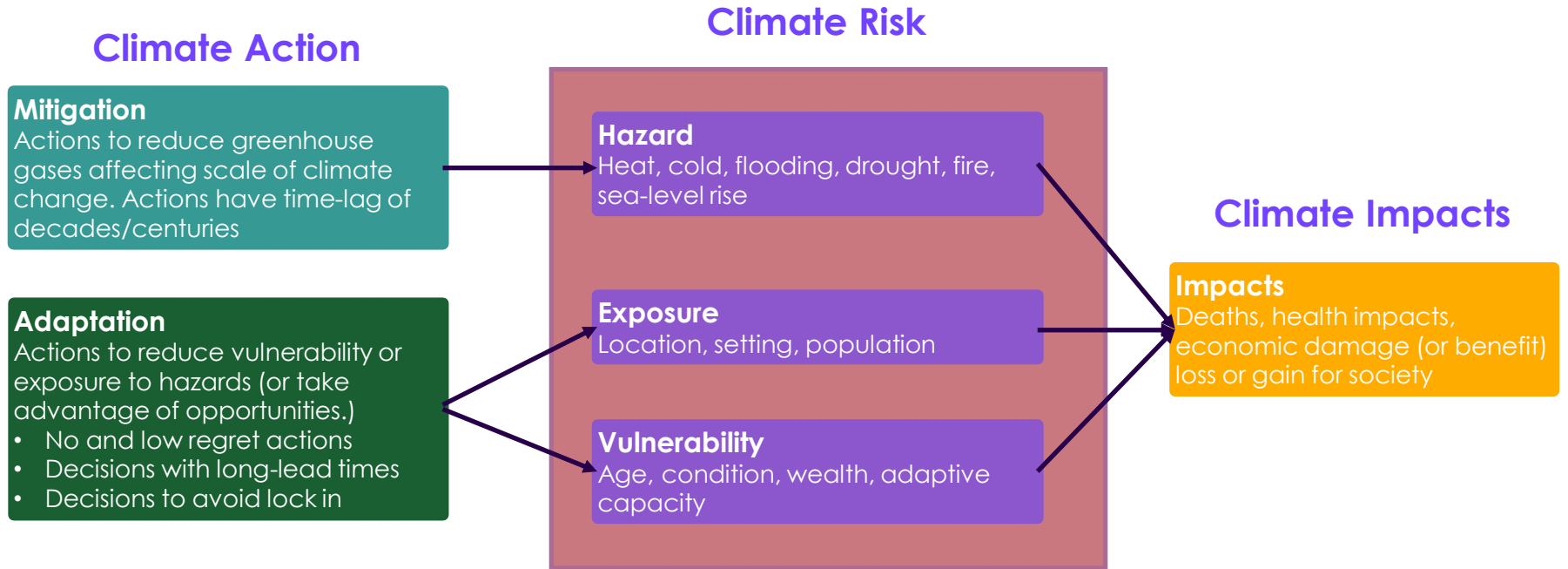
The UK's changing climate

Further climate change is inevitable

	Observed change to date	Inevitable change by mid-century	2°C by 2100C	4°C by 2100
Average annual UK temperature	~1.2°C above pre-industrial levels	~0.6°C from present	~0.7°C from present by mid-2080s	~3.0°C from present by mid-2080s
'Hot summer' occurrence	10 – 25% chance of a '2018 summer'	50% chance each year	50% chance each year	90% chance each year
Average summer rainfall	No significant long-term trend	-11% (to -24%)	-15% (to -28%)	-29% (-53%)
Average winter rainfall	No significant long-term trend	+5 % (+16%)	+6% (+18%)	+18% (+41%)
Heavy rainfall	No significant long-term trend	10% from present	20% from present	50% to 70% from present
Sea level rise	~16cm since 1900	3 - 37 cm from present by 2060	5 - 67cm from present	27 - 112cm from present

Two types of climate action essential to reduce climate impacts

Mitigation and adaptation



Reducing emissions - some history

We have known about this for a while

19th Century Science

- 1820 Fourier calculates the temperature at the earth's surface *including a coefficient for the heat retained by the atmosphere*
- 1856 Eunice Newton Foote proposed *CO₂ in the atmosphere causes global temperatures to rise*
- 1860 Tyndall suggested only minority gases CO₂, H₂O, CH₄ absorb heat *keeping the planet warmer*
- 1898 Arrhenius calculates the effect fossil fuel burning on the earth's temperature *doubling CO₂ results in a 5°C temperature rise*
- 1898 Atmospheric CO₂ level 295ppm
- 2021 April: 420ppm, August: 415ppm, Annual average: 413ppm
- 2021 Arrhenius would predict about 1.7° temperature rise, actual ~1.2°

Climate Change Act 2008

The world's first legislated target



Climate Change Act 2008

CHAPTER 27

CONTENTS

PART 1

CARBON TARGET AND BUDGETING

The target for 2050

- 1 The target for 2050
- 2 Amendment of 2050 target or baseline year
- 3 Consultation on order amending 2050 target or baseline year

Carbon budgeting

- 4 Carbon budgets
- 5 Level of carbon budgets
- 6 Amendment of target percentages
- 7 Consultation on order setting or amending target percentages
- 8 Setting of carbon budgets for budgetary periods
- 9 Consultation on carbon budgets
- 10 Matters to be taken into account in connection with carbon budgets

Limit on use of carbon units

- 11 Limit on use of carbon units

Indicative annual ranges

- 12 Duty to provide indicative annual ranges for net UK carbon account

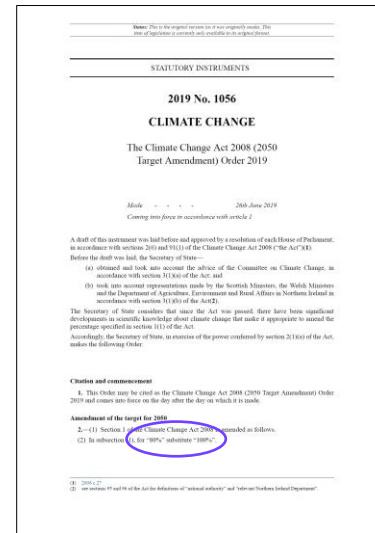
Proposals and policies for meeting carbon budgets

- 13 Duty to prepare proposals and policies for meeting carbon budgets
- 14 Duty to report on proposals and policies for meeting carbon budgets
- 15 Duty to have regard to need for UK domestic action on climate change

2015 – 2021

Paris to Glasgow - the six years the world changed?

- **2015 - 16 The Paris Agreement**
 - *Holding the increase in the global average temperature to well below 2° above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5° above pre-industrial levels, recognising that this would significantly reduce the risks and impacts of climate change*
 - 196 parties
 - Signed 12th December 2015
 - In force 4th November 2016
- **2019 IPCC Special Report on global warming of 1.5°**
 - The scientific case for the benefits of 1.5° vs 2°
 - The global pathways to limit warming to 1.5°
- **2019 CCC Net Zero Report**
 - UK could achieve Net Zero by 2050 at no extra cost
- **2019 Amendment of the 2008 Climate Change Act**
 - 80% reduction amended to 100% reduction
- **2020 CCC 6th Carbon Budget and Path to Net Zero**
 - First carbon budget to align with Net Zero and NDC
- **2021 IPCC AR6 Report**
 - Human activity changing climate in unprecedented ways
- **2021 The UK Net Zero Strategy**
- **2021 COP 26 in Glasgow**



Why Net Zero in 2050?

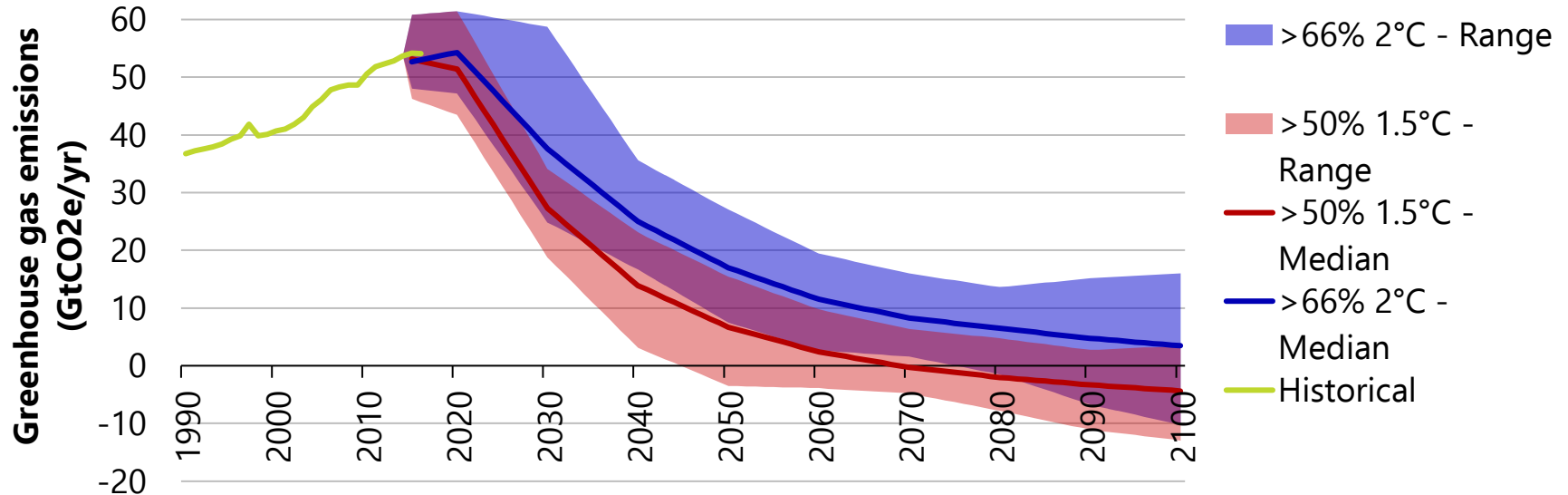
The Challenge

Meeting our Paris Commitments

- **Paris:**

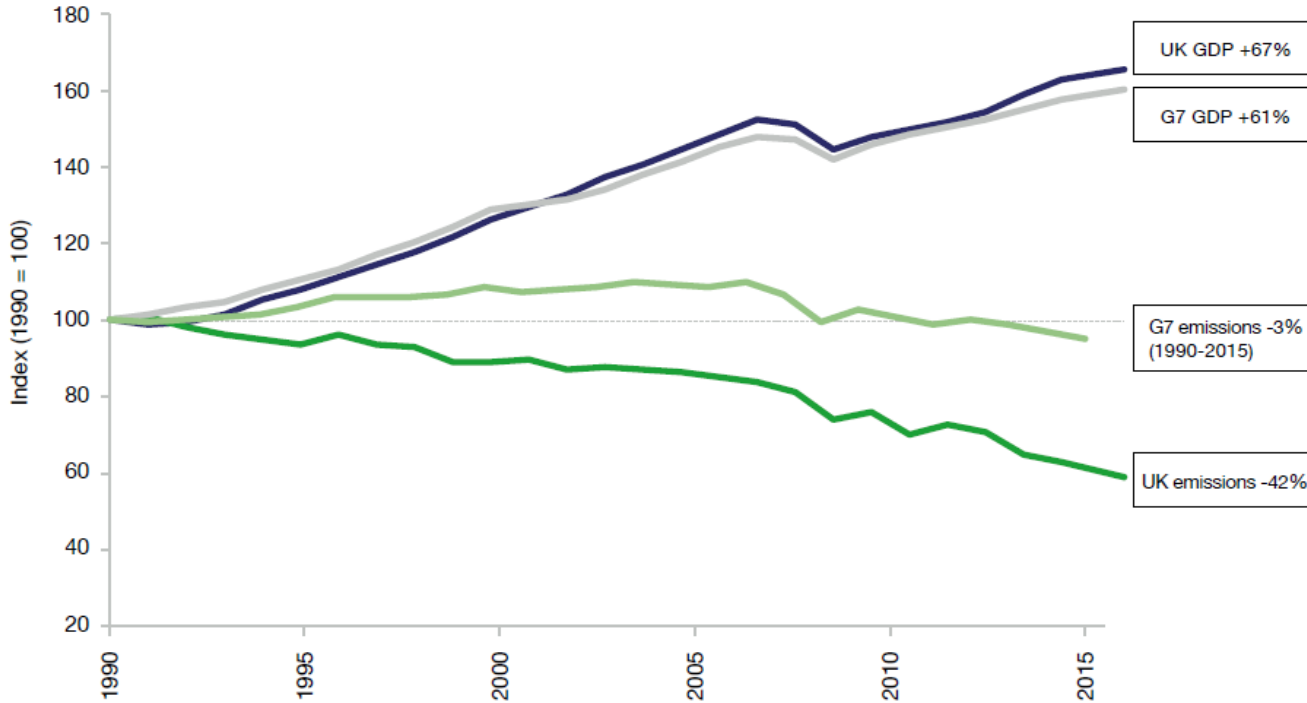
- Consistent with highest possible ambition
- Fair and ambitious in the light of national circumstances

Global emissions pathways consistent with Paris



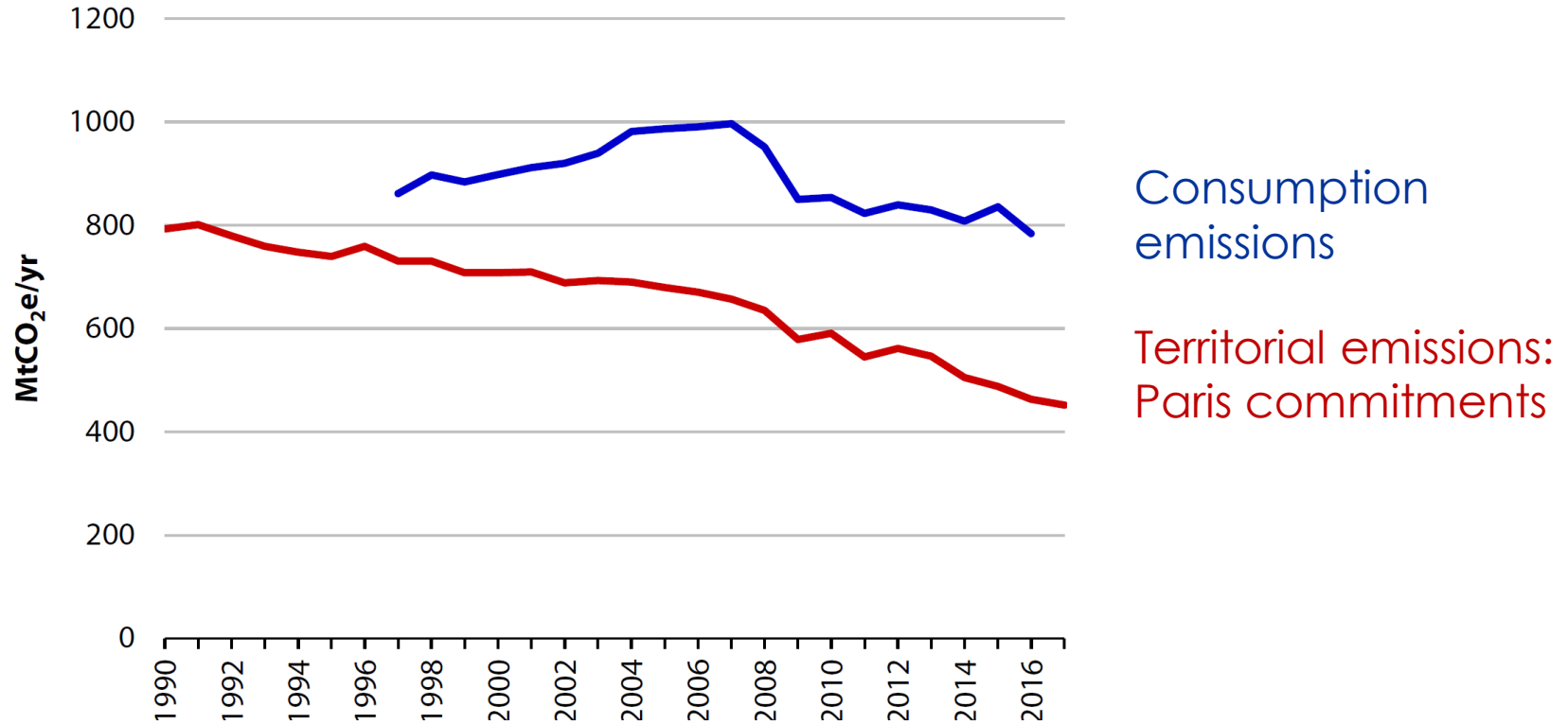
The UK should meet Net Zero early because...

Capability: it can be more ambitious



The UK should meet Net Zero early because...

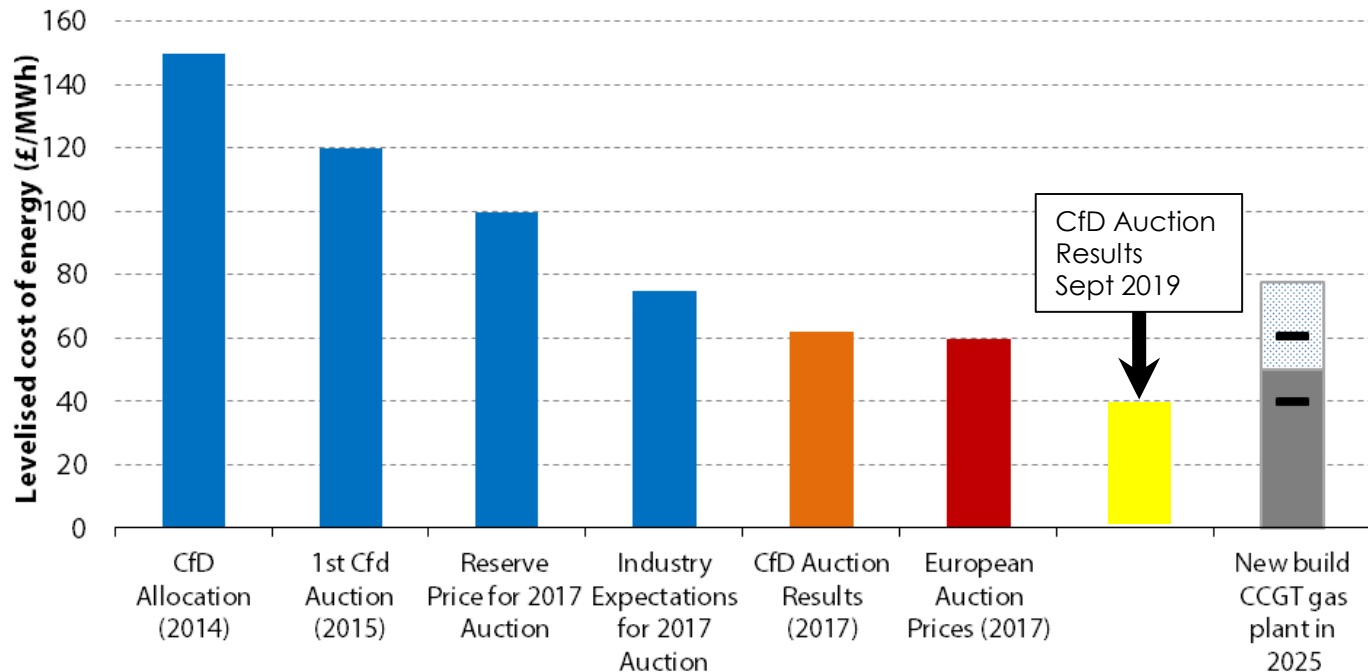
Equity: a rich economy with a large historic contribution and a large carbon footprint



The UK should meet Net Zero early because...

Global support: including technology and cost reduction

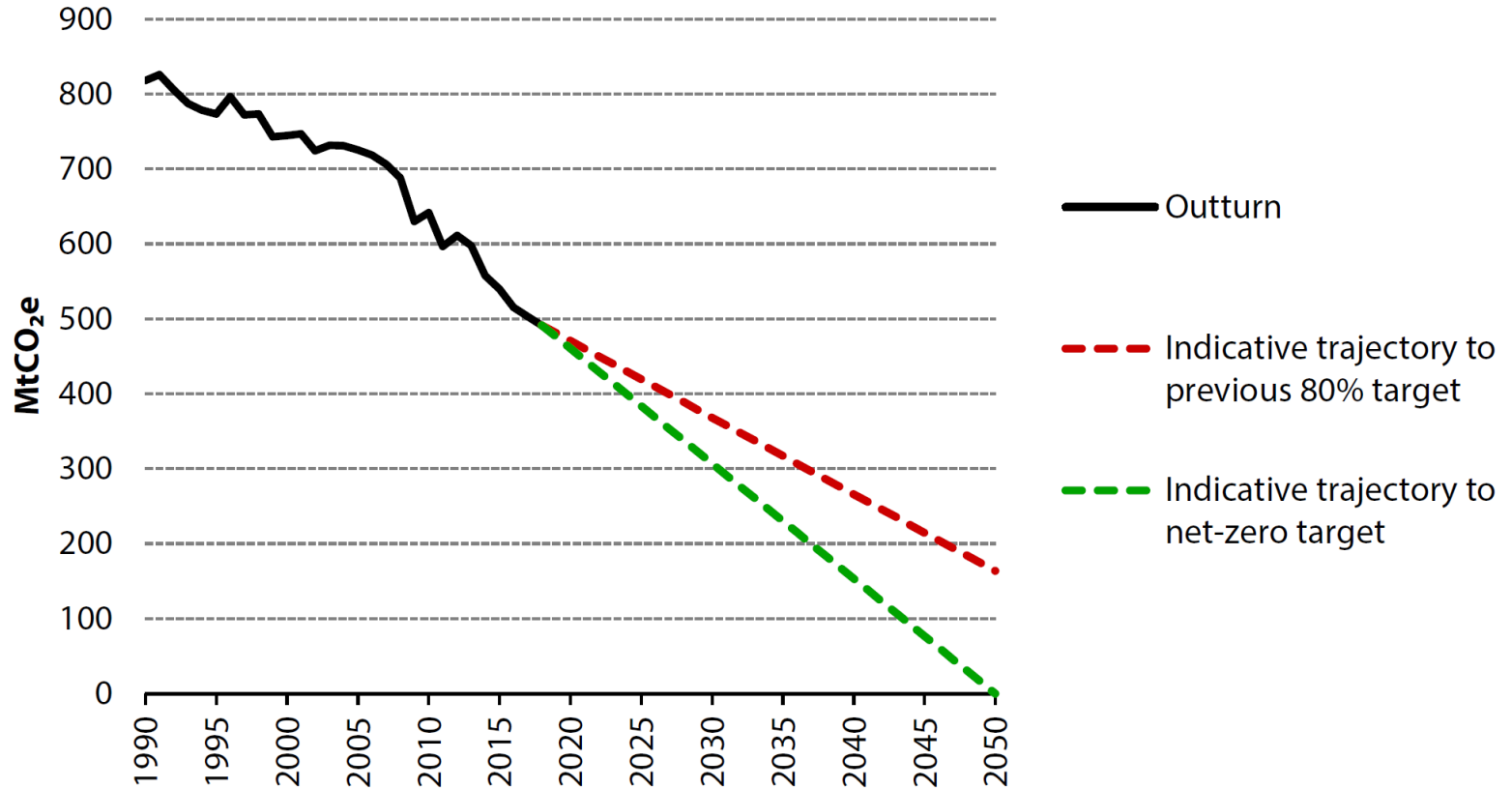
Contracts for Difference auction prices for Offshore Wind



The UK's path to Net Zero

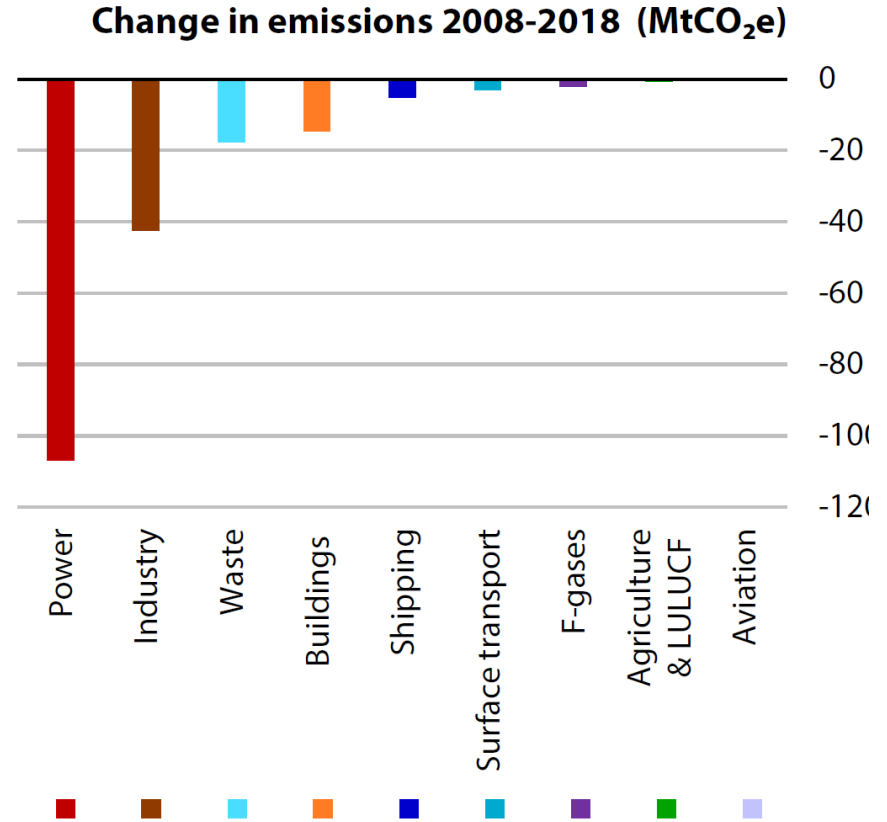
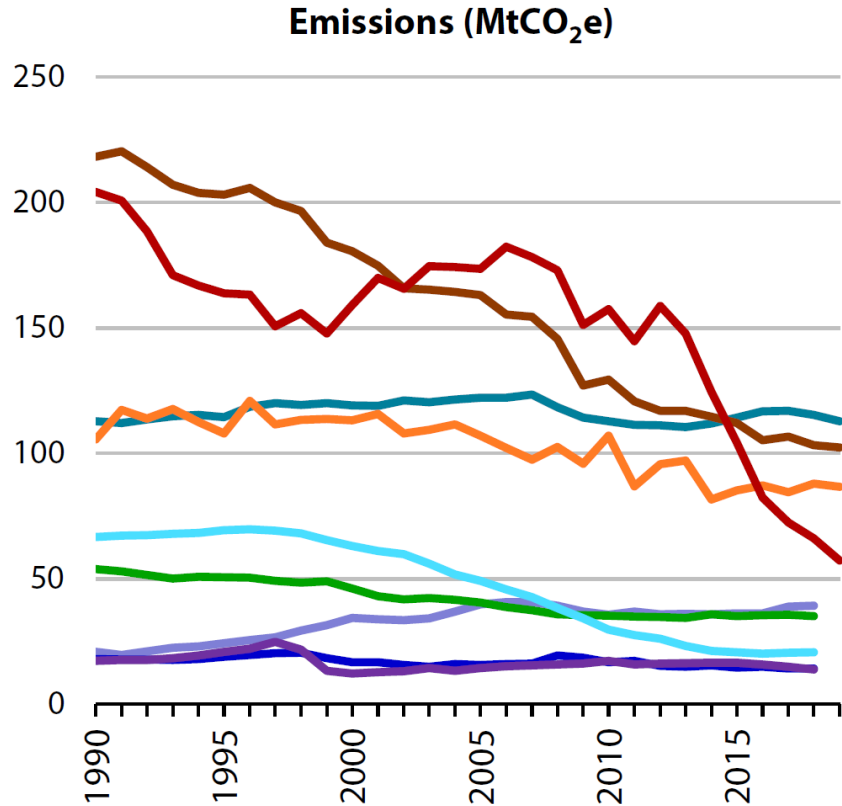
Net Zero

From 80% reduction to Net Zero



The starting point

UK sectoral emissions 2019



The Net Zero Challenge

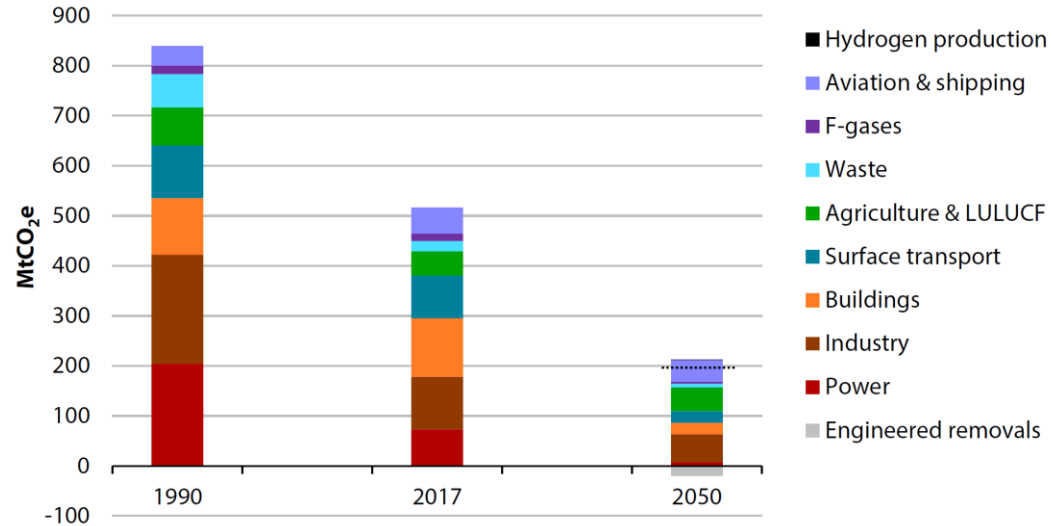
Getting to 80% reduction

Key actions

- Energy efficiency and demand reduction
- Electrification: heat, transport, industry
- Grow zero carbon power generation
- Industrial Carbon Capture and Storage
- Wood in construction
- Limited implementation of BECCS
- Afforestation 27,000 hectares pa

Remaining emissions

- Industry
- Heat in buildings
- Heavy transport
- Aviation
- Shipping
- Agriculture



Getting to Net Zero: the final 20%

Why you are hearing so much about hydrogen

For all those remaining emissions with an 80% target

- **Industry:** electrification, CCS, and **hydrogen**
- **Heat in buildings:** 90% low carbon heating including **hydrogen**
- **Heavy transport:** HGVs electric or **hydrogen**
- **Aviation:** efficiency, demand constraint, **liquid hydrogen** and synthetic fuels using **hydrogen**
- **Shipping:** efficiency and alternative fuels: **hydrogen** (NH₃)
- **Agriculture:** 0% reduction in beef and dairy, low carbon **hydrogen** for fertilizer

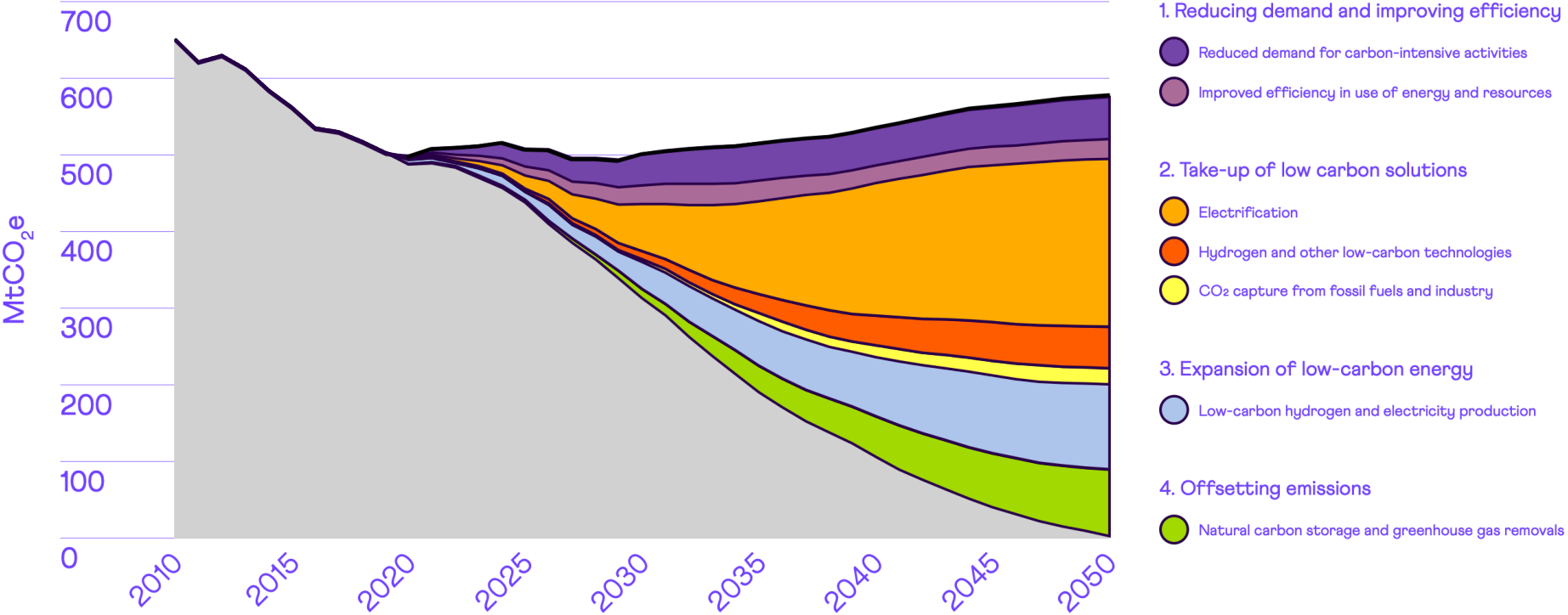
Energy supply

- **Electricity:** 95% low carbon power, including **hydrogen**
- **Storage:** with variable renewable generation, including **hydrogen**

Delivering Net Zero

Emissions abatement

Actions across four key areas

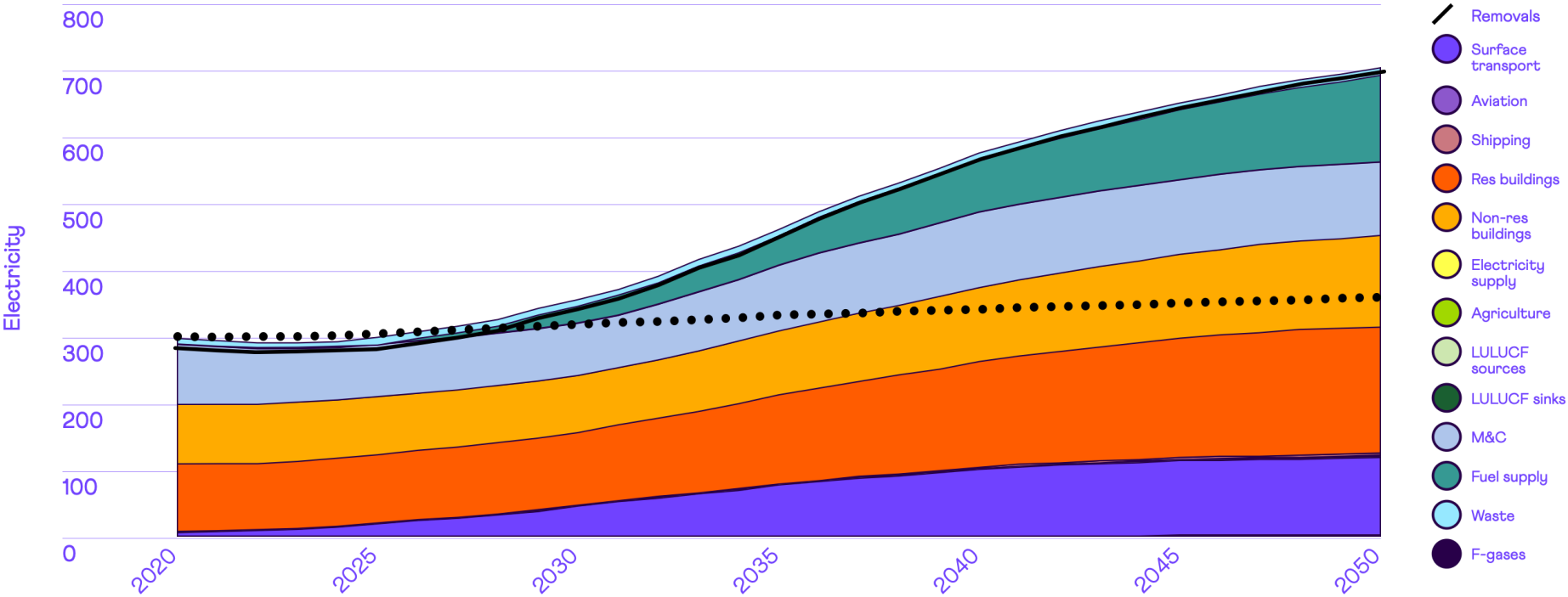


Major changes in fuel use

Changes in energy demand

Electricity (TWh)

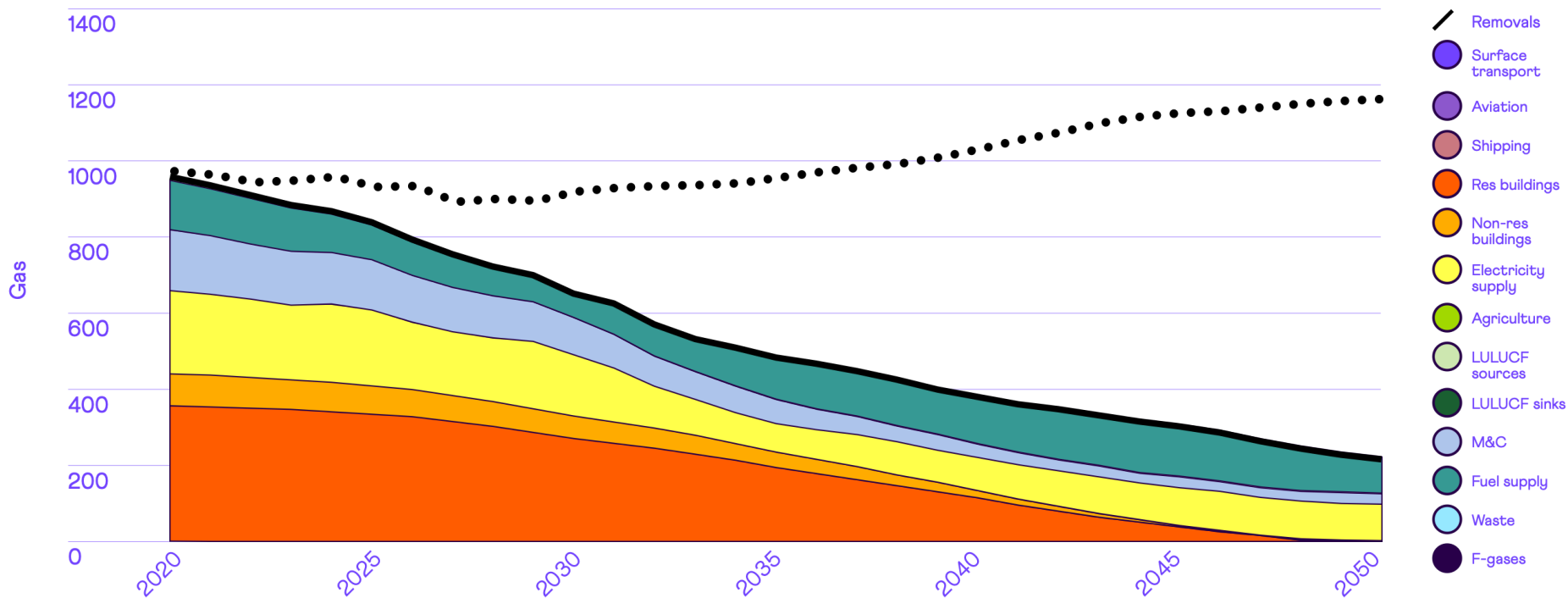
Source:
CCC Analysis



Changes in energy demand

Natural gas (TWh)

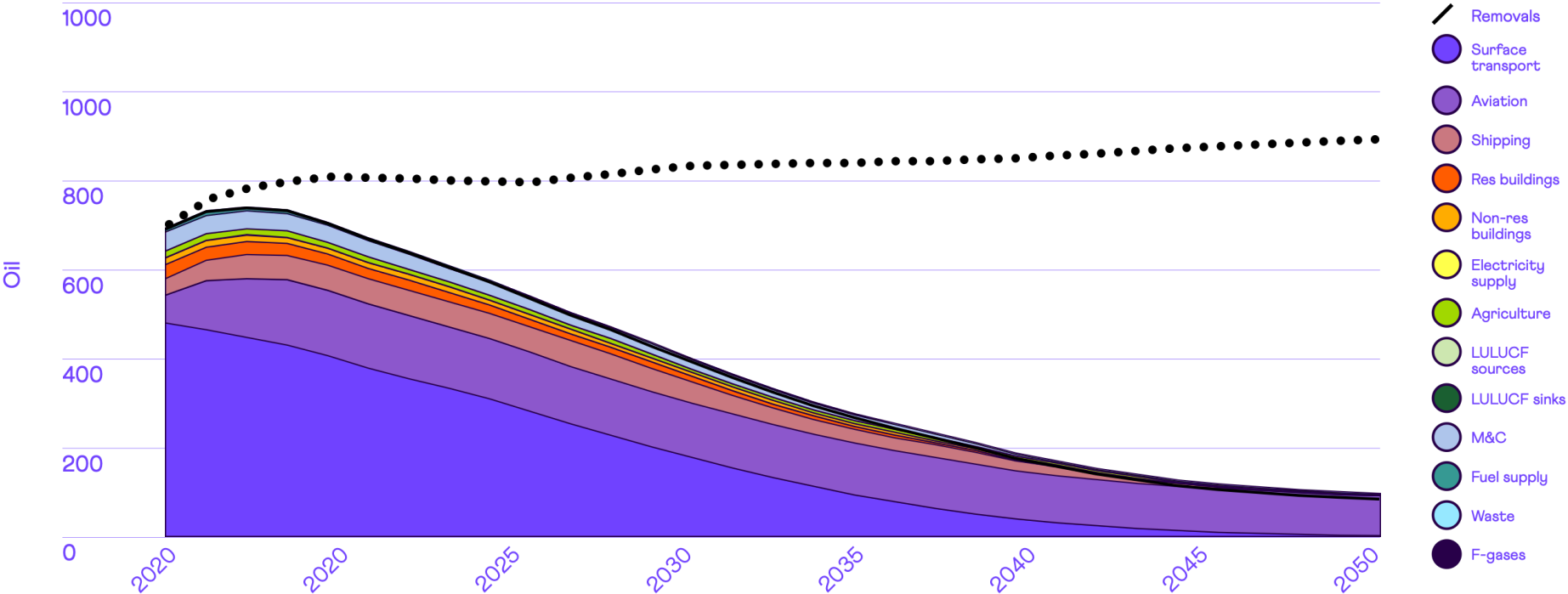
Source:
CCC Analysis



Changes in energy demand

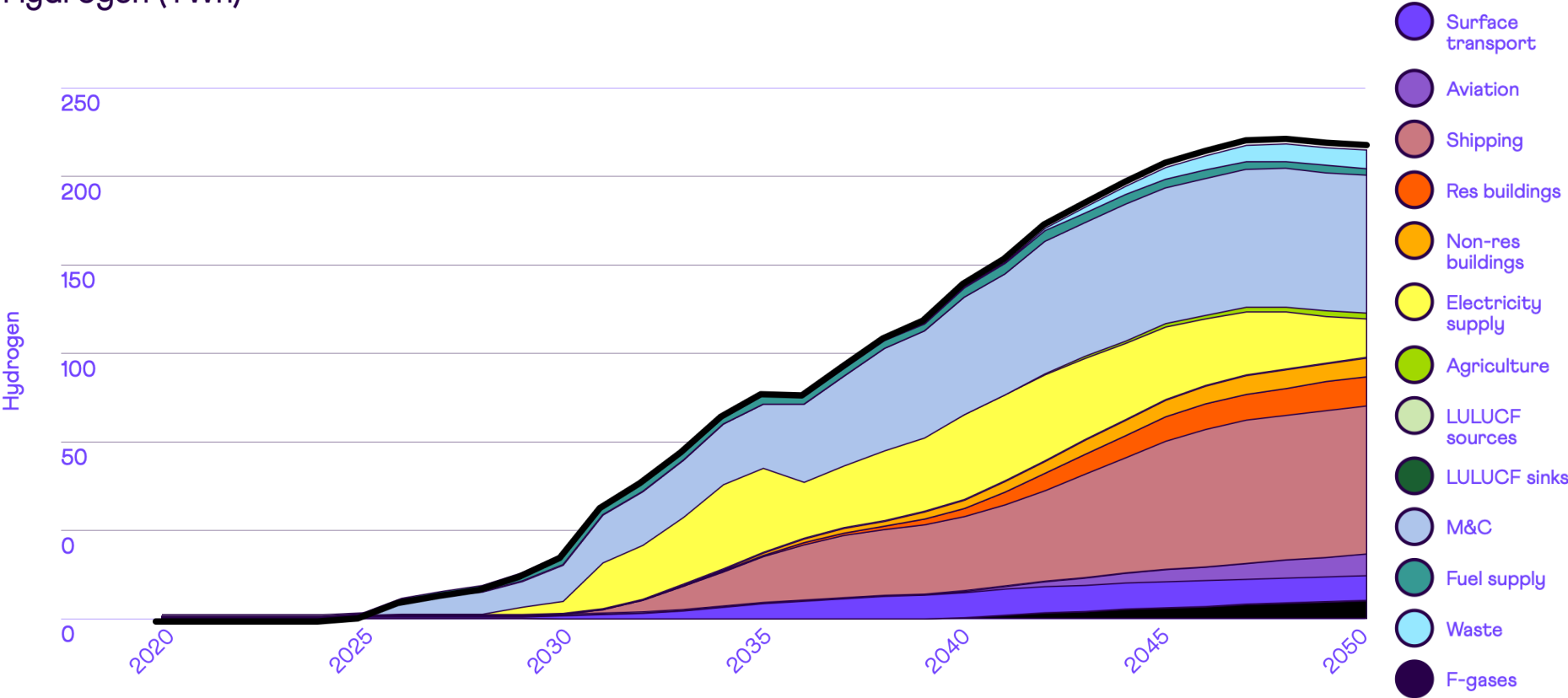
Oil (TWh)

Source:
CCC Analysis



Changes in energy demand

Hydrogen (TWh)



Our energy use today:*

2000TWh: 300TWh electricity + 1700TWh oil+gas
15% electric

Our energy use in 2050:

1000TWh: 700TWh electricity + 300TWh oil+gas
70% electric

including 200TWh hydrogen from electricity and gas

The scale of the challenge

Delivering Net Zero

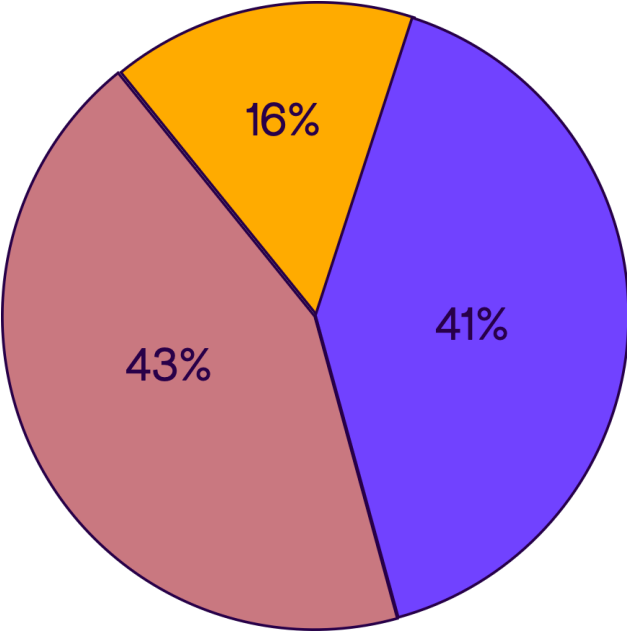
In the next 30 years...

- Electricity system more than doubles in size
- Offshore wind 10 GW to around 100GW
- Transformation of the grid: scale, flexibility, storage, resilience
- Hydrogen production 27TWh to over 220TWh
- Carbon Capture and Storage CCS 0 to 180 Mt CO₂
- 29 million existing buildings installed with low carbon heat
- Zero carbon cars 100,000 to 35 million
- 25,000 to over 500,000 public charging points
- Afforestation 10,000 to up to 50,000 hectares pa
- Woodland and forest 14 to 18% of UK area
- Major changes in agriculture
- Major changes to diet: beef, lamb and dairy consumption down 20-50%

It's getting tougher

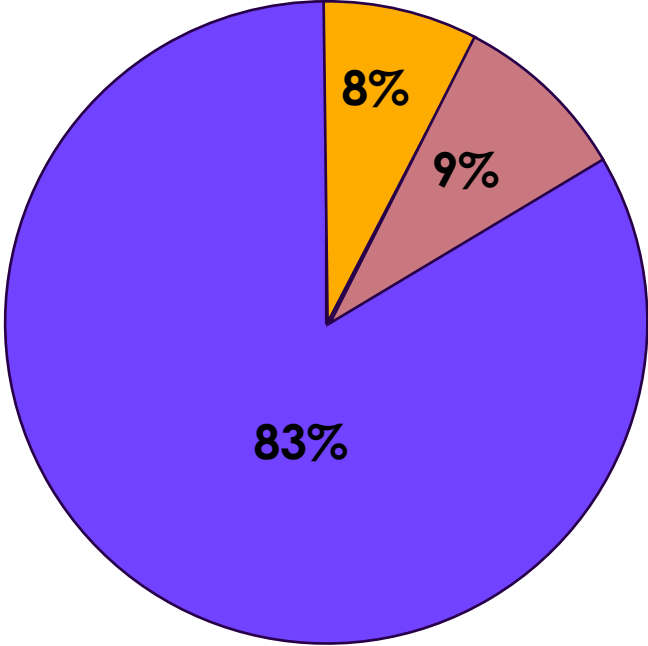
Behavioural change: more engagement needed

2020 to 2050



- Low-carbon technologies or fuels, not societal/behavioural changes
- Measures with a combination of low-carbon technologies and societal/behaviour changes
- Largely societal or behaviour changes

2008 to 2019*

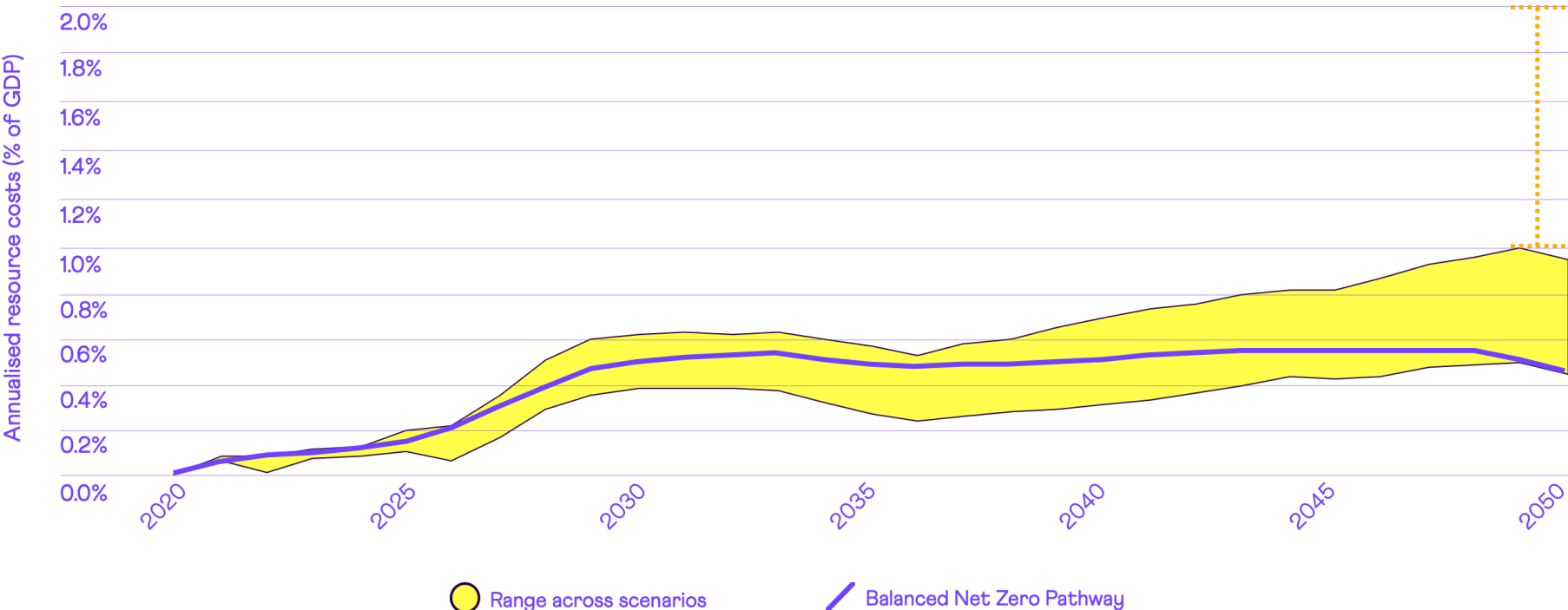


Source: CCC Analysis

* Author's estimates

It's getting cheaper

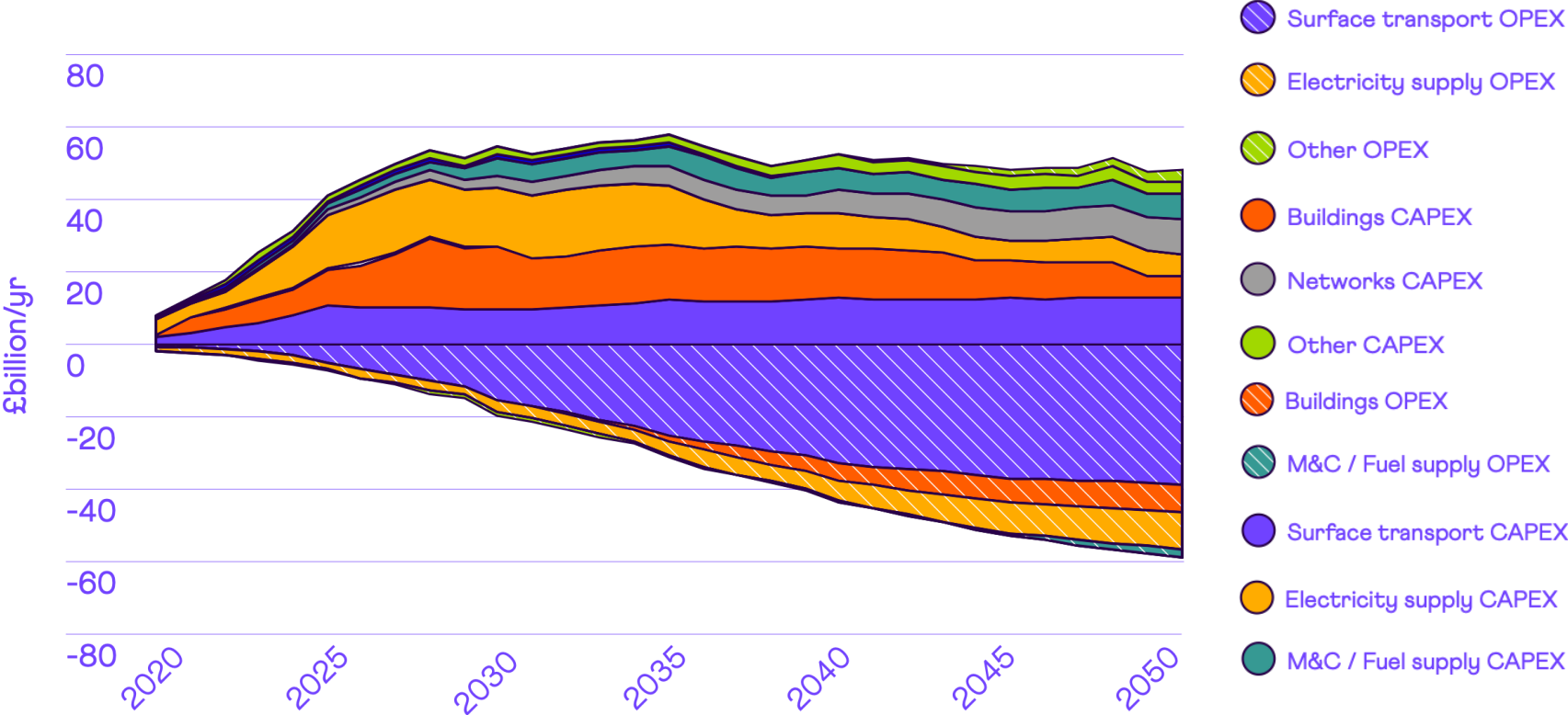
Modelling suggests potential additional GDP growth of 2%



Source: CCC analysis.

Investing for Net Zero

Capital investment and offsetting operating cost savings




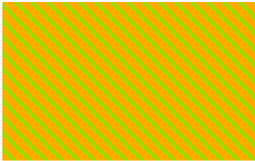
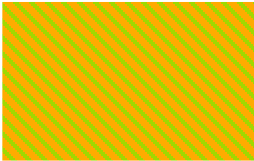
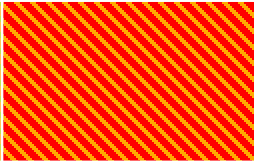

The Government's Net Zero Strategy

Will it deliver?

- World-leading Net Zero Strategy
- Sets out scenarios to reach Net Zero by 2050 and 78% reduction by 2035
- Ambitious and comprehensive
- No recourse to international carbon credits
- Close alignment to CCC pathway:
 - Electricity decarbonised by 2035
 - Transport decarbonisation
 - Hydrogen
 - Tree planting
 - GHG removals
 - Waste
 - ...
- Technology preferred over demand reduction: meat, aviation
- Enabling people: principles but not Government action

The Government's Net Zero Strategy

The best parts and the least clear

Surface transport	Buildings	Industry	Agriculture and land use	Power generation
23%	17%	15%	12%	11%
				

Three final thoughts...

Net Zero is not enough!

Tesla charging station in Sindlesham December 2019



Solutions must address inequality and fairness

Contributed least; least able to pay; most affected; least resilient



Greta Thunberg

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

