

# BIEE Energy Seminar

The Sixth Carbon Budget: Defining a path to Net Zero

# Defining a path to Net Zero

## 1. Climate change

Where are we now?

## 2. What can we do about this?

Requirements of the Paris Agreement

## 3. Our approach

The CCC approach to Carbon Budgets

## 4. The recommended path for the UK

A path for UK emissions to 2050

## 5. What changes will we see on the balanced pathway?

A walk through the changes ahead for the UK

## 6. Costs and benefits of Net Zero

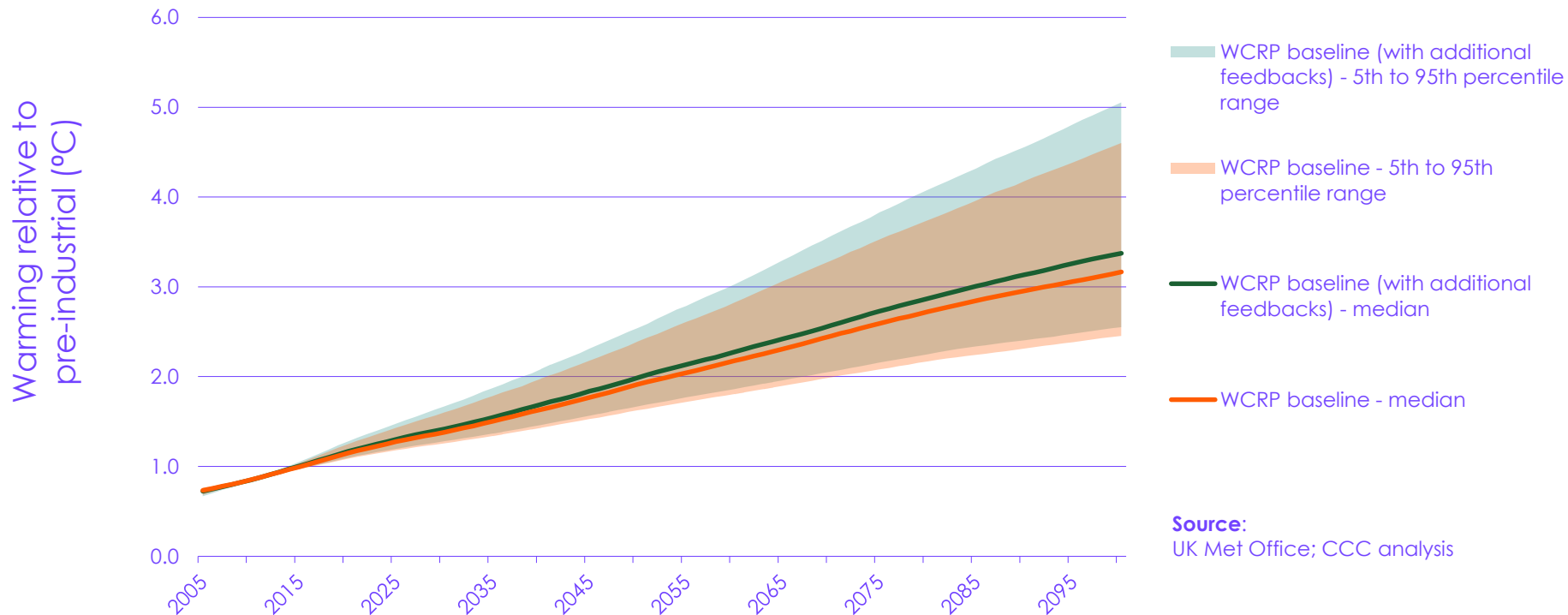
Investing for Net Zero

## 7. A fair and ambitious contribution to the Paris Agreement

The UK's offer to COP26 – Glasgow 2021

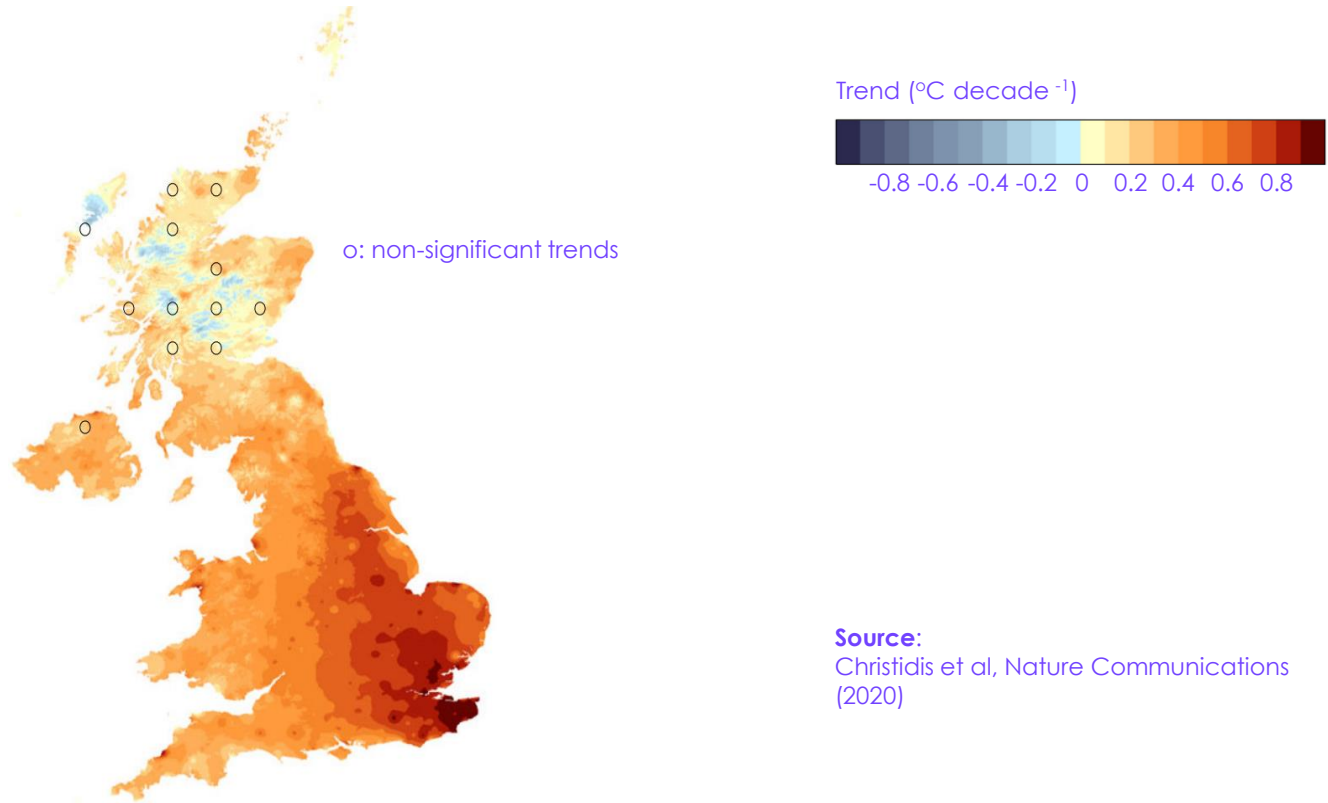
## Climate change

### Global temperature projections for current global ambition for 2030 emissions reductions



## Climate change

### Warmest daytime temperatures in the UK (1960 to 2019)



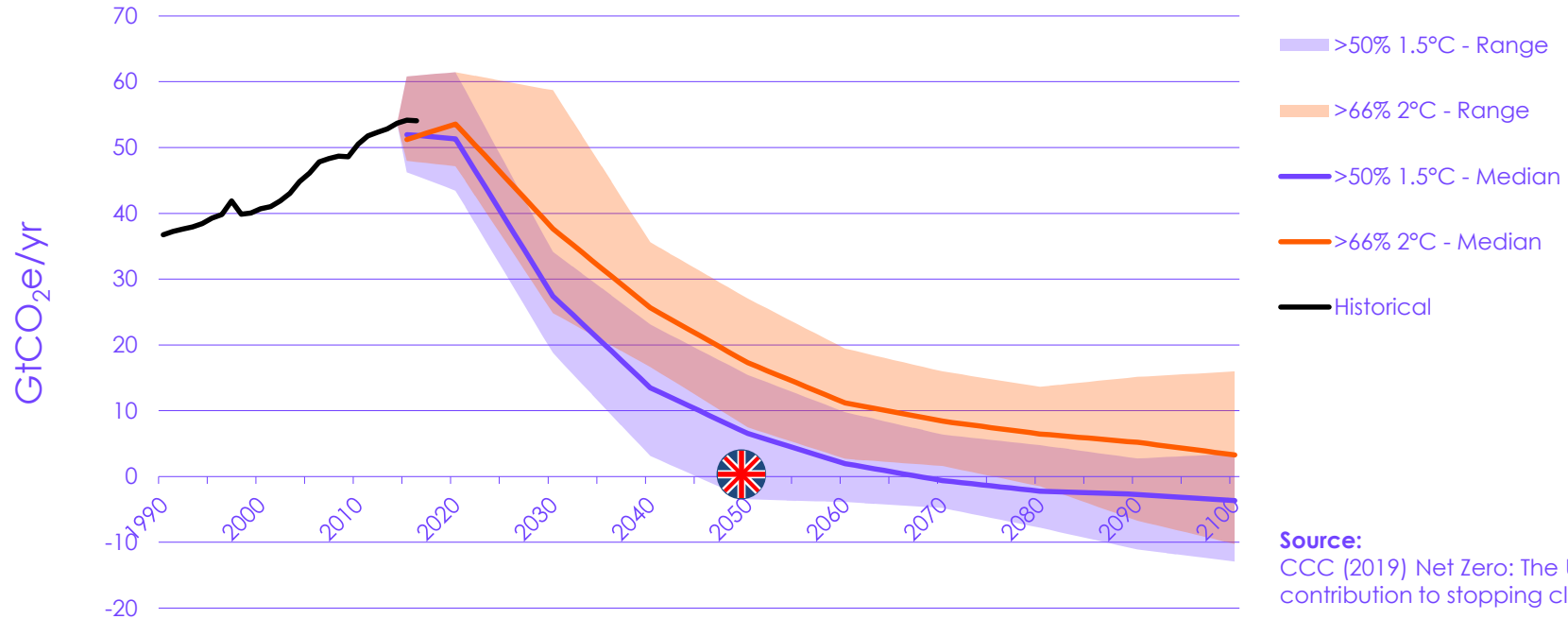
**Source:**

Christidis et al, Nature Communications  
(2020)

# What can we do about this?

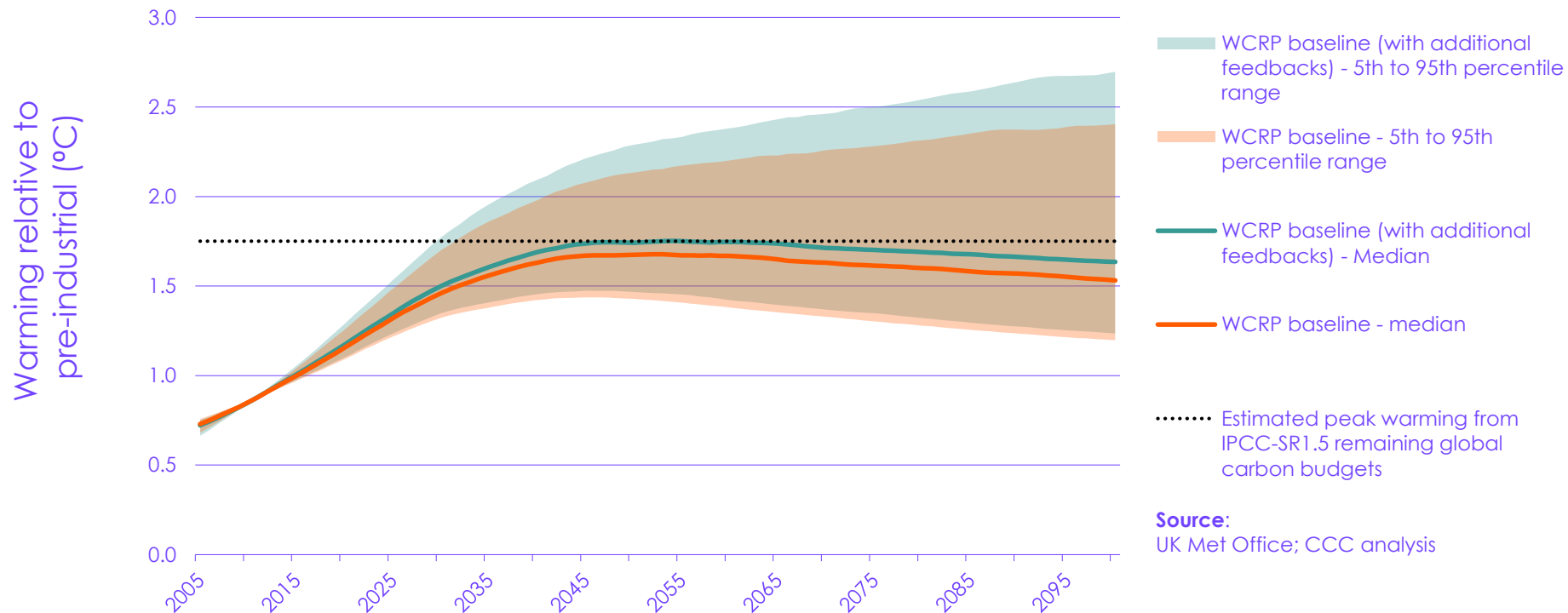
## What do we do about this?

Global emissions (all GHGs) pathways consistent with the Paris Agreement



## Rapid global decarbonisation scenarios

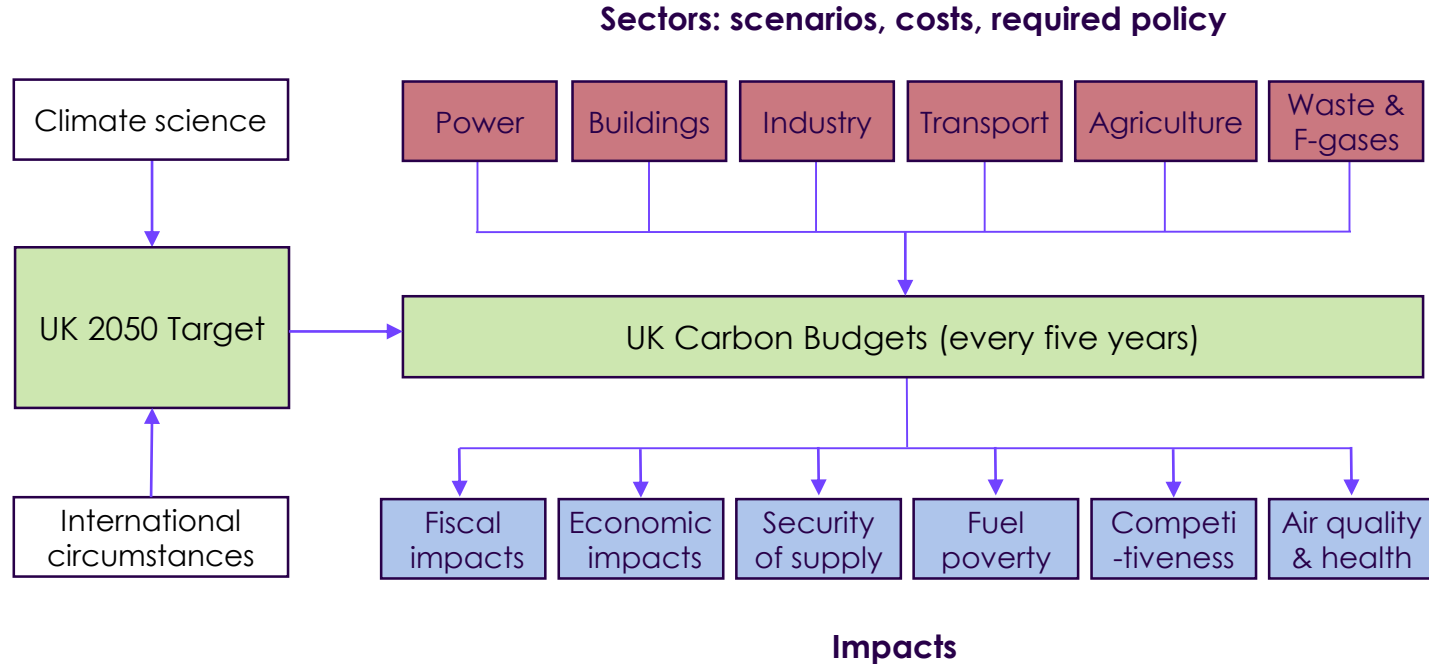
Global temperature projections, including additional Earth system feedbacks



# Our approach



### Carbon budgeting under the Climate Change Act



## Our approach

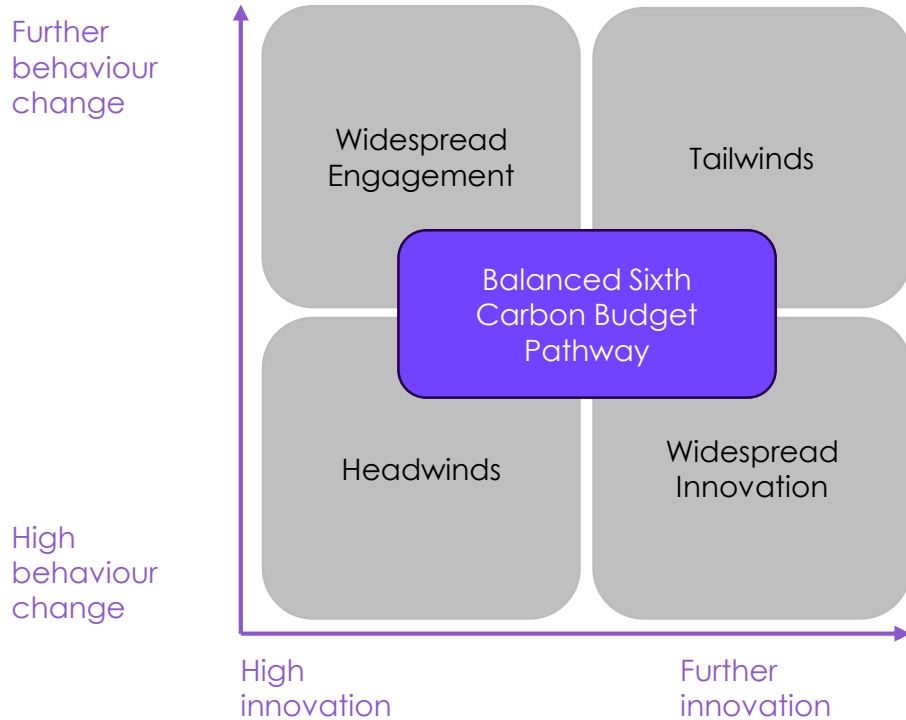
### A real-world constraint: asset lives

Sector	Asset	Lifetime
Transport	Light Vehicle HGV	14 years (average) 8 – 13 years
Manufacturing and Construction	Combustion (Boilers, furnaces, mobile machinery, generators, kilns, compressors, dryers, heaters, ovens, Other process assets.	10-35 years
Buildings	Fossil fuel boiler Air Source Heat Pump Ground Source Heat Pump Loft and cavity insulation Solid wall insulation New build home	15 years 15 years 20 years 42 years 36 years 60 years
Power generation	Gas plant Offshore wind Nuclear plant	25 years 30 years 60 years
Aviation	Aircraft	30 year technical
Shipping	Ships	30 years technical

Sector	Asset	Lifetime
Fuel Supply	Offshore platforms, flaring, compressors, generators Biofuel plants BioH2 plants Biogas, biomethane plants Waste to jet plants	25-35 years 30 years technical 30 years technical 20 years technical 20 years technical
Wastes/Bio	Refuse collection vehicles Landfill methane capture and biocovers Waste water treatment equipment Composting equipment	8 years technical 20 years technical 25 years technical 20 years technical
Removals	DACCS Biomethane displacing natural gas  Wood in construction BECCS	25 years technical 20 years technical Set by buildings sector Set by asset lifetimes in each sector

## Our approach

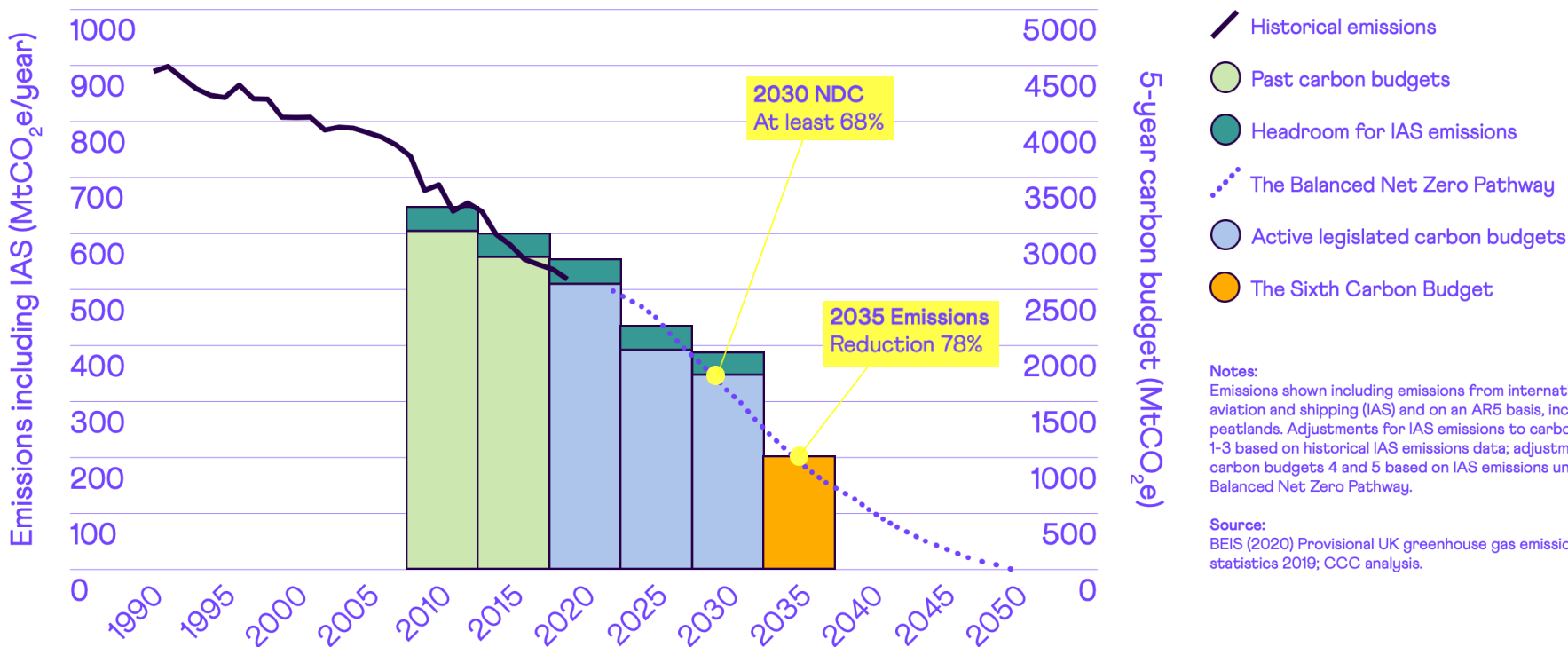
A balanced pathway to keep options open



# The recommended path for the UK

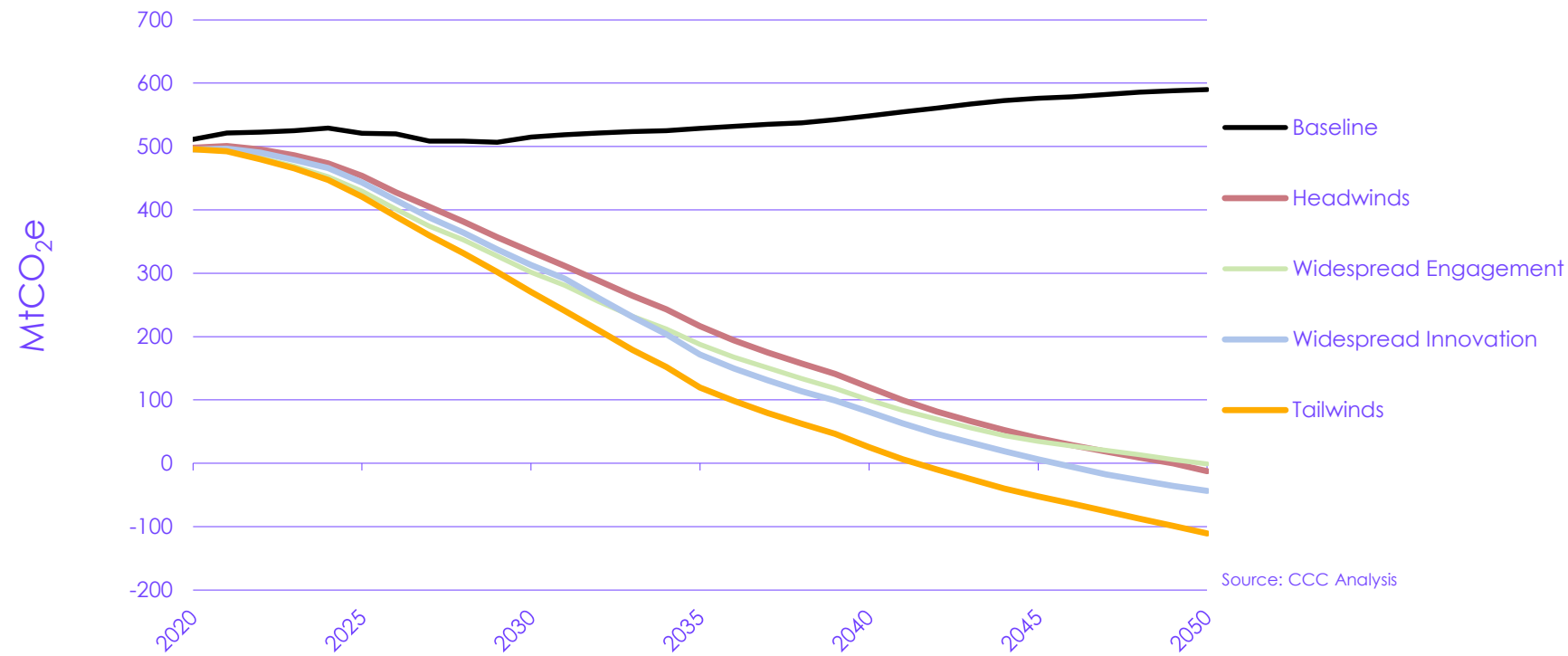
## Our recommended path

The recommended sixth carbon budget and 2030 NDC



# Our recommended path

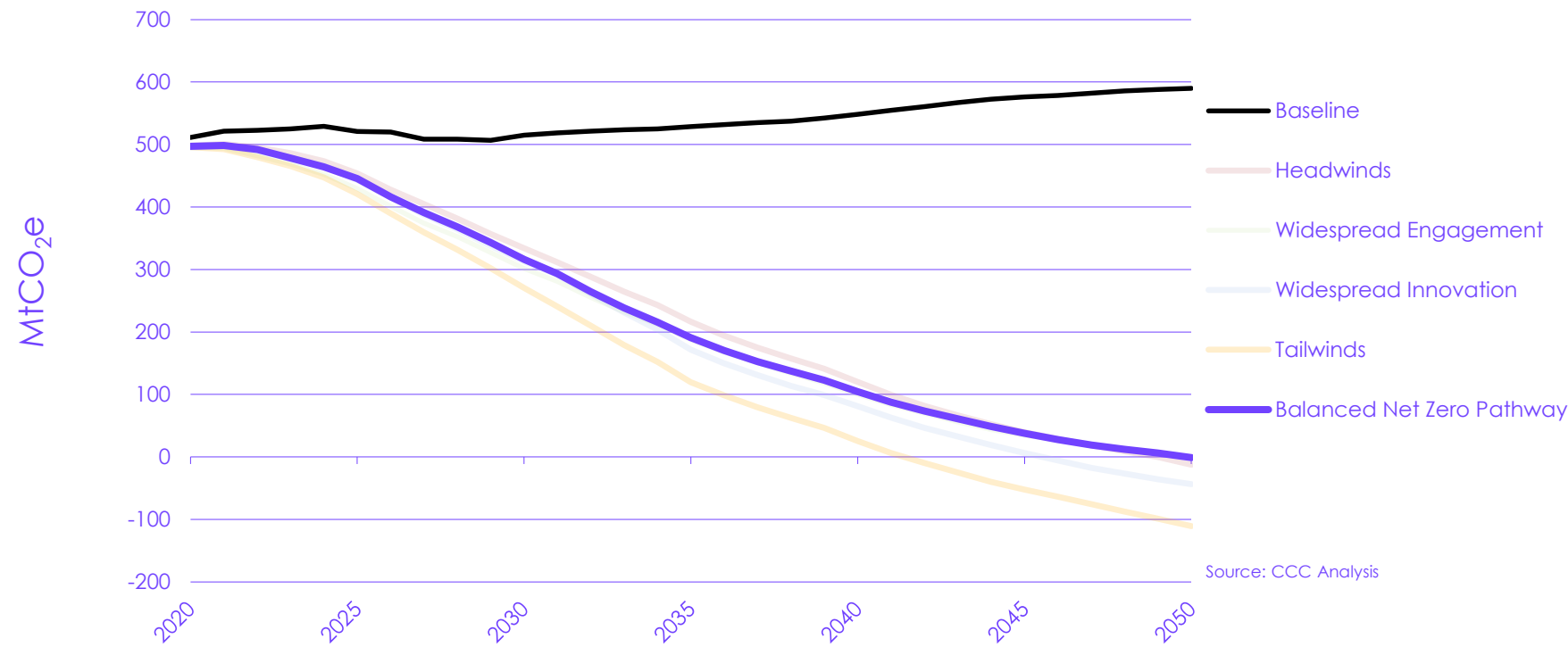
## Illustrative scenarios for Net Zero



Source: CCC Analysis

# Our recommended path

## Illustrative scenarios for Net Zero



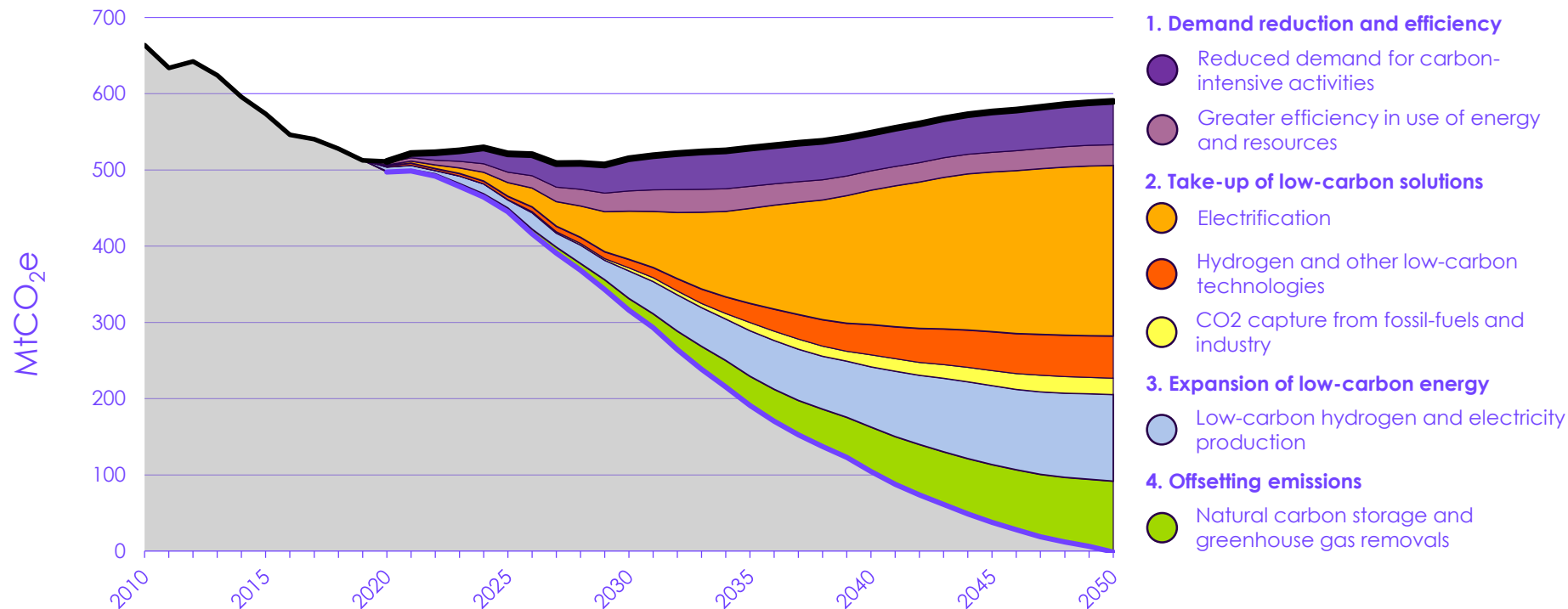
Source: CCC Analysis

# Delivering Net Zero UK



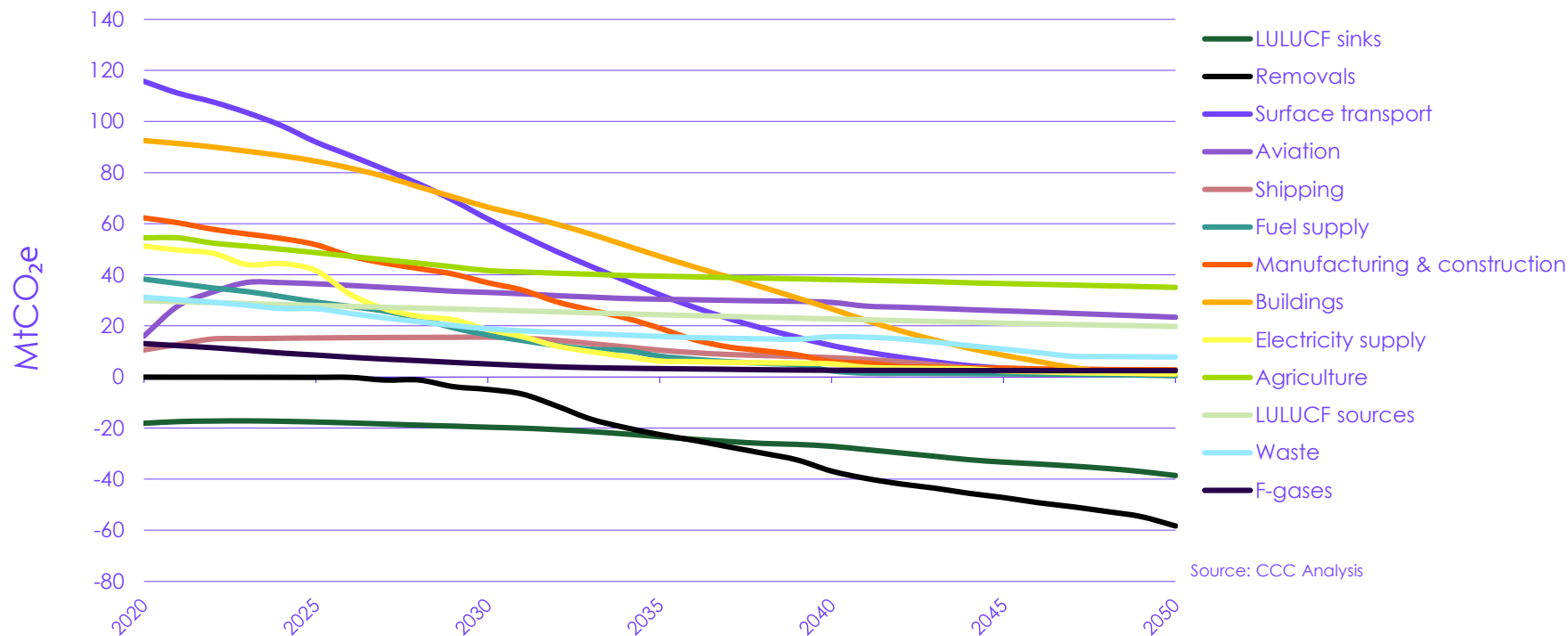
# Emissions abatement on the balanced path

Meeting Net Zero requires actions across four key areas



# Emissions abatement on the balanced path

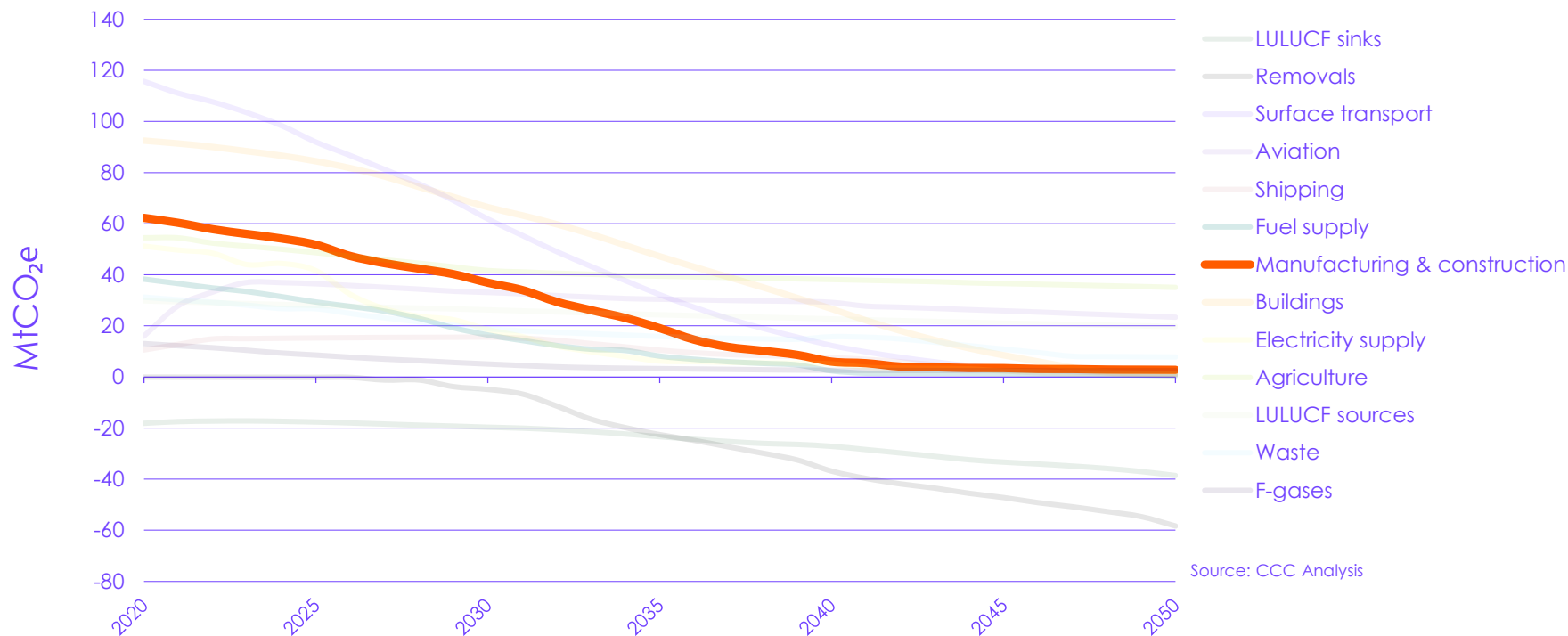
## Sectoral contribution to meeting Net Zero



Source: CCC Analysis

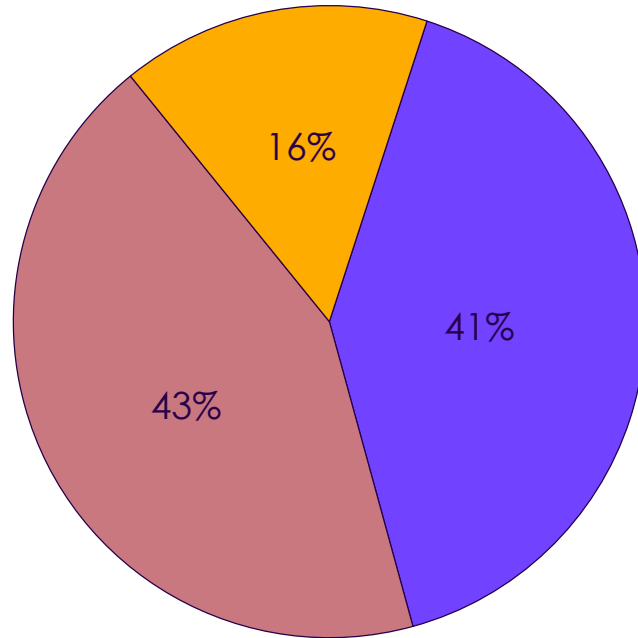
# Emissions abatement on the balanced path

## Industry emissions – no longer ‘hard to treat’



## Emissions abatement on the balanced path

Role of behavioural and societal change in meeting the Sixth Carbon Budget (by 2035)



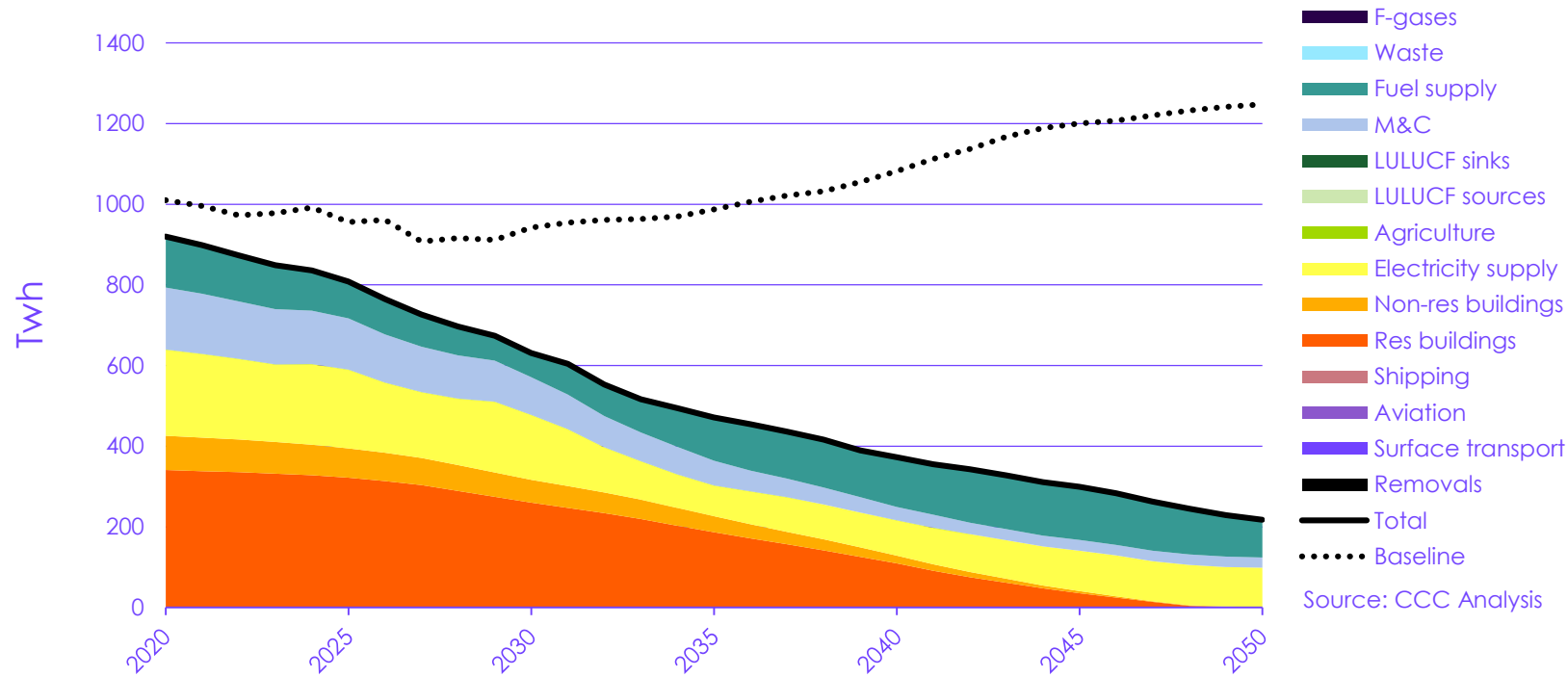
- Low-carbon technologies or fuels, not societal/behavioural changes
- Measures with a combination of low-carbon technologies and societal/behaviour changes
- Largely societal or behaviour changes

Source: CCC Analysis

# What changes will we see on the balanced pathway?

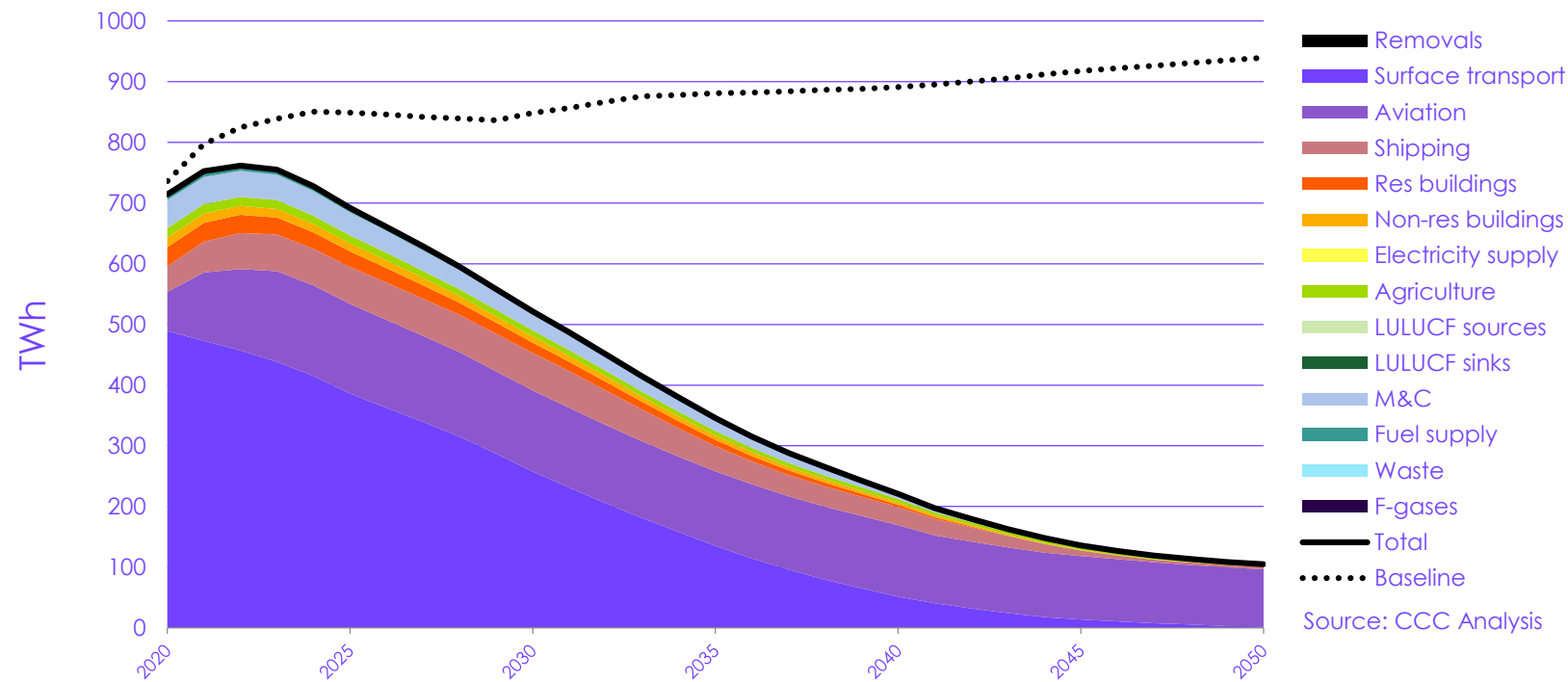
# Changes in high-carbon energy

## Natural gas demand (TWh)



# Changes in high-carbon energy

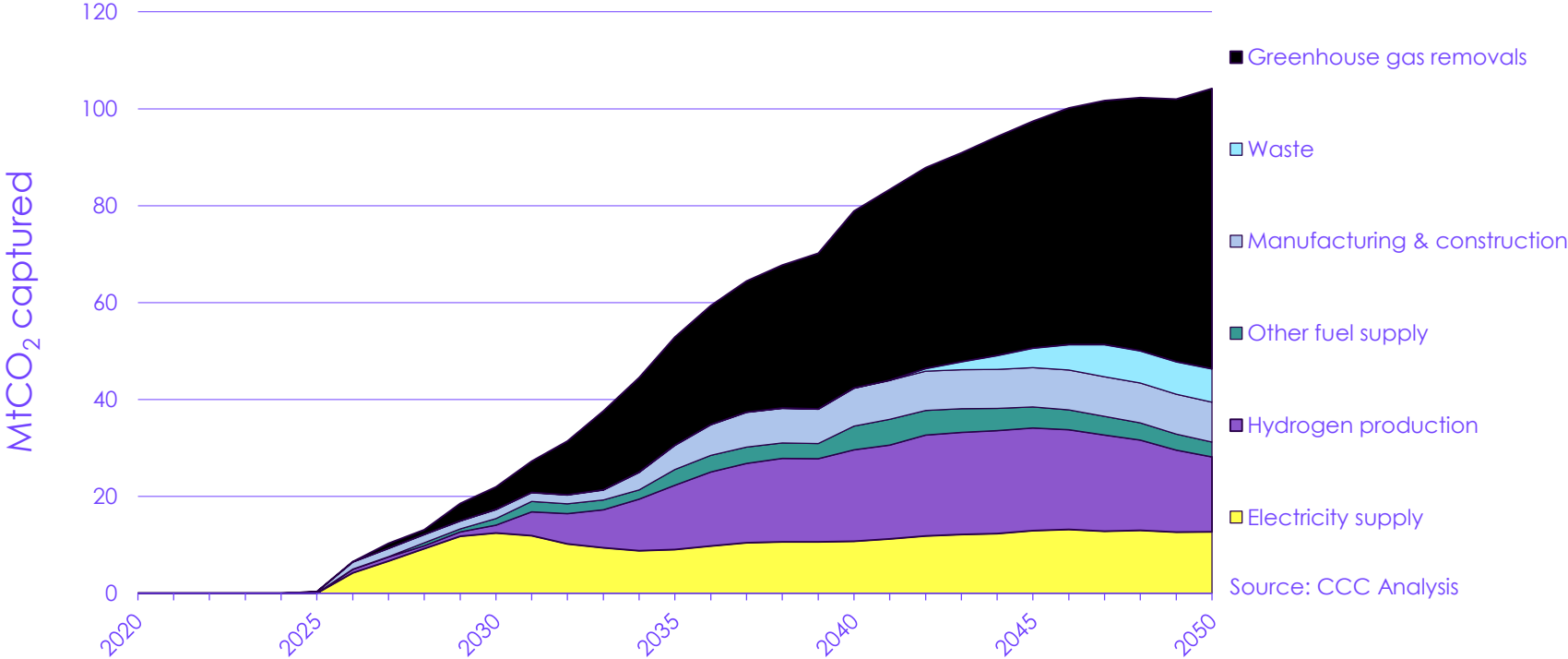
## Oil demand (TWh)



Source: CCC Analysis

# Changes in low-carbon energy

## Carbon capture (MtCO<sub>2</sub> captured)

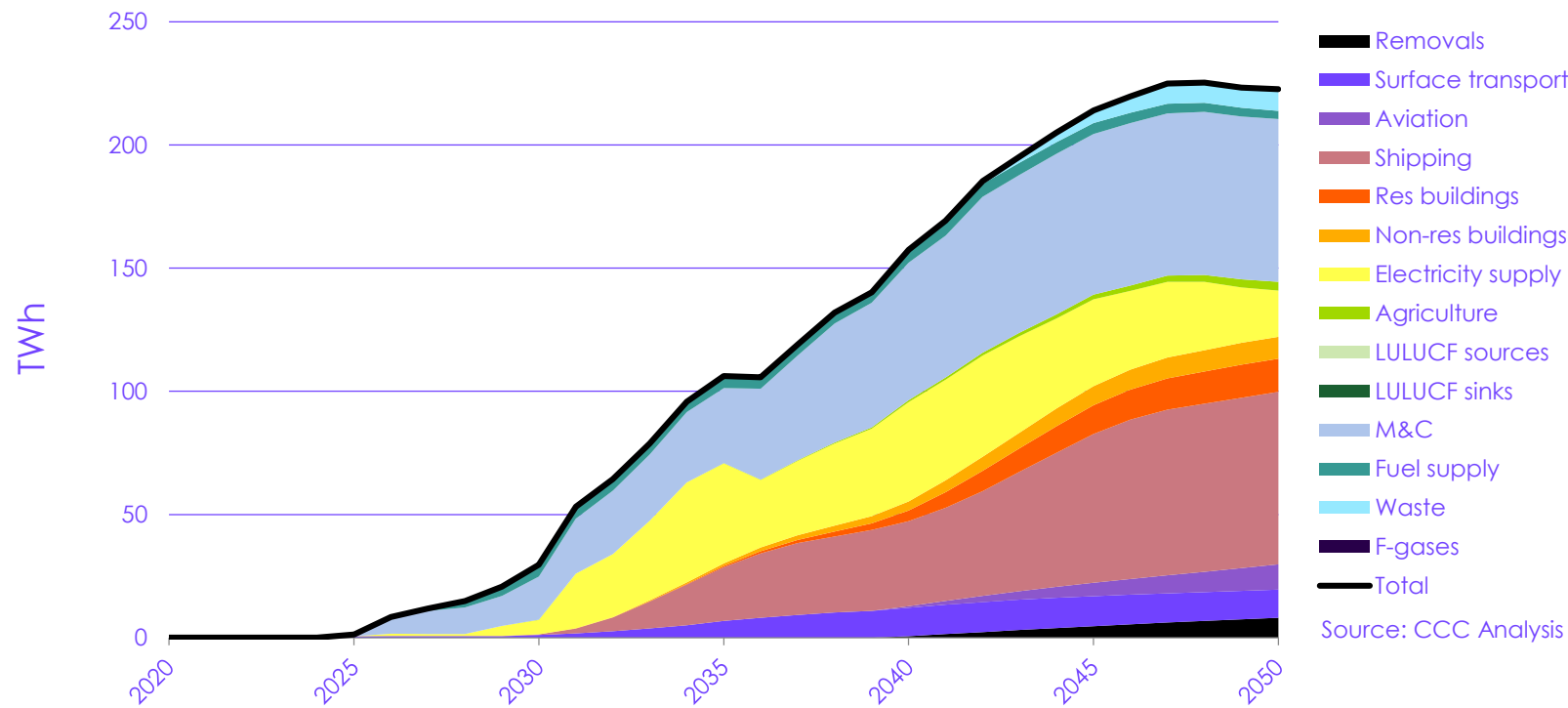


Source: CCC Analysis



# Changes in low-carbon energy

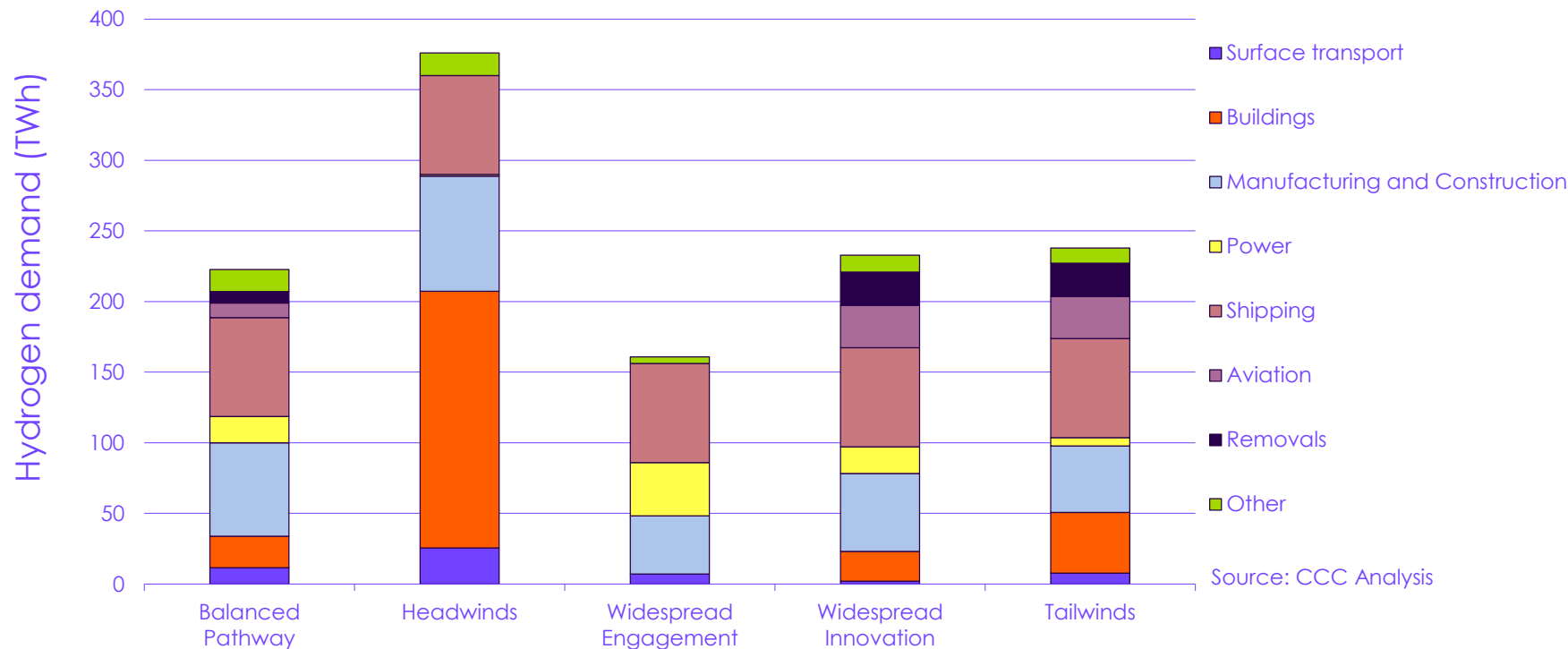
## Hydrogen demand (TWh)



Source: CCC Analysis

# Changes in low-carbon energy

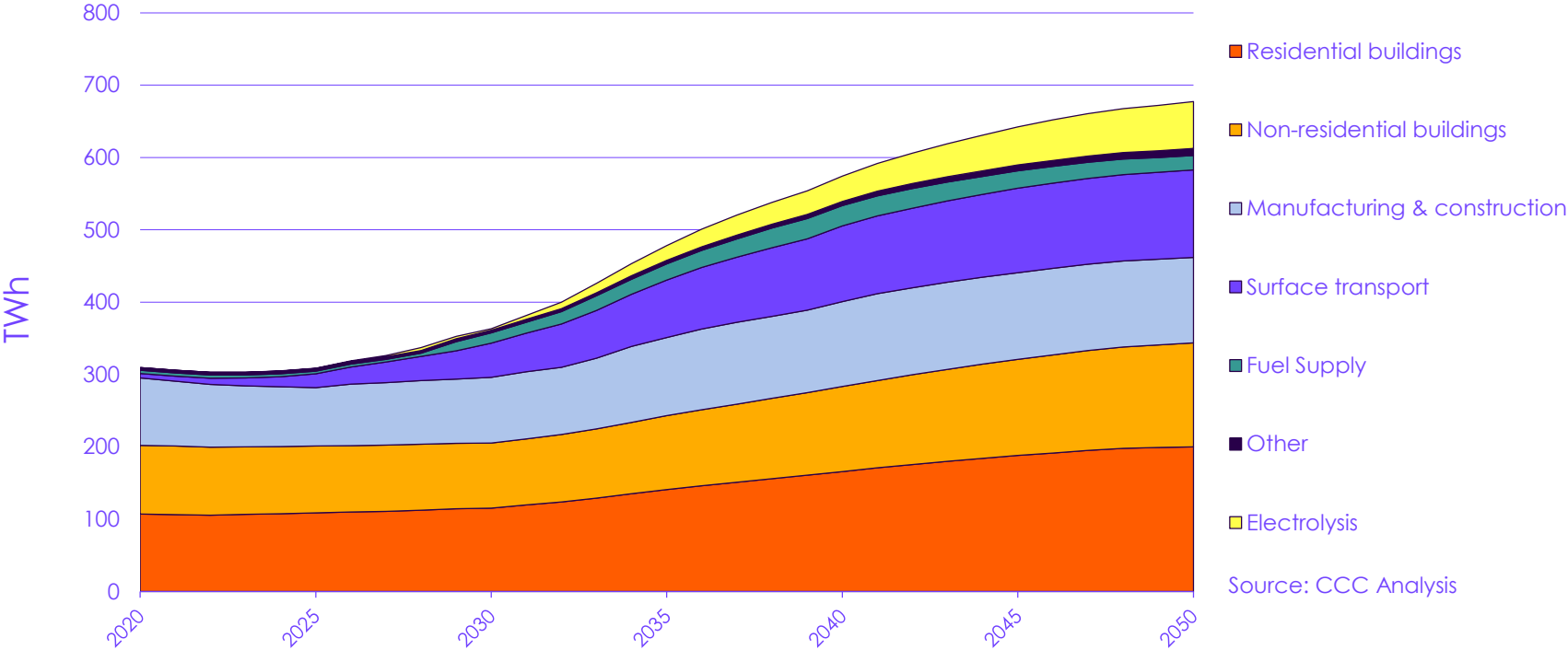
## Sectoral hydrogen demands in 2050



Source: CCC Analysis.

# Changes in low-carbon energy

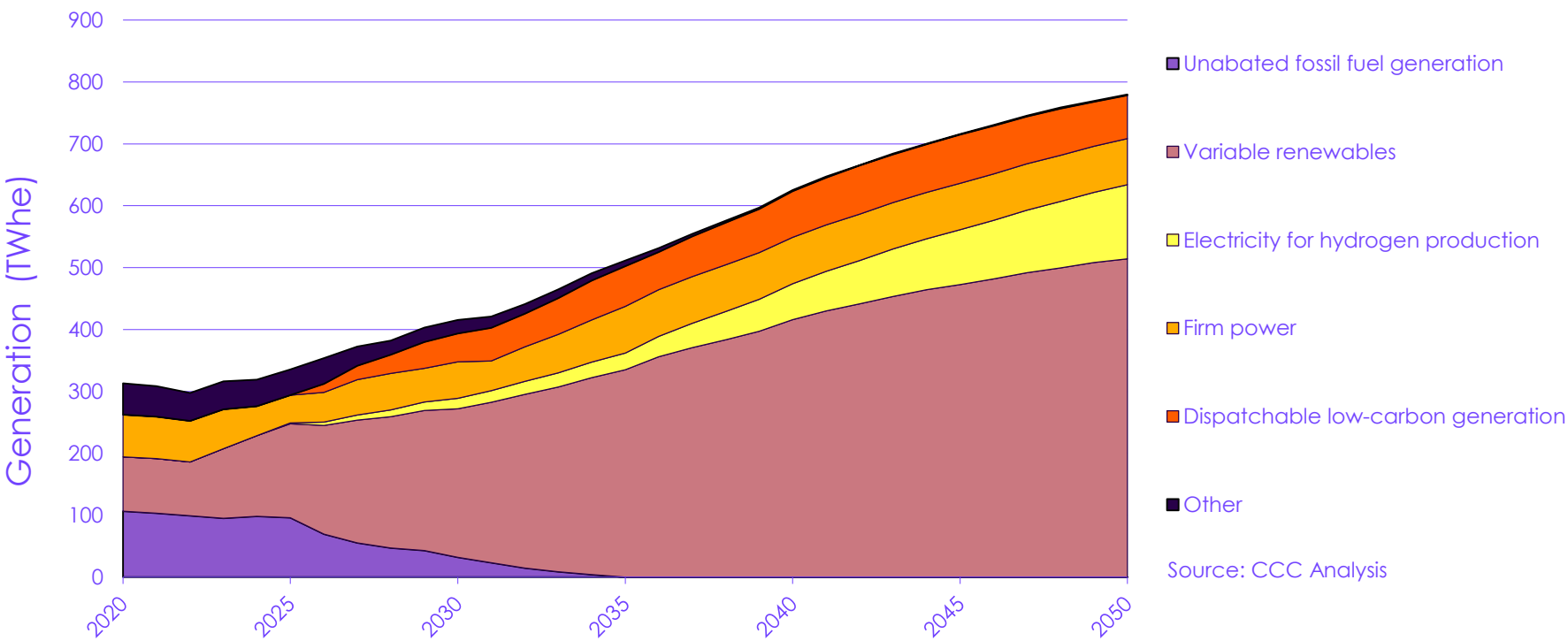
## Electricity demand (TWh)



Source: CCC Analysis

# Changes in low-carbon energy

## Electricity supply (TWh)



# What changes will we see on the Balanced Pathway

## 2019

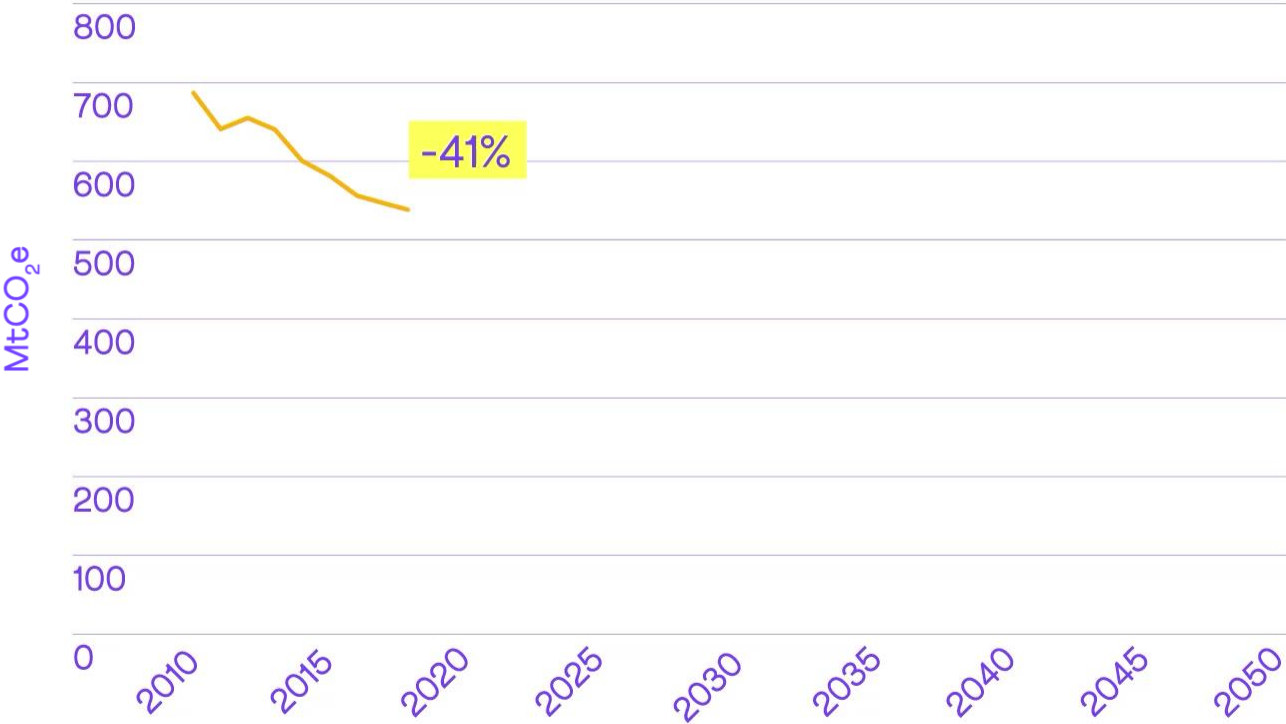


### Key developments

Meat consumption p/ person (% reduction)	Reduced Demand
Insulation fitted (millions)	
EV share of new sales (%)	Low-carbon Choices
Low-carbon share of boiler replacements	
CCS (MtCO <sub>2</sub> e)	Low-carbon energy
Electricity (TWh)	
Hydrogen (TWh)	
Afforestation (kha pa)	Land use
Perennial energy crops (kha pa)	
Peatland restored (%)	

# What changes will we see on the Balanced Pathway

## 2025

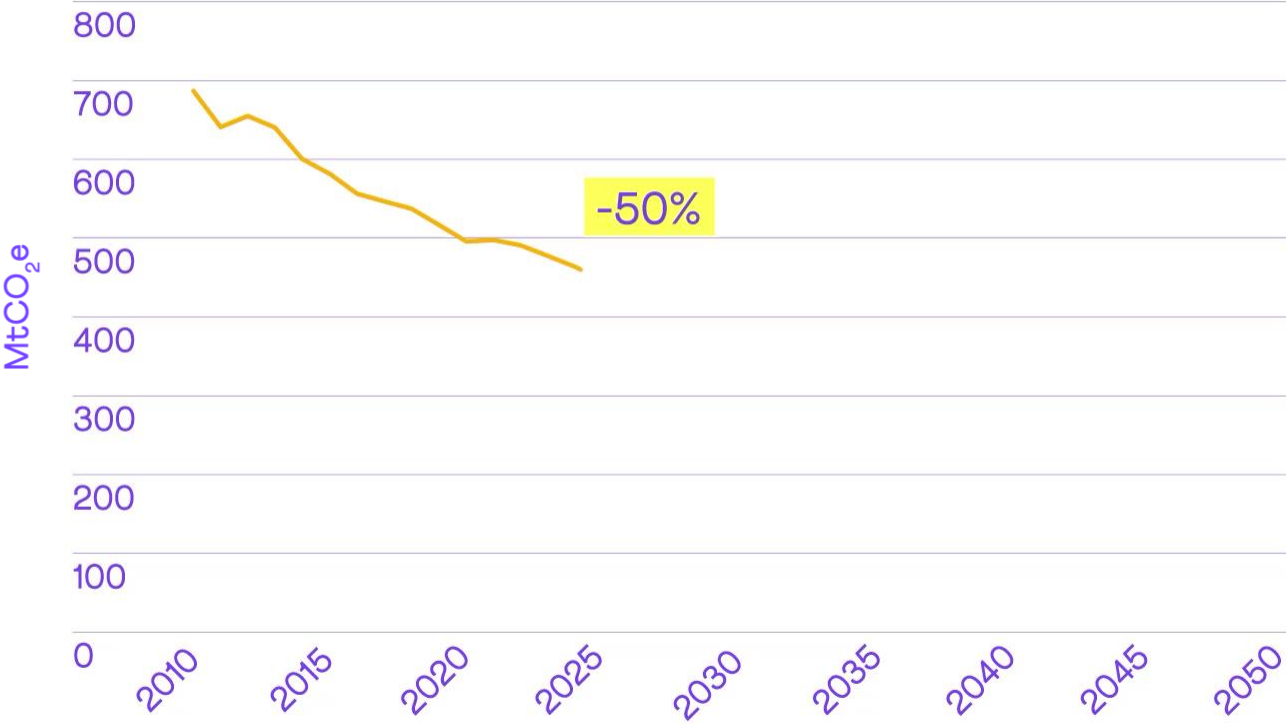


### Key developments

Meat consumption p/ person (% reduction)	0%	Reduced Demand
Insulation fitted (millions)	0	
EV share of new sales (%)	13%	Low-carbon Choices
Low-carbon share of boiler replacements	11%	
CCS (MtCO <sub>2</sub> e)	0	Low-carbon energy
Electricity (TWh)	205	
Hydrogen (TWh)	0	
Afforestation (kha pa)	19	Land use
Perennial energy crops (kha pa)	0	
Peatland restored (%)	25%	

# What changes will we see on the Balanced Pathway

## 2030

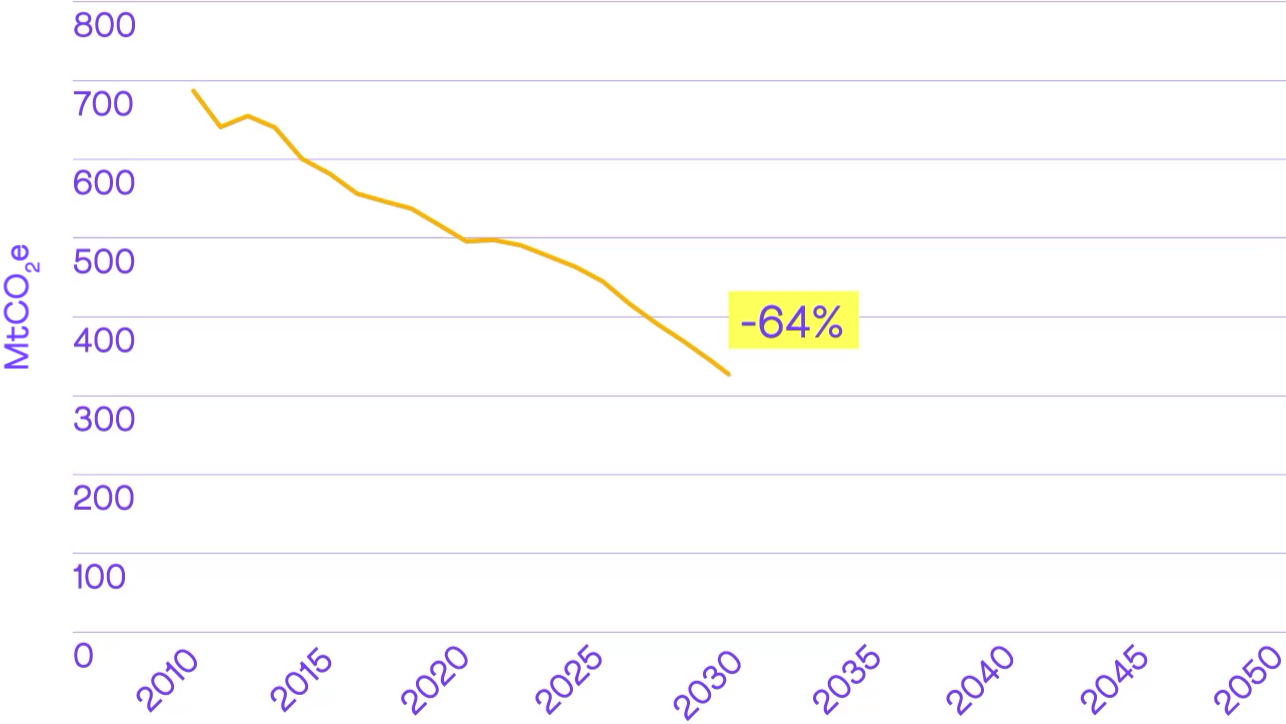


### Key developments

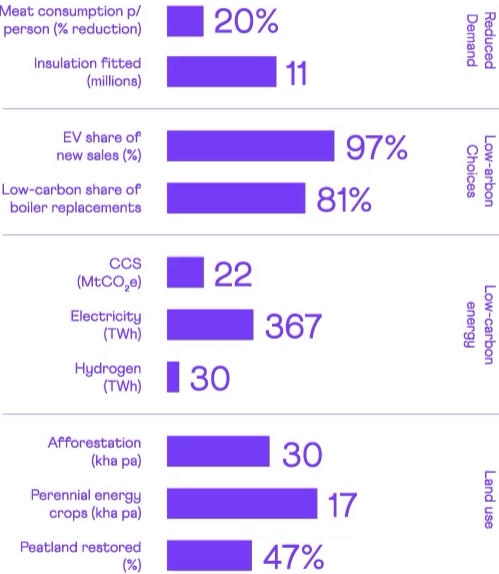
Meat consumption p/ person (% reduction)	9%	Reduced Demand
Insulation fitted (millions)	4	
EV share of new sales (%)	48%	Low-carbon Choices
Low-carbon share of boiler replacements	31%	
CCS (MtCO <sub>2</sub> e)	0	Low-carbon energy
Electricity (TWh)	238	
Hydrogen (TWh)	1	
Afforestation (kha pa)	30	Land use
Perennial energy crops (kha pa)	5	
Peatland restored (%)	36%	

# What changes will we see on the Balanced Pathway

## 2035

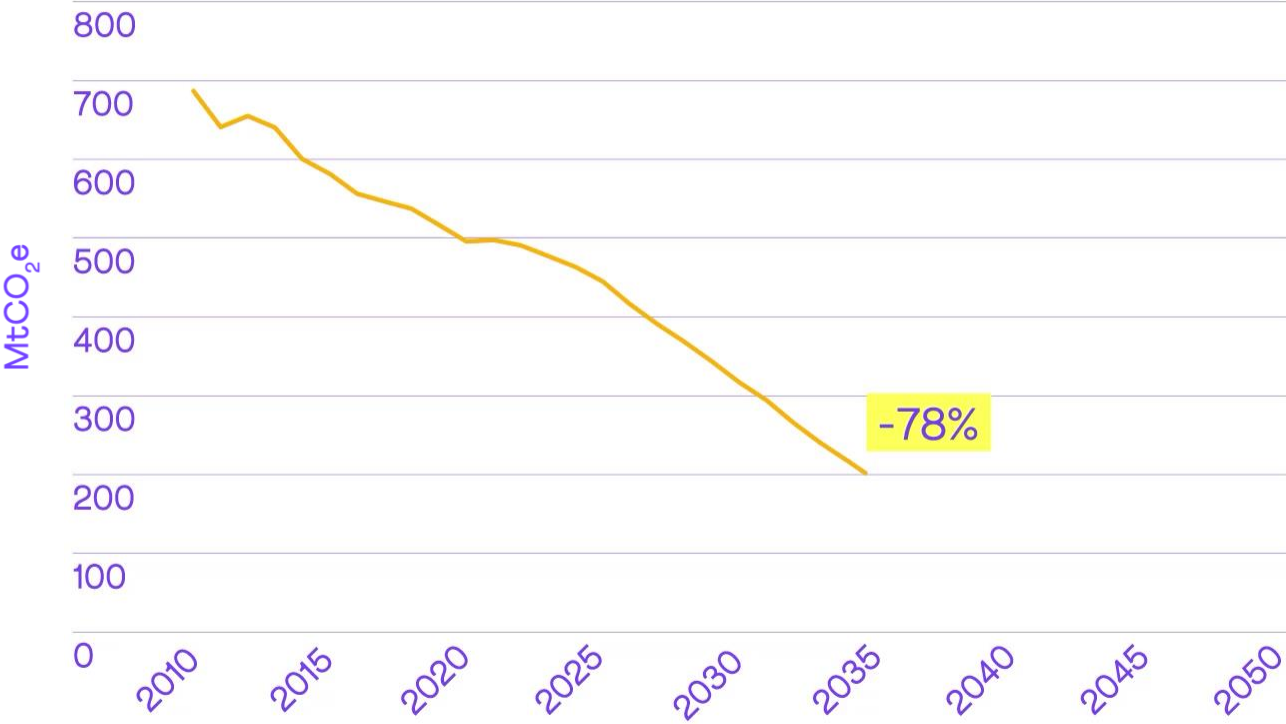


### Key developments





# What changes will we see on the Balanced Pathway 2050



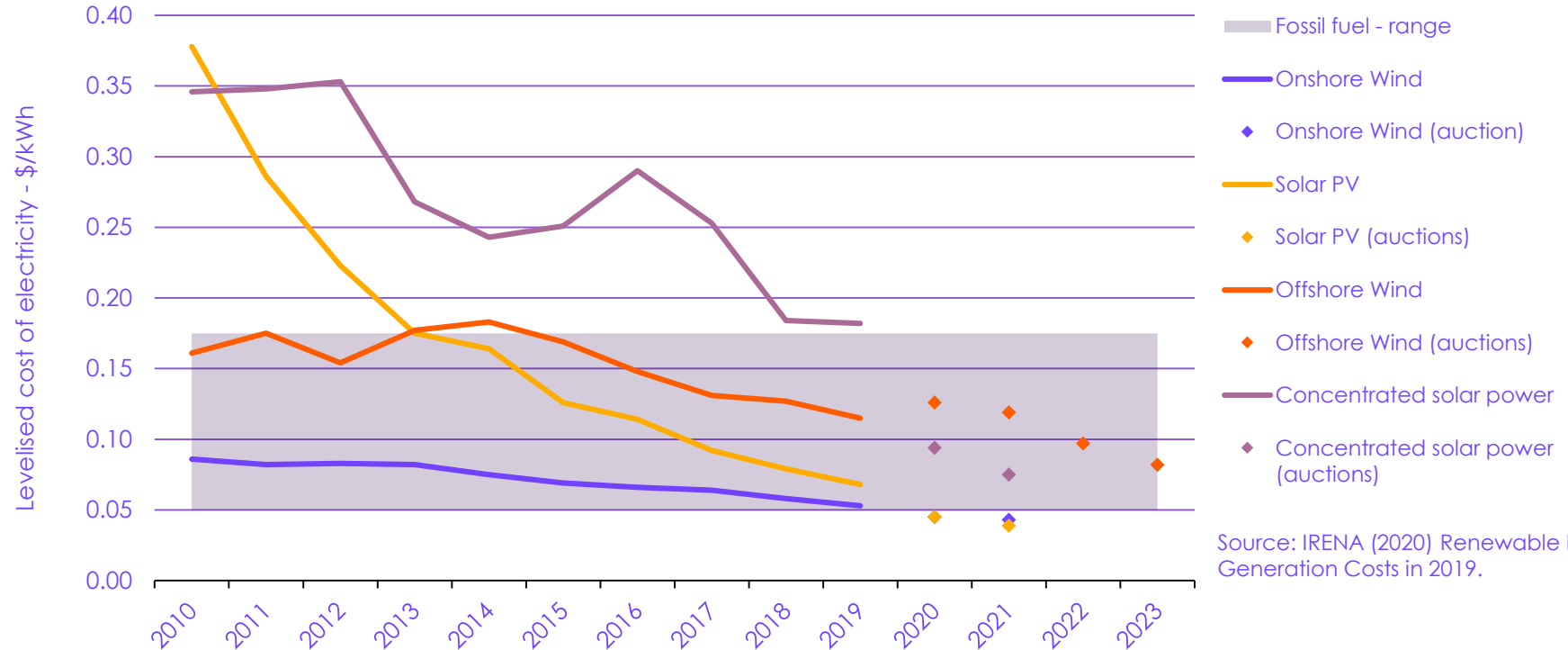
## Key developments



# Costs and benefits of Net Zero

# The impact of innovation

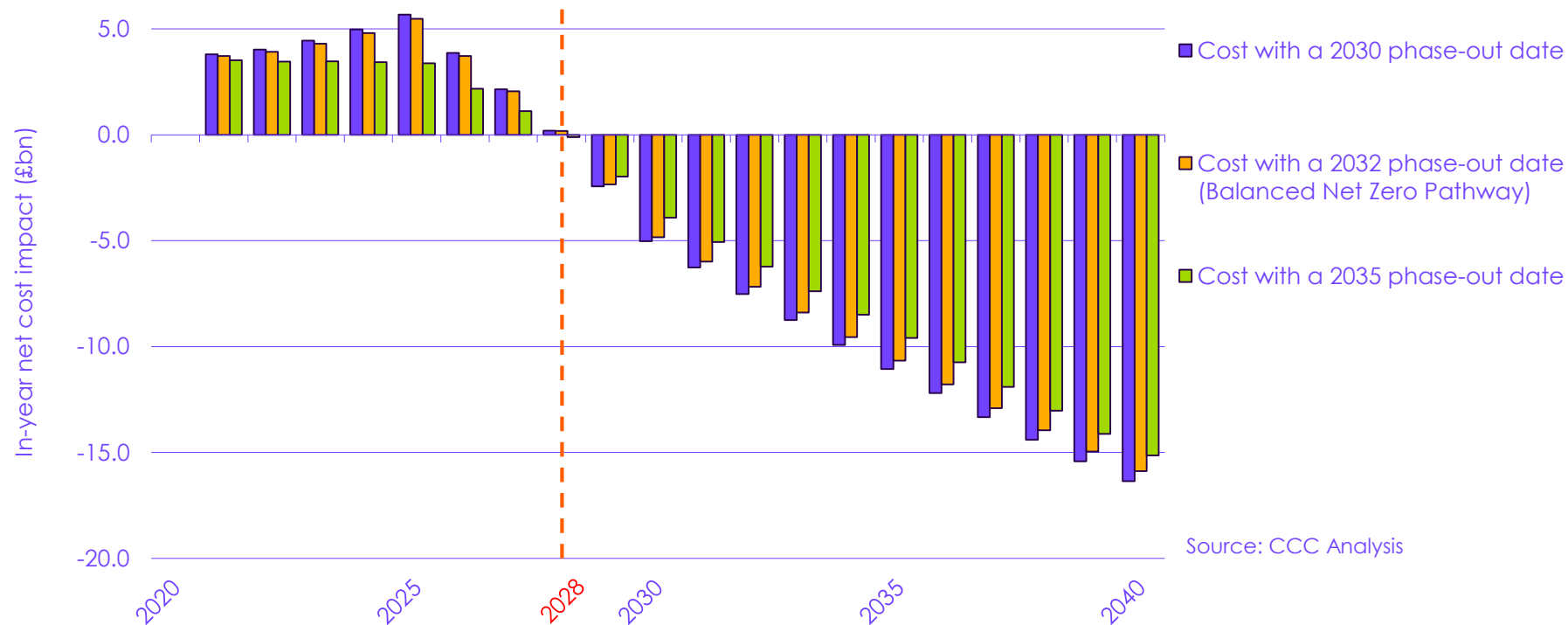
## Global average levelised cost of electricity (\$2019)



Source: IRENA (2020) Renewable Power Generation Costs in 2019.

## The impact of innovation

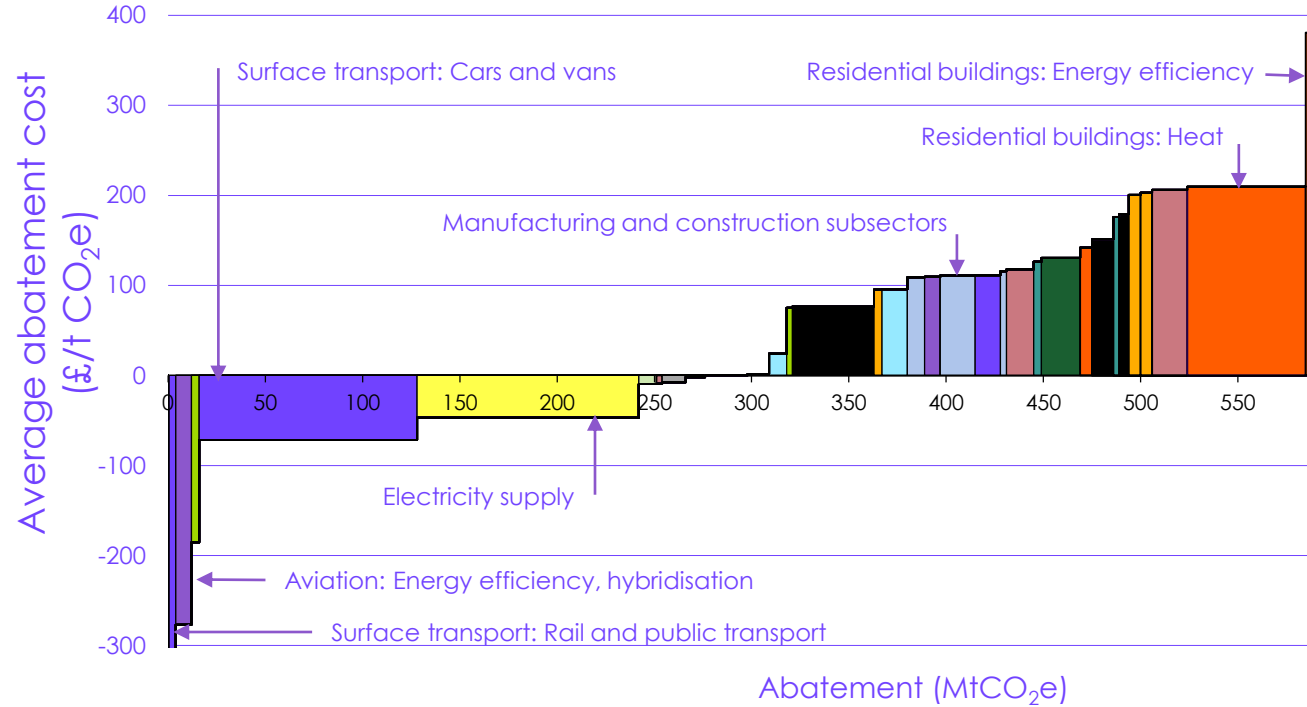
Net cost to the UK economy of the phase-out of fossil-fuelled cars and vans - 2030, 2032, 2035



Source: CCC Analysis

## Abatement cost

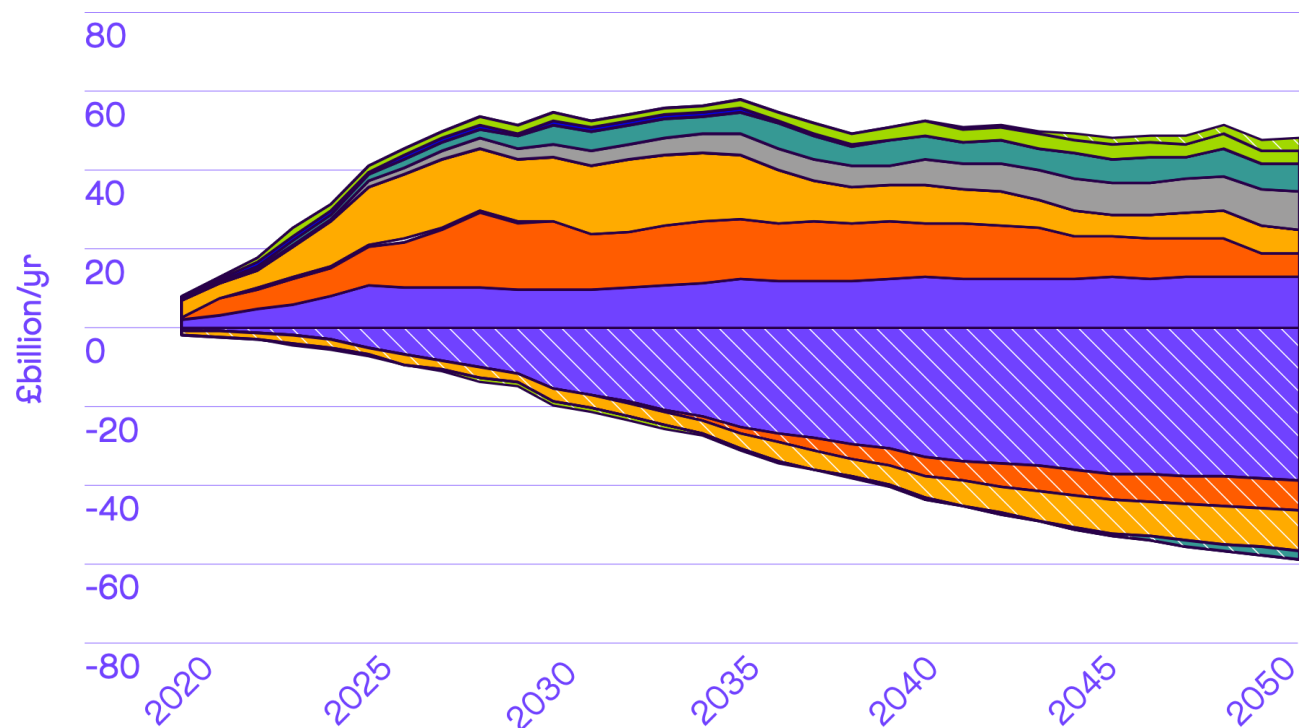
Average cost of abatement across major subsectors in 2050



Source: CCC Analysis

## Investing for Net Zero

Major investment programme, delivering offsetting operating cost savings



- Surface transport OPEX
- Buildings OPEX
- Electricity supply OPEX
- M&C / Fuel supply OPEX
- Other OPEX
- Surface transport CAPEX
- Buildings CAPEX
- Electricity supply CAPEX
- Networks CAPEX
- M&C / Fuel supply CAPEX
- Other CAPEX

### 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.

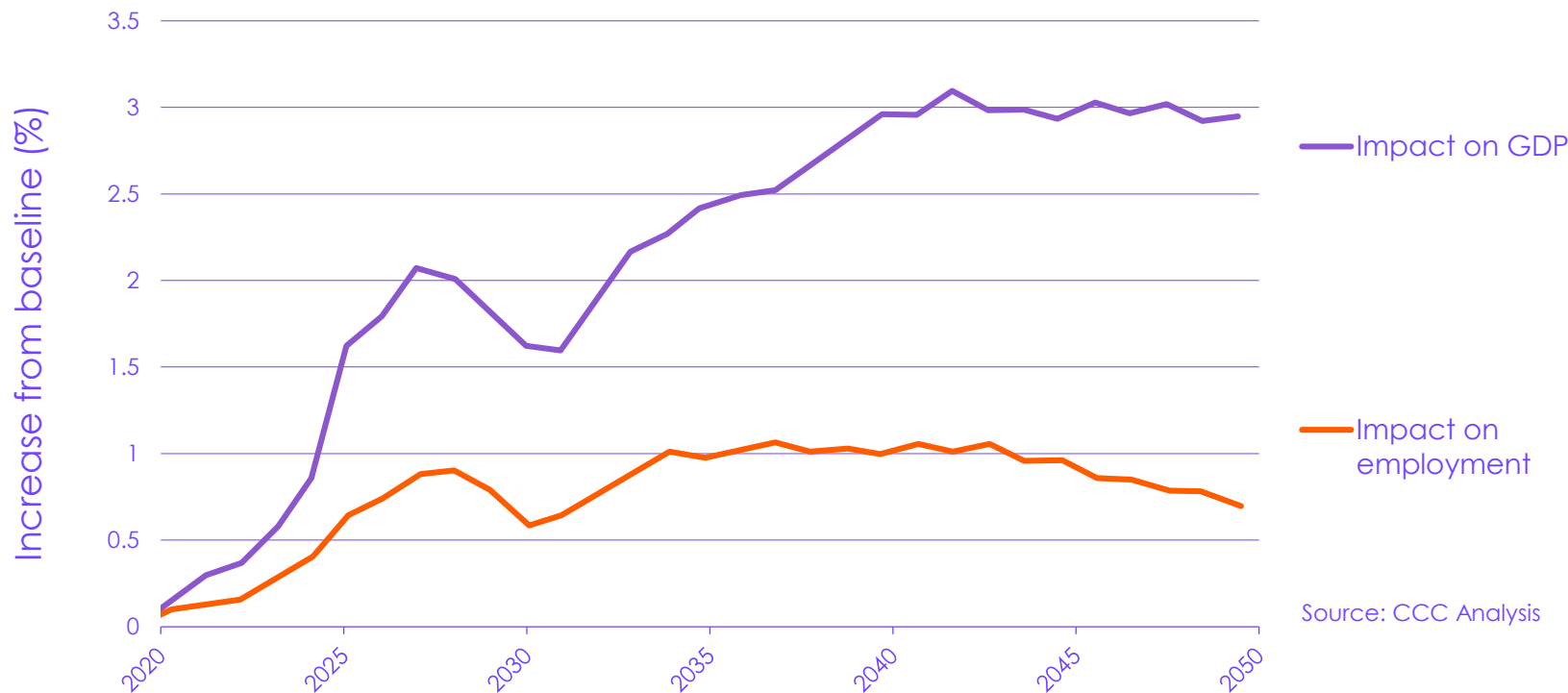
M&C is manufacturing and construction. "Other" category includes aviation, shipping, land-use, land-use change and forestry, agriculture, removals, waste and F-gases. CAPEX refers to additional annual capital investment. OPEX refers to savings due to operational cost reductions

### Source:

CCC analysis.

# Resource cost?

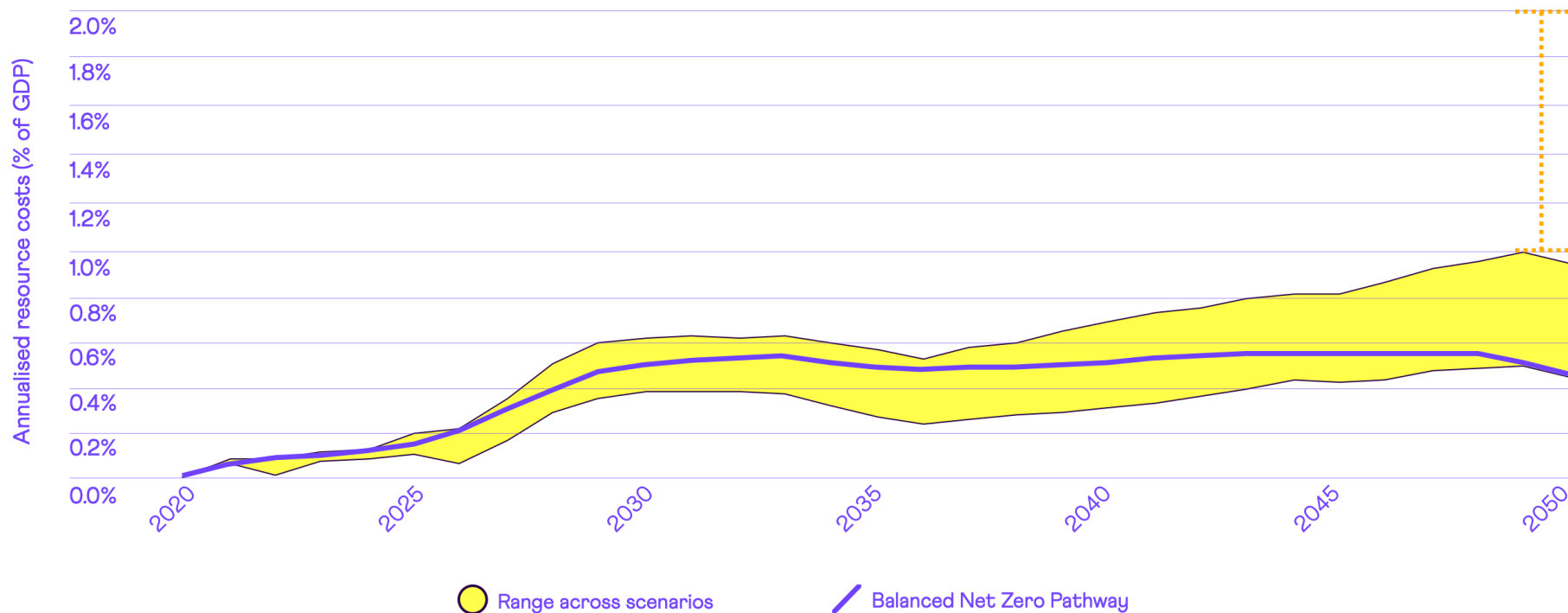
## Economic impacts of investing for Net Zero



Source: CCC Analysis

## Resource costs

Change in resource costs over time as a percentage of GDP

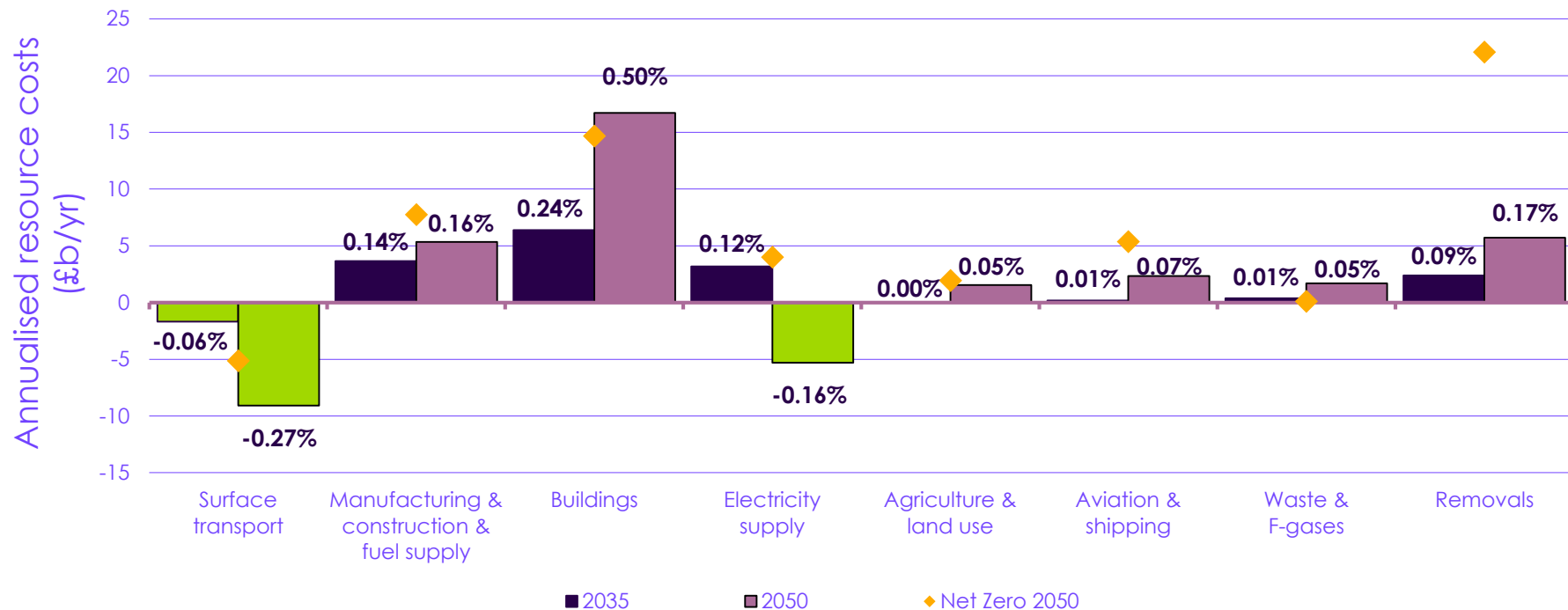


Source: CCC analysis.



## Resource costs

### Annualised resource costs in 2035 and 2050

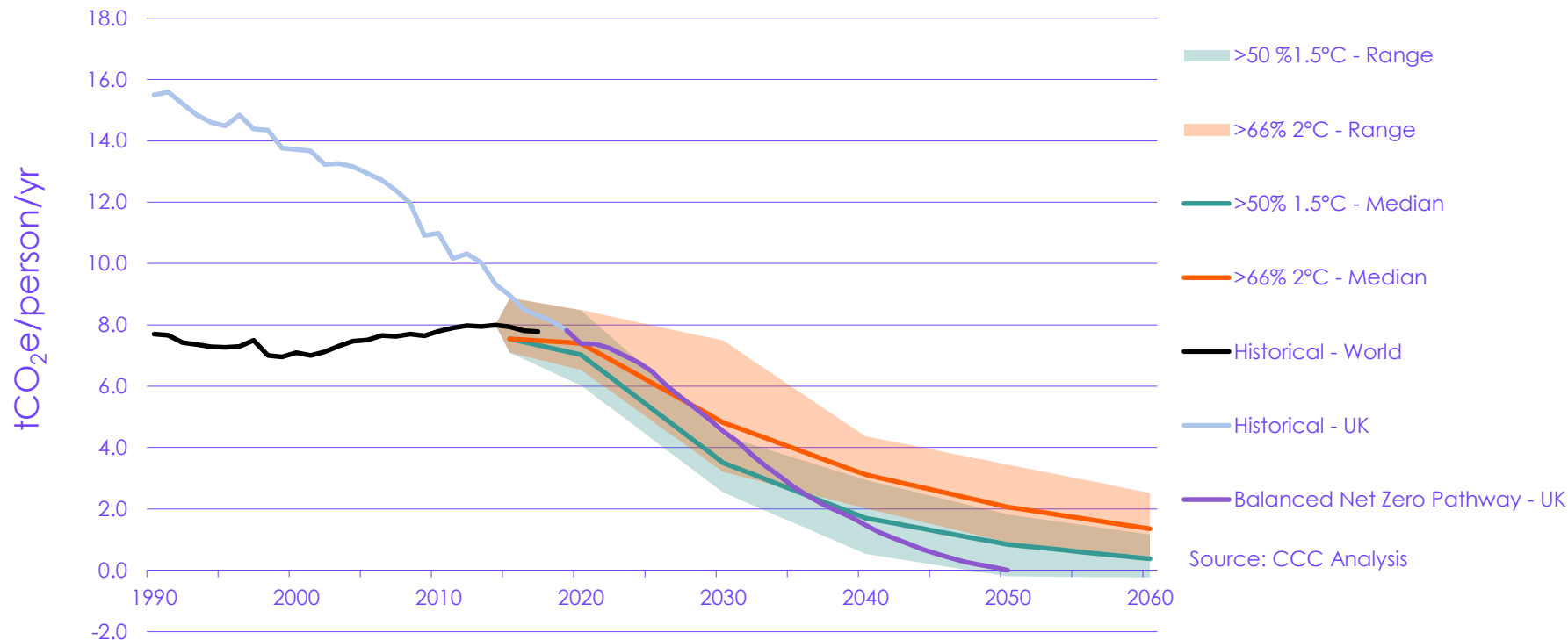


Source: CCC Analysis

# A fair and ambitious contribution to the Paris Agreement

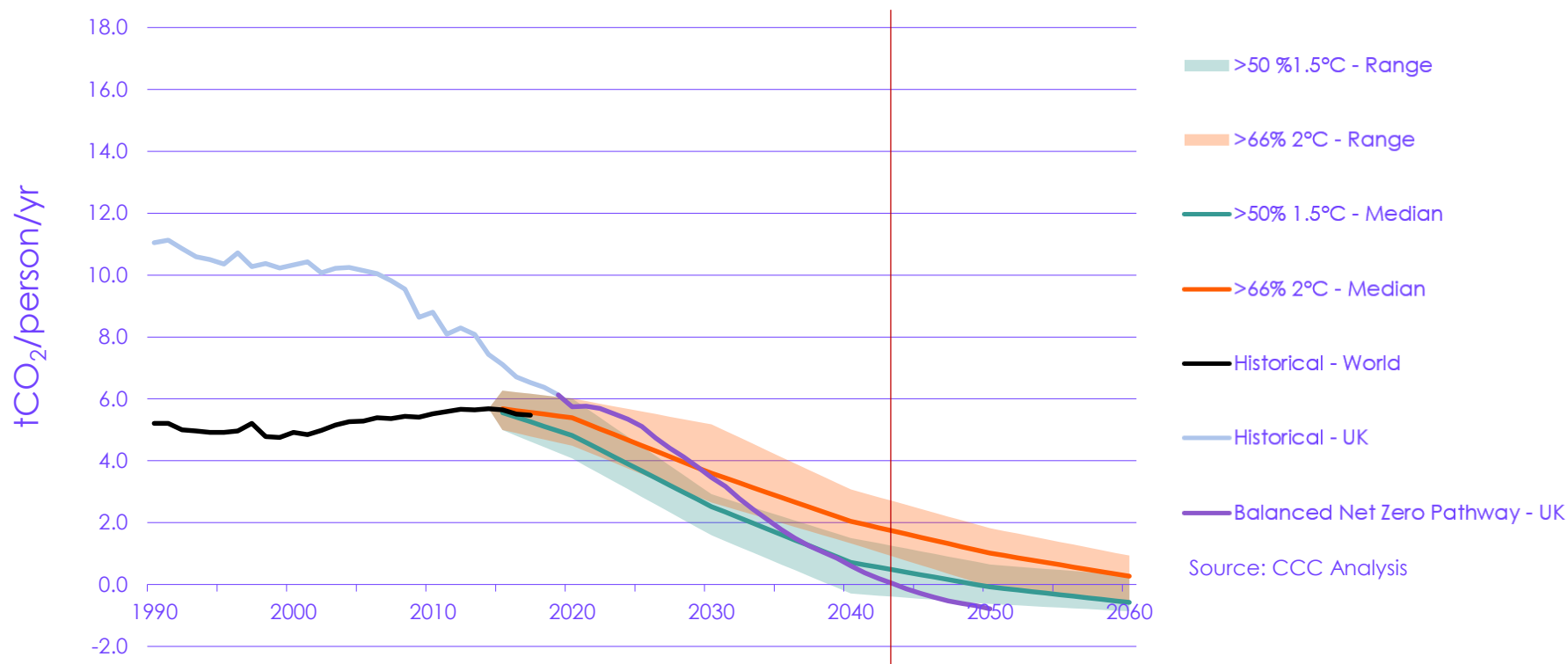
## UK's offer at COP26 Glasgow 2021

UK per person emissions (All GHGs) on the balanced path



## UK's offer at COP26 Glasgow 2021

UK per person emissions (CO<sub>2</sub> only) on the balanced path



[www.theccc.org.uk](http://www.theccc.org.uk)

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