Tackling climate change: what's the plan, and are we on course?

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About the CCC

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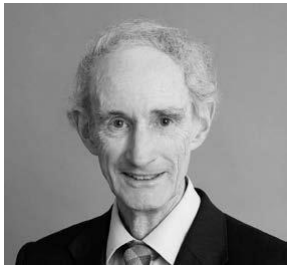
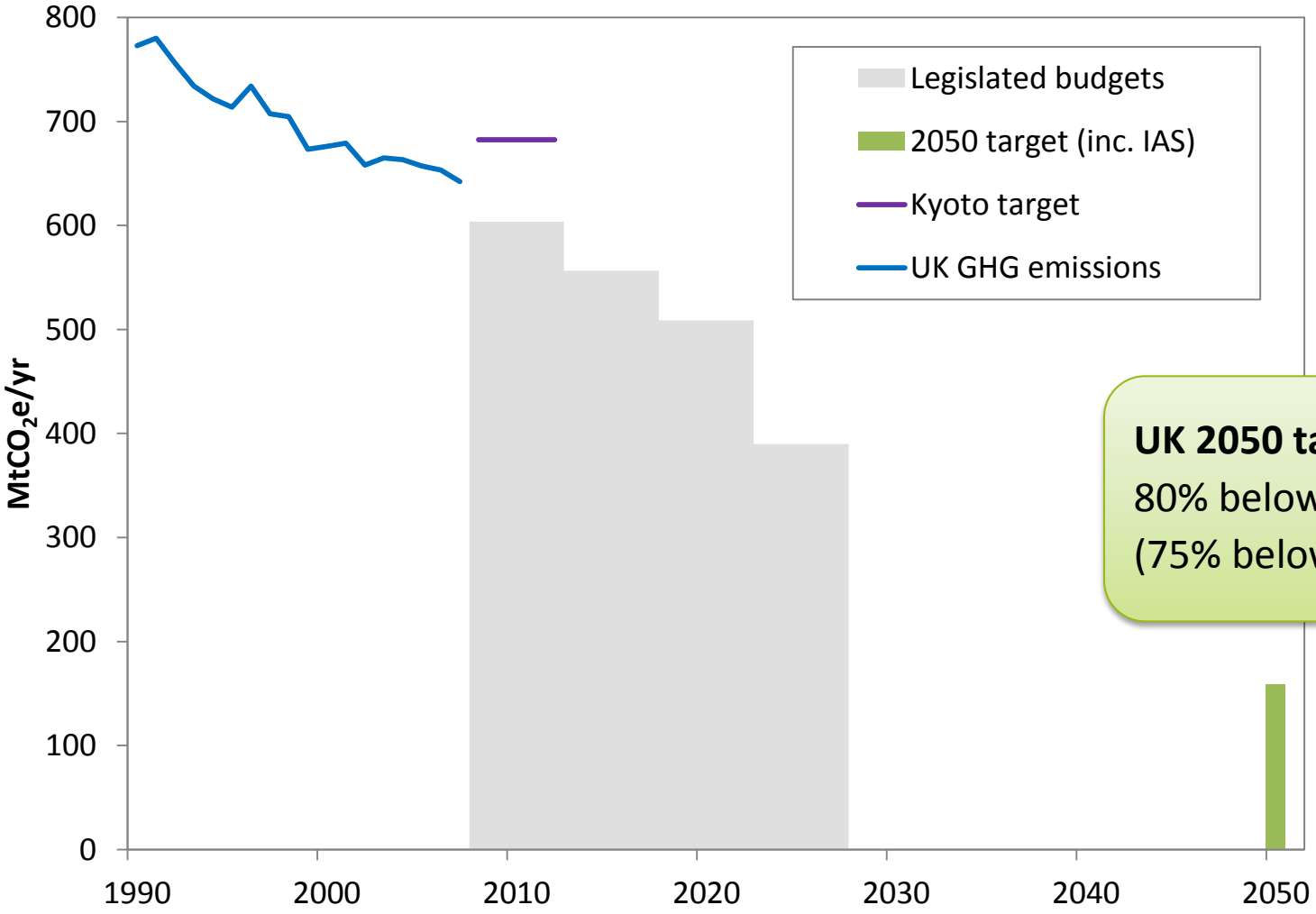


Bob May

- Independently advise Government on emissions limits
- Monitor progress
- Advise on adaptation through ASC

The UK's emissions targets



UK 2050 target:
80% below 1990 levels
(75% below 2010)

Where the 2050 target comes from

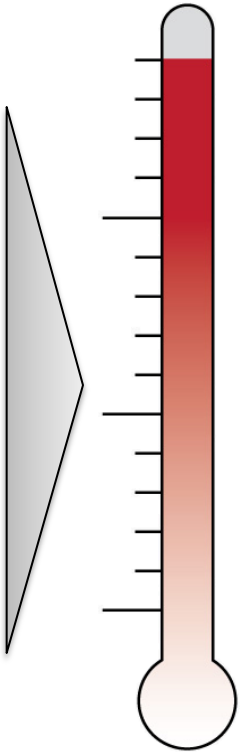
Science guides the discussion, but a decision is ultimately a difficult value judgment

Risk of impacts

- 2°C above pre-industrial by 2100 will exacerbate current impacts and trigger regional problems
- Beyond 4°C many systems will not be able to adapt

Committed change

- Emissions trends and uncertainty in climate projections make it very difficult to rule out a 2°C increase with 100% confidence

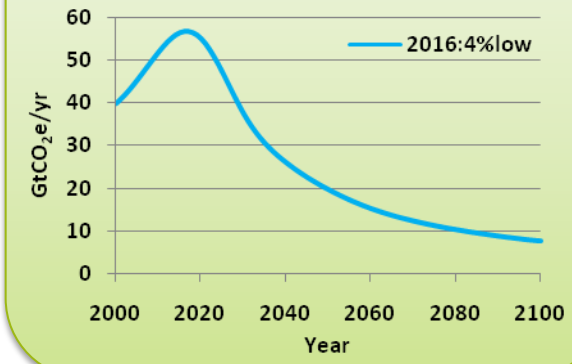


Decision rule

- Median projected temperature increase by 2100 must be close to 2°C above pre-industrial levels
- Keep probability of a 4°C increase very low (e.g. 1%)

Where the 2050 target comes from

Global emissions



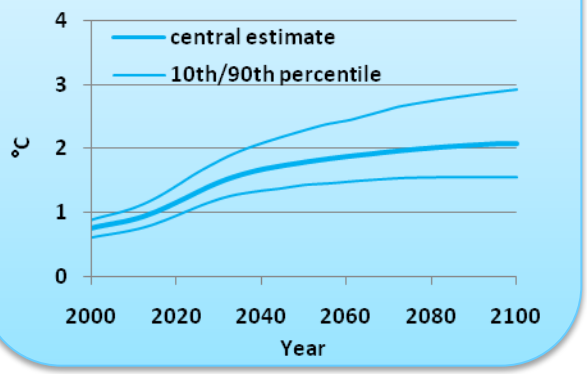
Climate parameter pdfs

- Climate sensitivity
- Ocean mixing rate
- Carbon cycle feedback strength

Climate modelling with Met Office

- MAGICC
- ~700 runs per emissions trajectory

Global temperatures



Where the 2050 target comes from

'Feasible' emission pathways show peaking by 2020, then 3-4% annual decline in CO_2 out to 2100

20-24GtCO_2e Kyoto GHG emissions by 2050 (50-60% cut)

Burden share among nations

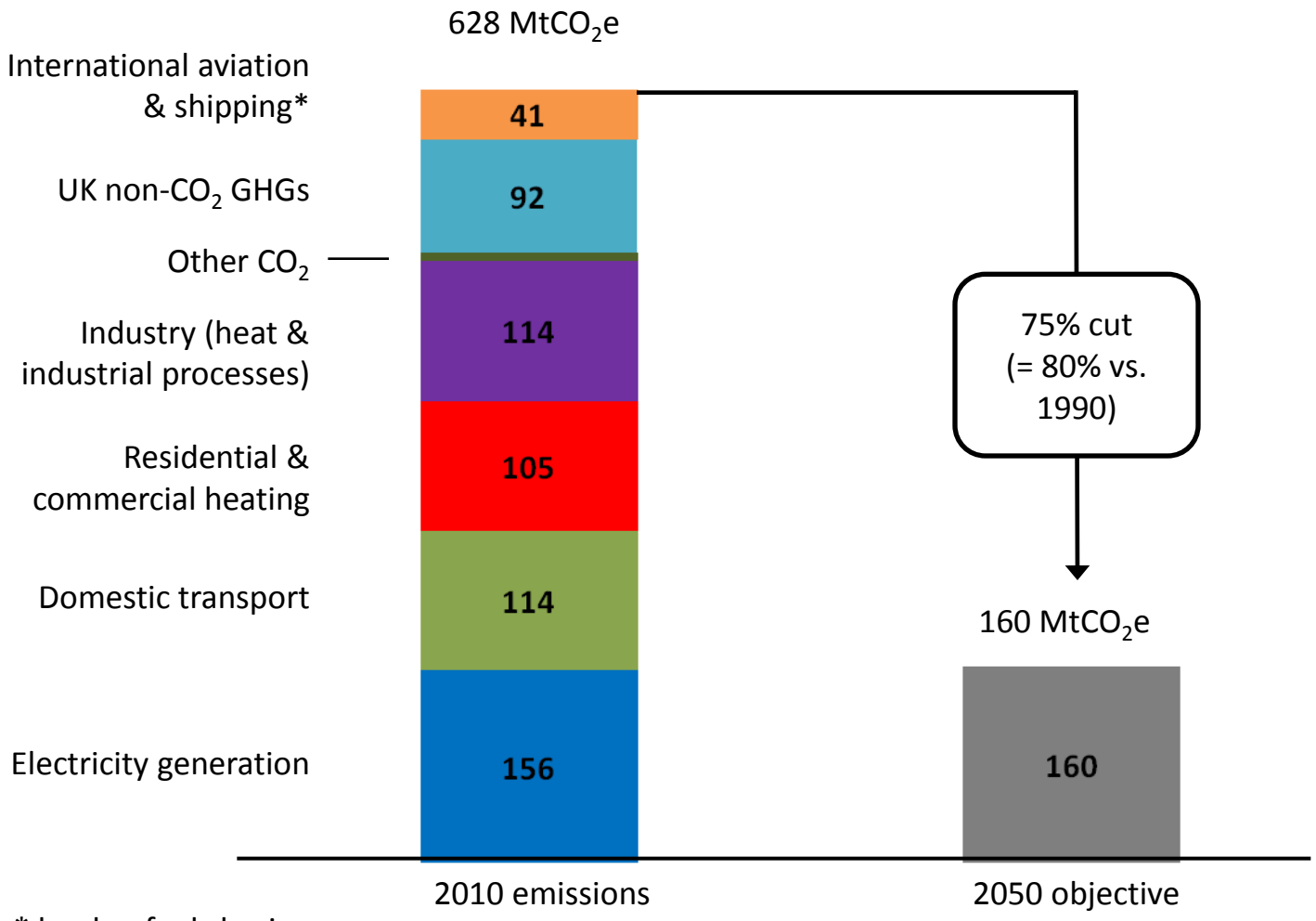
- Various methods exist
- A fair deal will tend towards equal emissions per person in the long term:
  - Implies 2.1-2.6tCO_2e per capita

~80% UK reduction in 2050, relative to 1990 levels

All Kyoto GHGs from all sectors

How we look at the UK

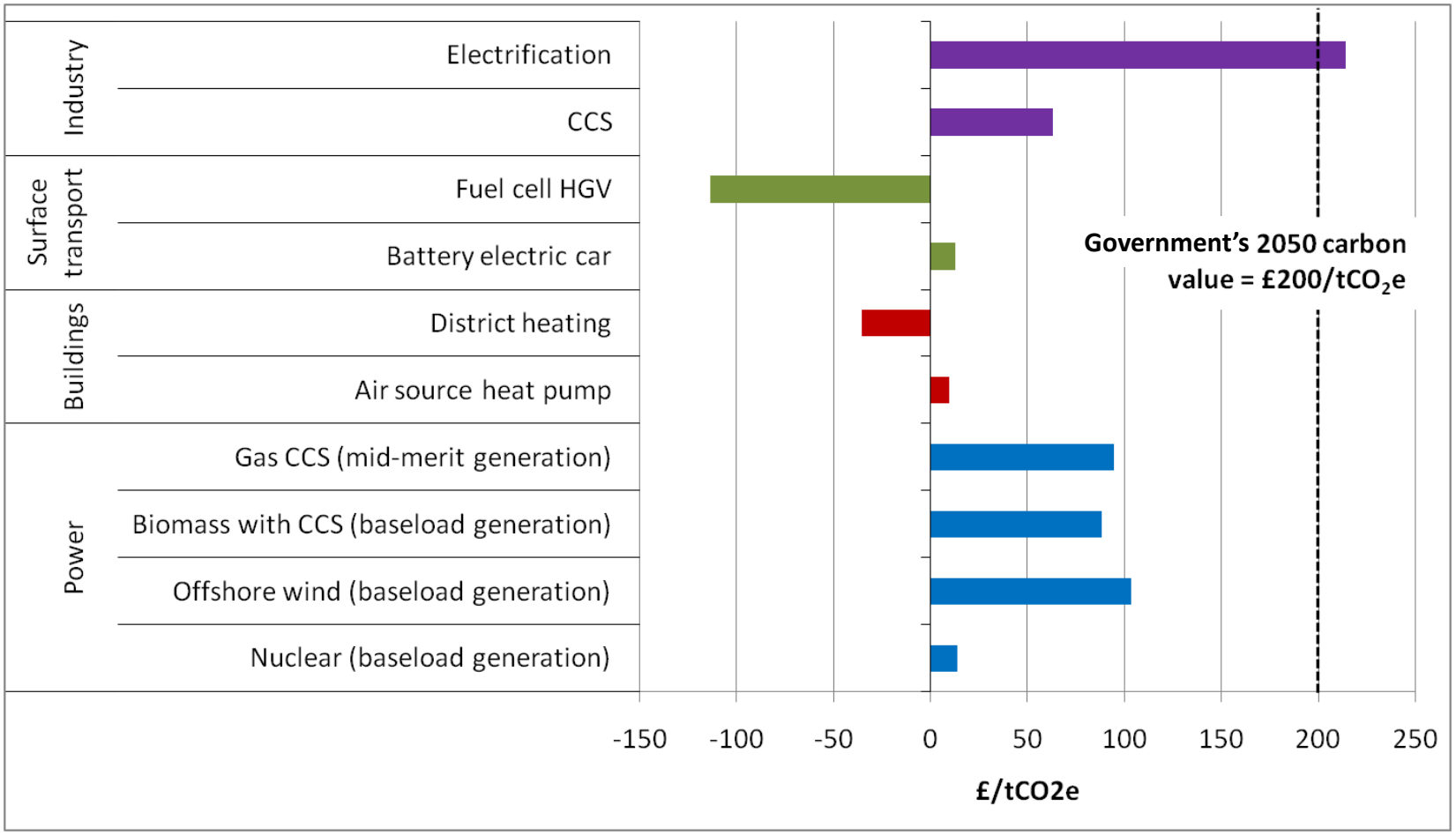
The scale of the 2050 challenge



* bunker fuels basis

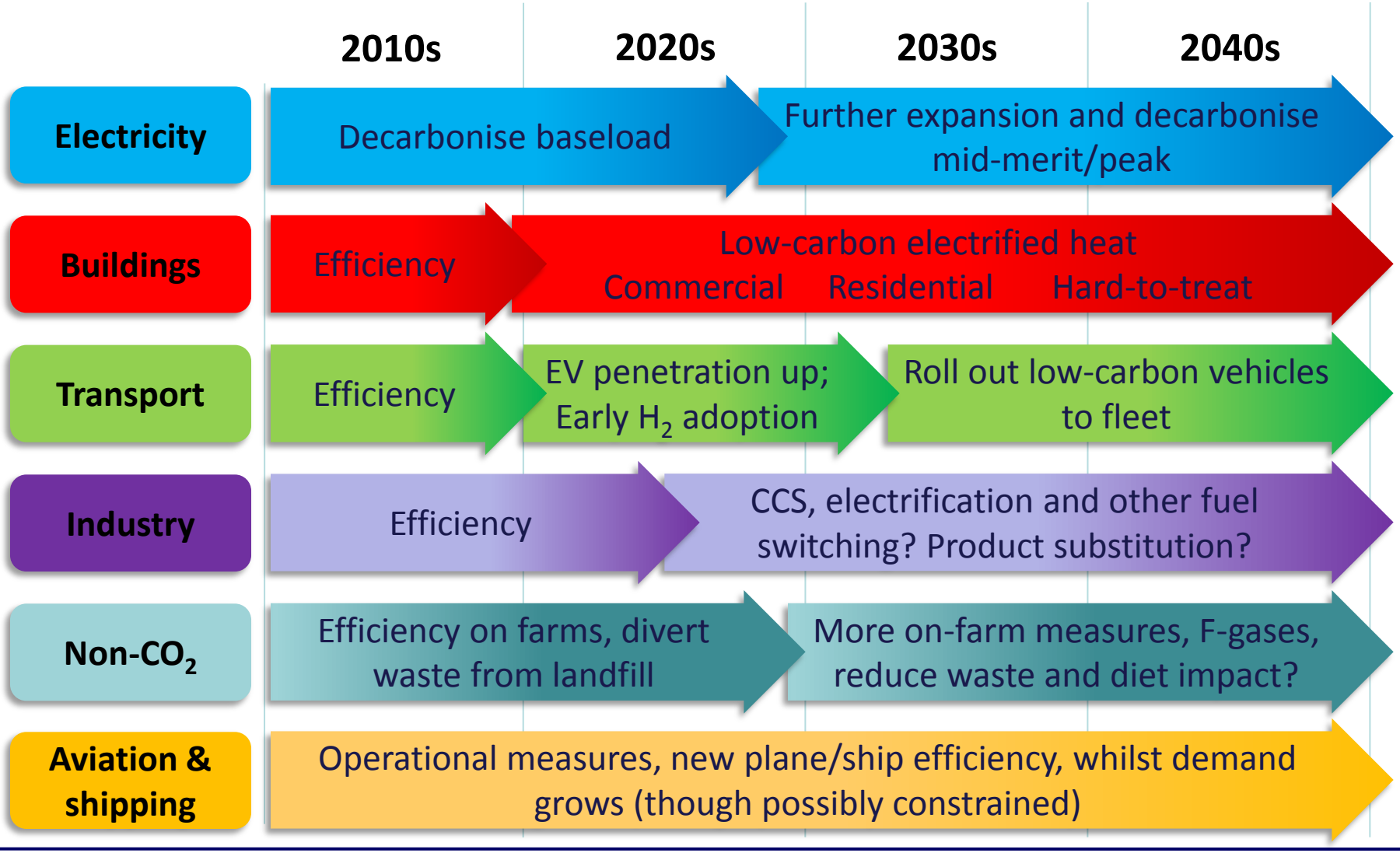
How to meet it?

Cost-effective measures across the economy

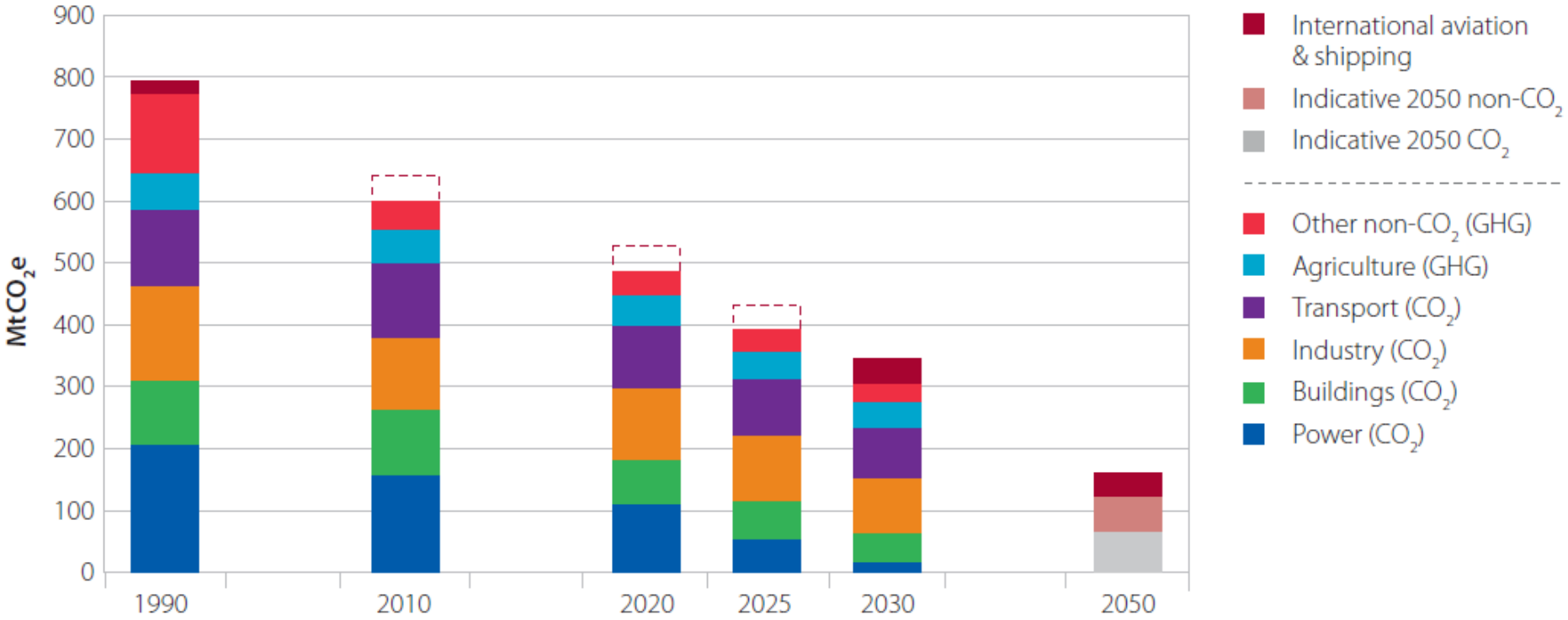


Plus non-CO_2 measures that are generally low-cost or cost-saving

Key measures likely to be required



Central scenario to 2030



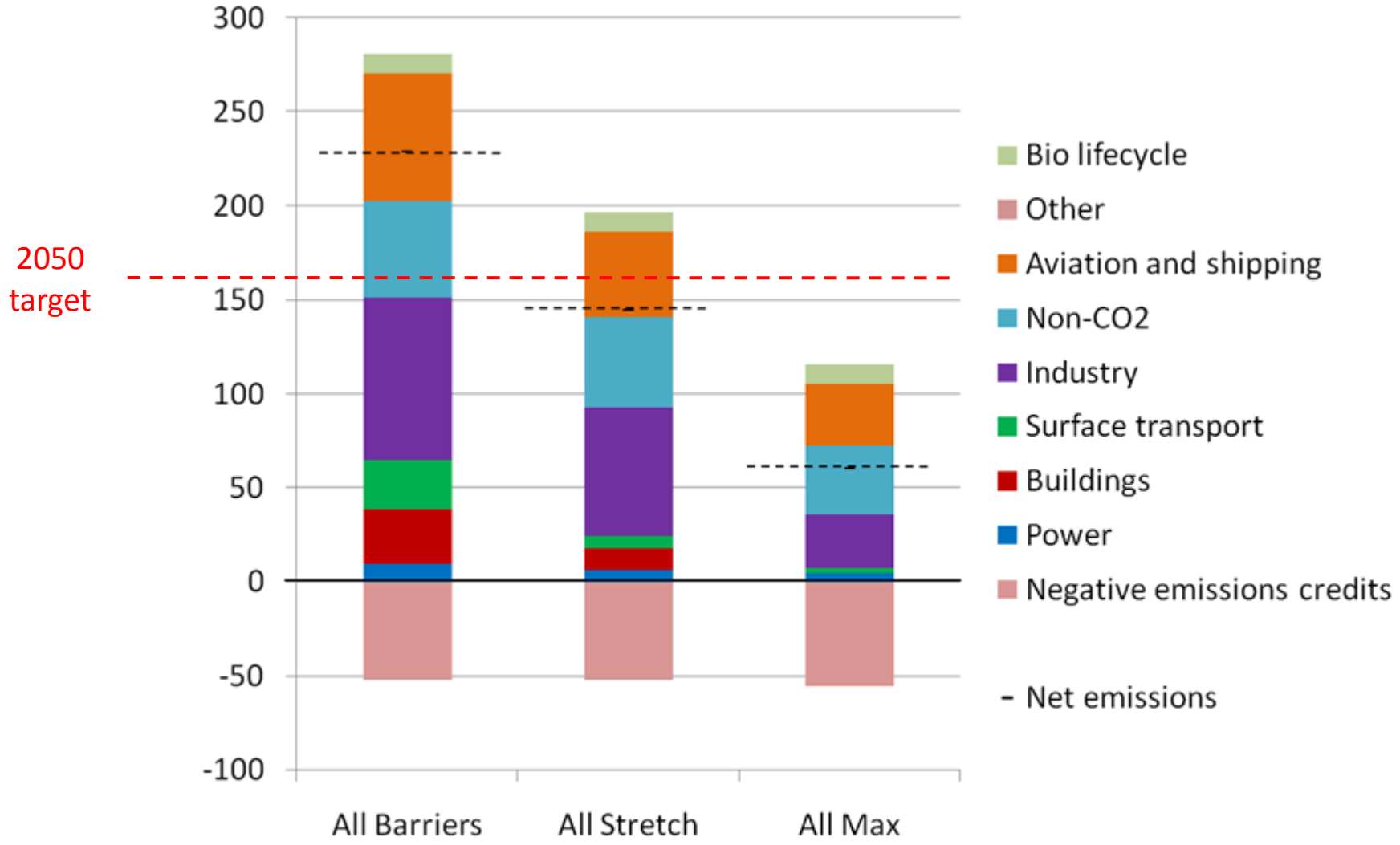
Economy-wide cost of meeting 1st four budgets

Sector	Estimated cost (% GDP) in 2030		
	Central assumptions	High fuel prices	Low fuel prices
Power	0.6%		
Industry	-0.1%		
Buildings	0.0%		
Transport	-0.1%		
Non-CO_2	0.0%		
TOTAL	**0.5%**	**0.1%**	**0.8%**

New work builds bottom-up scenarios

	Max	Stretch	Barriers
Power	**5 $MtCO_2$** Full decarbonisation. Peaks met by low-carbon storage.	**6 $MtCO_2$** Full decarbonisation. Peaks met by unabated gas.	**10 $MtCO_2$** Full decarbonisation. Peaks met by unabated gas. Inflexible demand.
Buildings	**0 $MtCO_2$** Full roll-out of EE, HPs and DH. Remainder met by resistive.	**12 $MtCO_2$** Extensive roll-out of EE. Full roll-out of HPs and DH. Rest met by gas boilers.	**28 $MtCO_2$** Barriers restrict take-up of disruptive EE, HPs and DH. Gas still meets 25%.
Surface Transport	**2 $MtCO_2$** All cars and vans are EVs. All HGVs use H_2.	**6 $MtCO_2$** All cars and vans are EVs. 75% HGVs use H_2.	**25 $MtCO_2$** Late take-up or focus on PHEVs means 30% liquid fuel remains for cars and vans. 50% HGVs use H_2.
Industry	**28 $MtCO_2$** Full deployment of CCS and electrification where possible.	**68 $MtCO_2$** No (expensive) electrification, and CCS not applied to refineries or cement.	**87 $MtCO_2$** No electrification and very limited use of CCS.
Non-CO_2	**36 $MtCO_2e$** All on-farm measures deployed. Landfill eliminated by 2020, reduced food waste and livestock products.	**48 $MtCO_2e$** All on-farm measures deployed. Landfill reduced beyond EU Landfill Directive, 'simple' reductions in food waste.	**51 $MtCO_2e$** All on-farm measures deployed, EU Landfill Directive met. No waste, reduction, diet change or F-gas ban.
Aviation & Shipping	**33 $MtCO_2$** DfT low aviation scenario. CCC low shipping scenario.	**45 $MtCO_2$** Central scenarios: Aviation at 2005 levels. Shipping a third below 2010.	**68 $MtCO_2$** DfT high aviation scenario. CCC high shipping scenario.
Biomass CCS	**-45 $MtCO_2$** Biomass use with CCS prioritised as most effective at reducing emissions (includes lifecycle emissions).		

Need to go beyond 'Barriers' to meet 80%



Multiple combinations meet the 2050 target

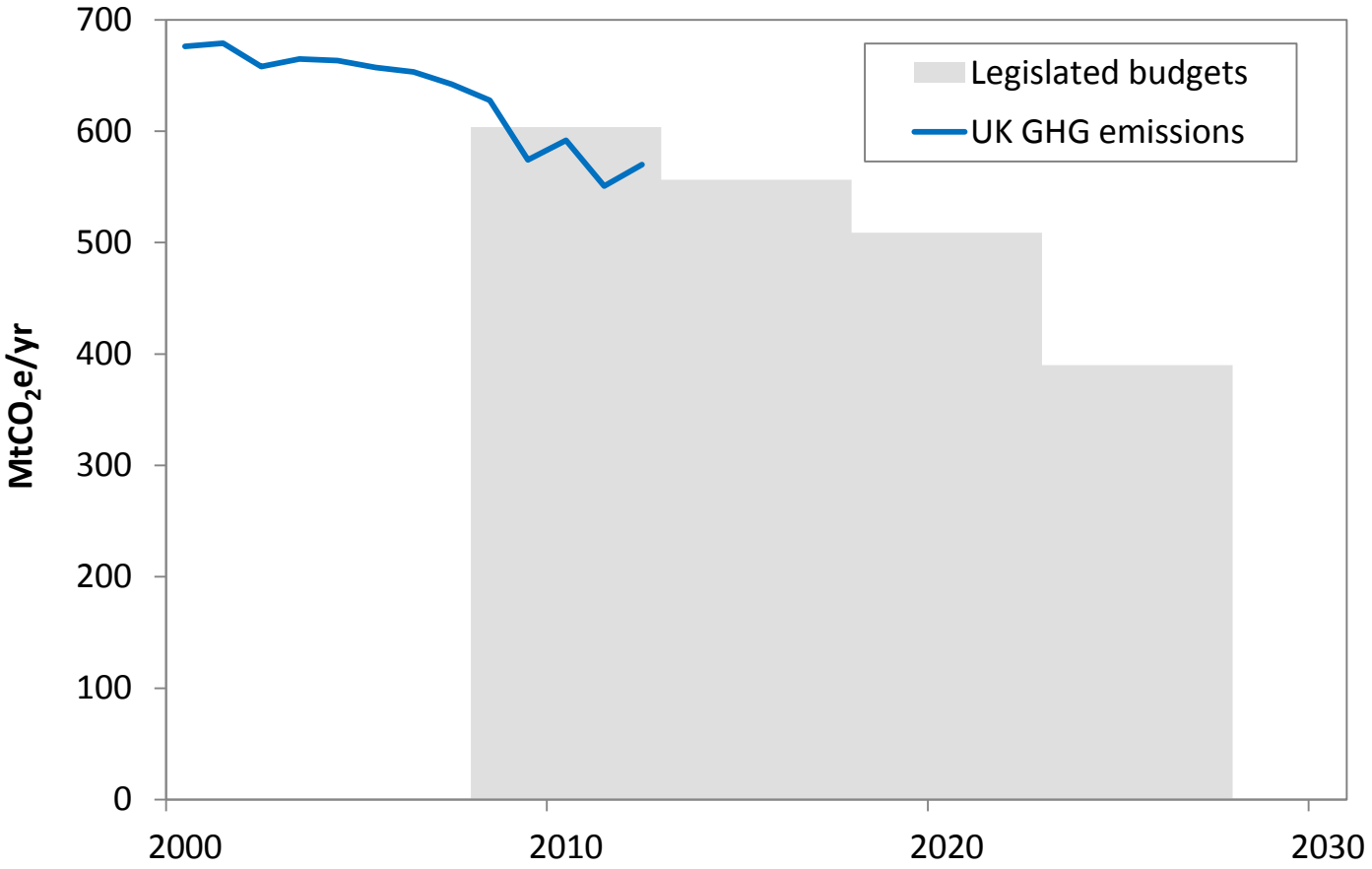
	Barriers in industry	Barriers in aviation, shipping and non-CO_2	Barriers in heat for buildings	Barriers in surface transport and power
Power	Stretch	Stretch	Stretch	Barriers
Buildings	Stretch	Max	Barriers	Stretch
Surface transport	Max	Stretch	Max	Barriers
Industry	Barriers	Stretch	Stretch	Stretch
Non CO_2	Stretch	Barriers	Stretch	Max
Aviation and Shipping	Stretch	Barriers	Stretch	Stretch
Resource cost (% GDP in 2050)	**0.5%**	**0.7%**	**0.6%**	**0.7%**

CCS and bioenergy are important

	No CCS	Limited bioenergy	Limited bioenergy and no CCS
Power	Stretch[1]	Stretch	Stretch[1]
Buildings	Stretch	Max	Stretch
Surface transport	Max	Stretch	Stretch
Industry	Max[2]	Stretch	Max[5]
Non CO_2	Stretch	Stretch	Stretch
Aviation and Shipping	Stretch[3]	Stretch[4]	Stretch[4]

Note: Includes reallocation of bioenergy and use of substitute low-carbon technologies where available (e.g. nuclear/renewables for CCS in power).

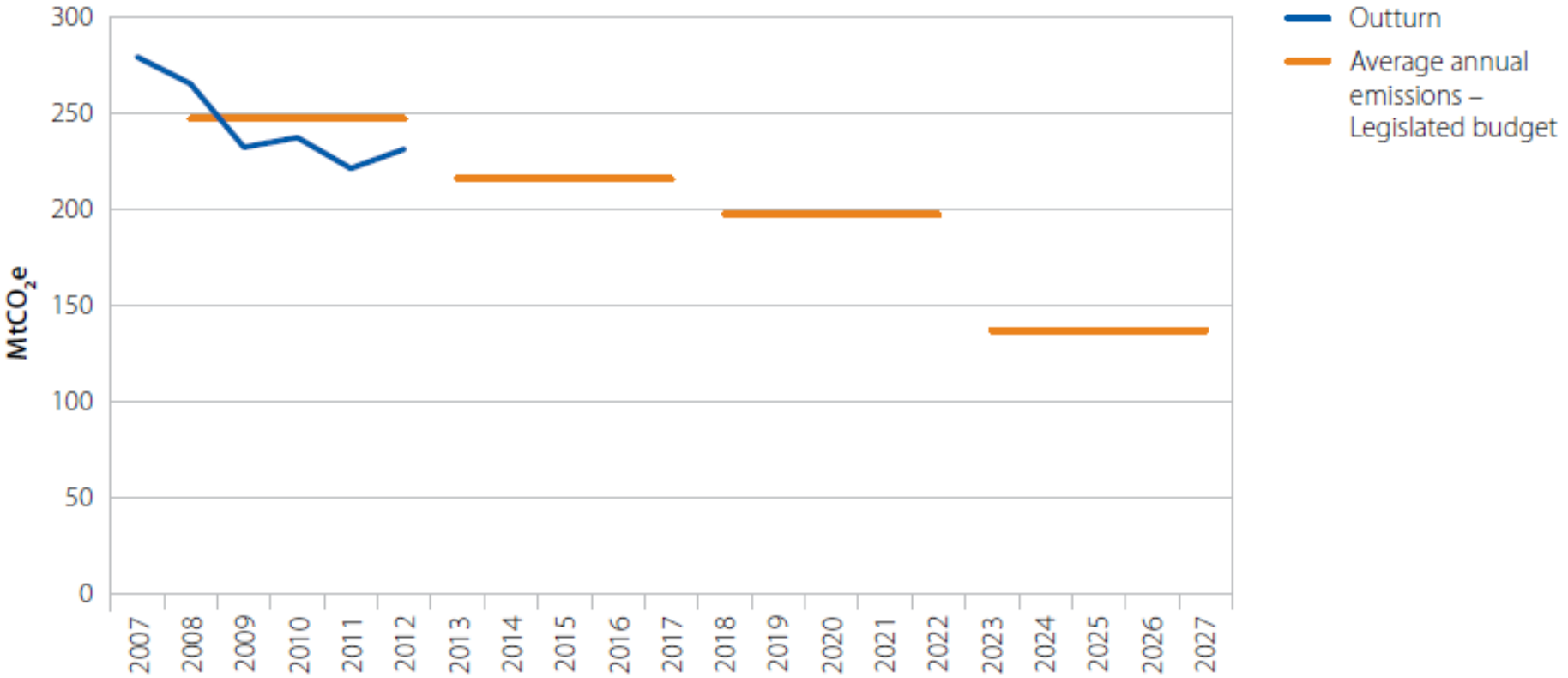
So how is the UK doing?



- Budget 1 met, mainly due to the recession
- New Government policies (Energy Bill, Green Deal…)

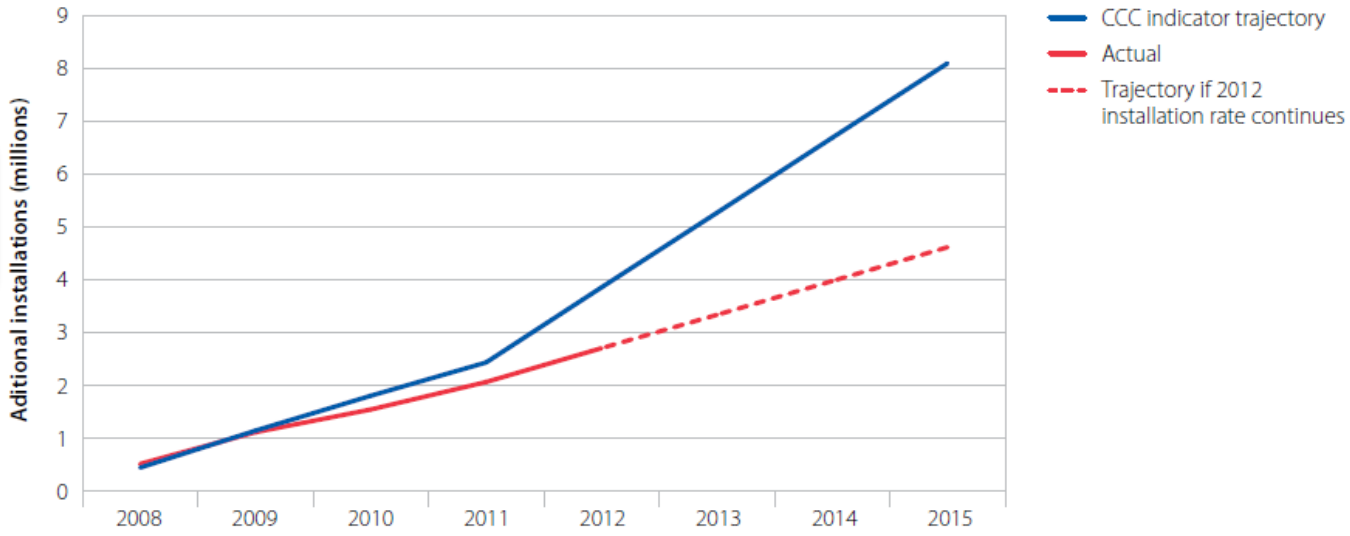
Some bits will be met by definition!

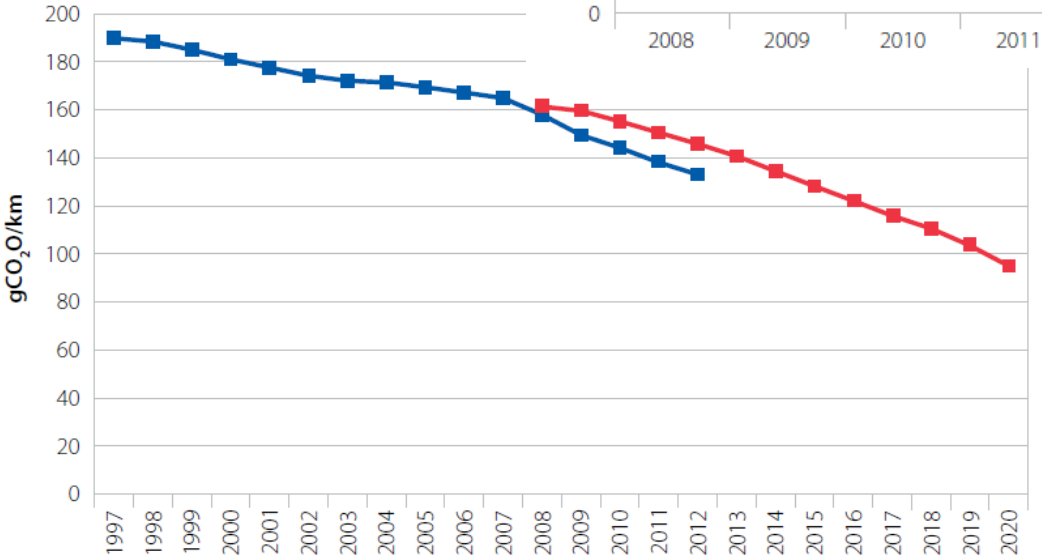
UK emissions covered by EU Emissions Trading Scheme



Non-traded emissions show mixed progress

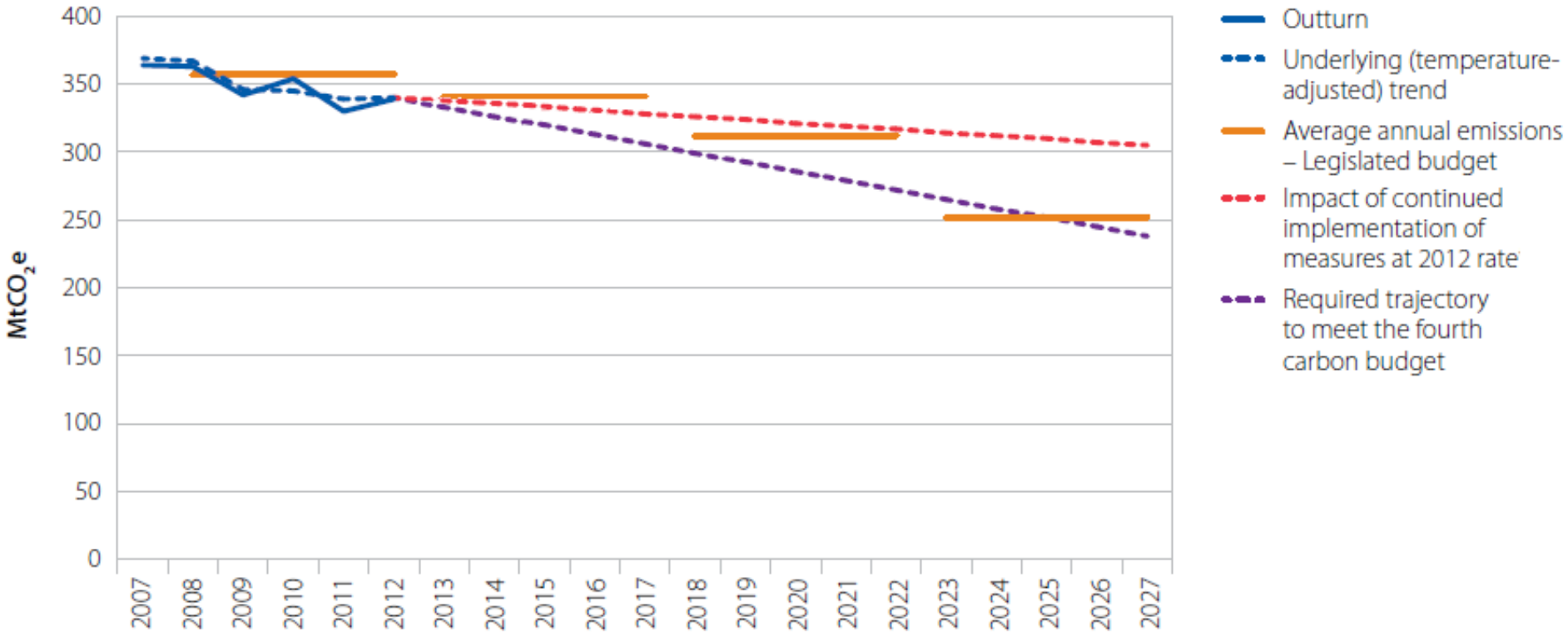
…behind on cavity wall insulation





Ahead of schedule on vehicle efficiency…

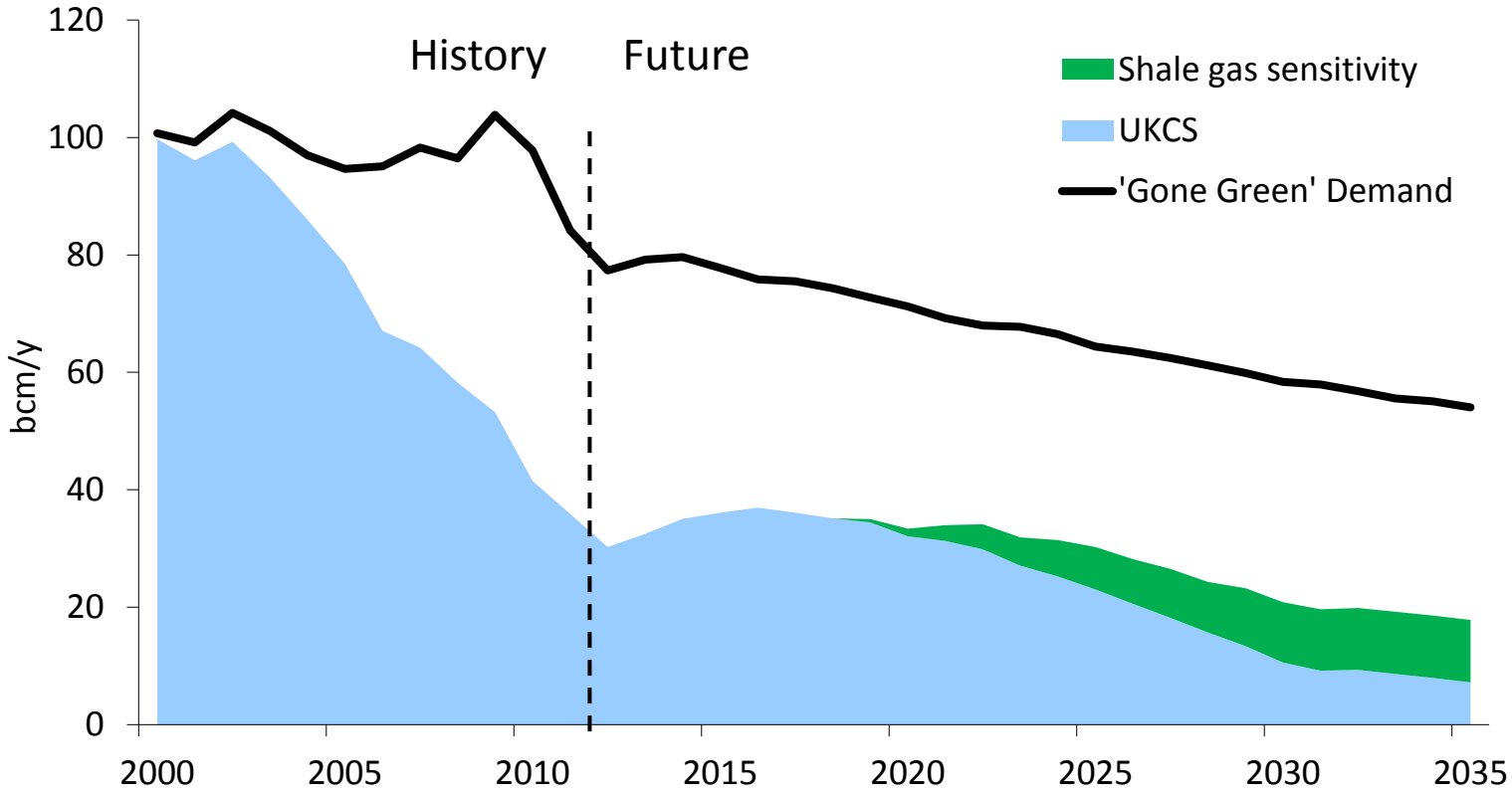
Non-traded emissions



Budget 2 likely to be met, further action required to meet 3 and 4

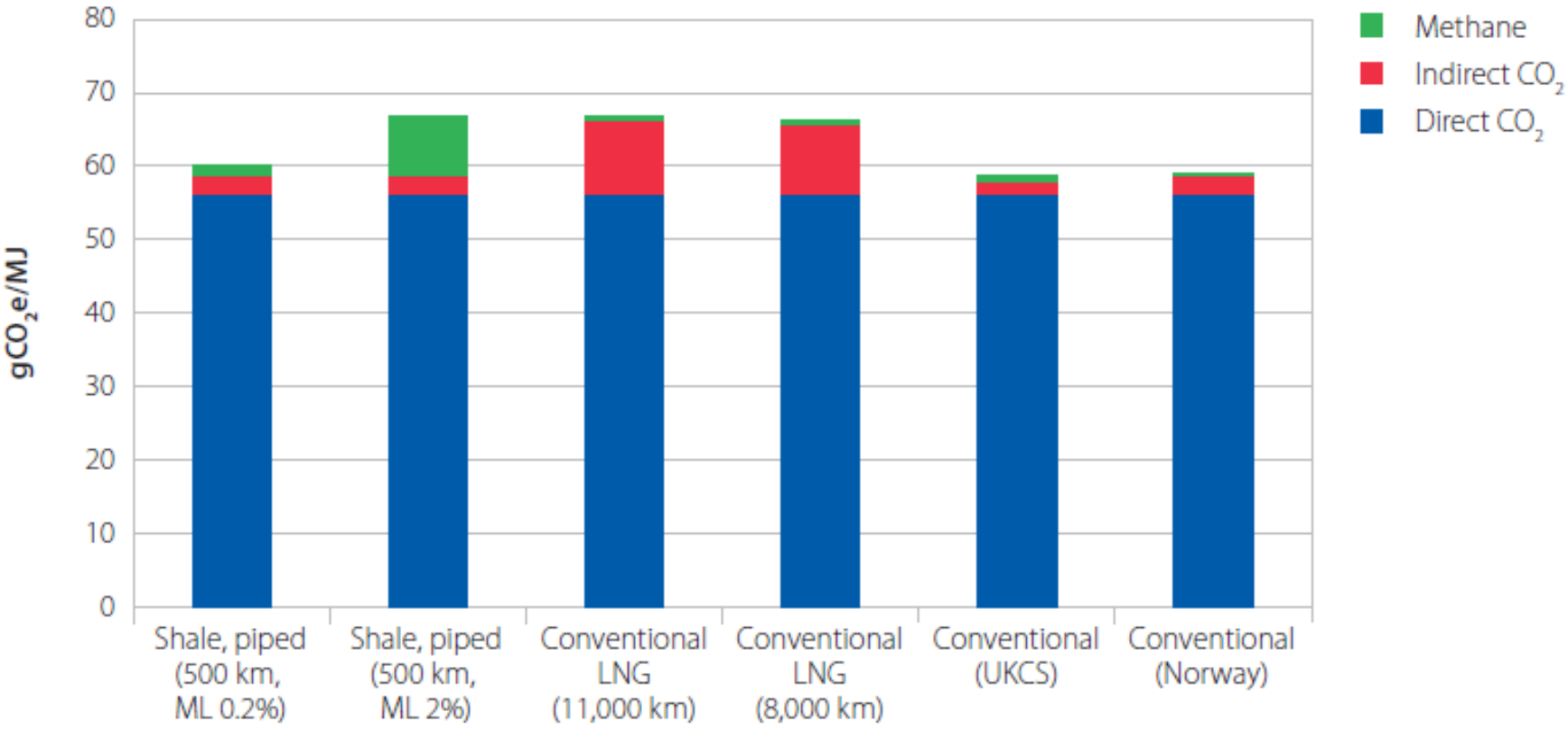
What about shale gas?

Unlikely to meet UK demand on its own



Source: National Grid (2013) UK Energy Future Scenarios

Likely lower emissions than gas imports



Wider impacts of mitigation on health & the environment

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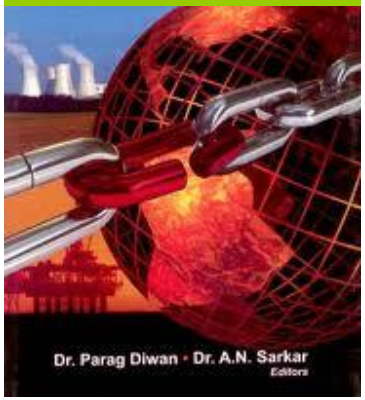
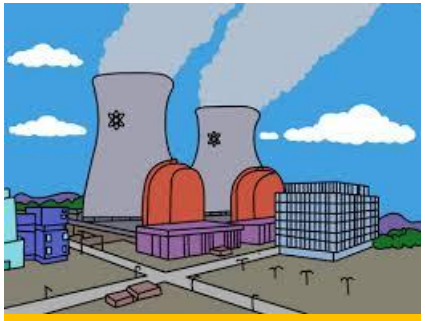
Landscape

Energy security



Comfort

Air quality

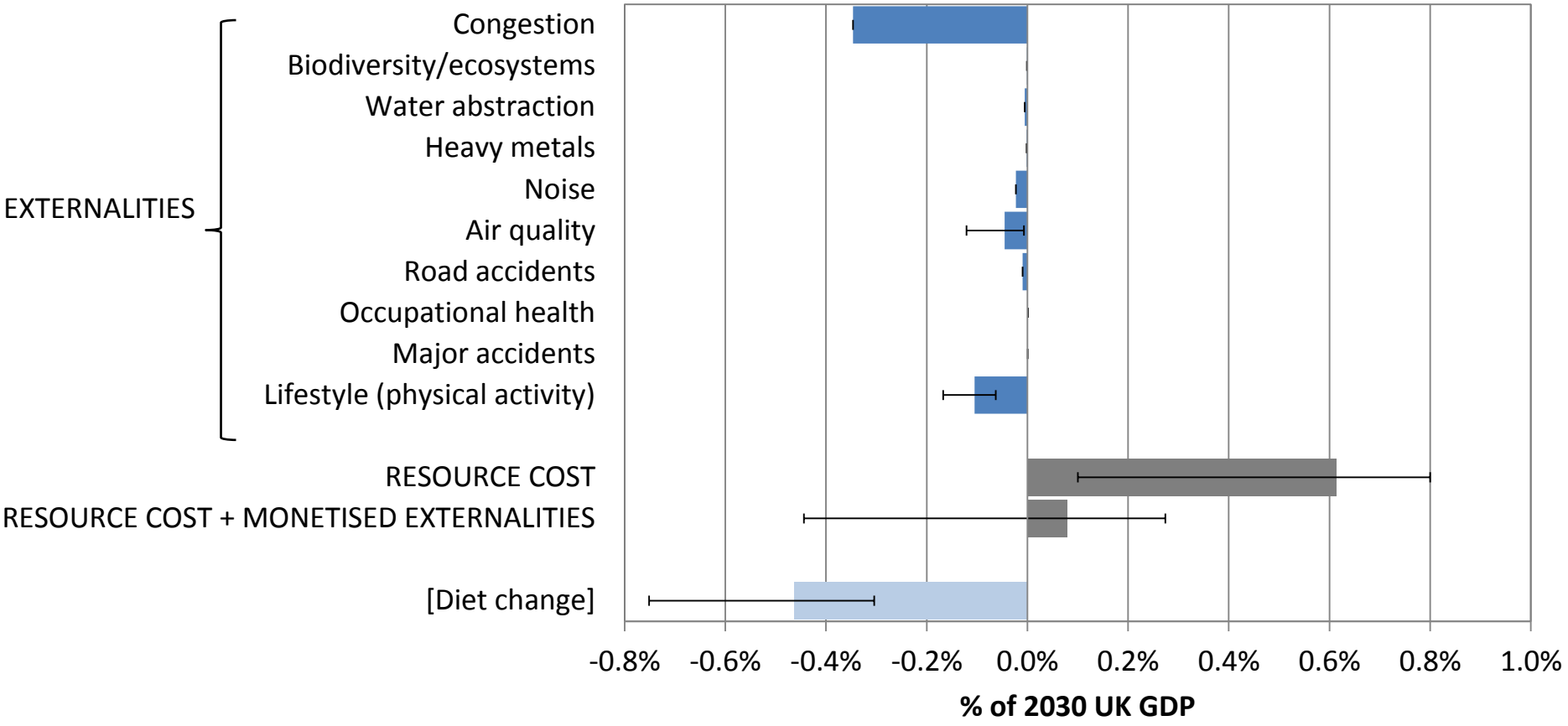


Nuclear?

Active travel

Noise

A likely net benefit (for those we can quantify)



Summary

- 80% by 2050 is stretching, requiring action across the economy
- But it is feasible given known technologies and price projections
- It only gives ~50/50 odds of staying near 2°C, and assumes global effort to 2050 and beyond

- Likely to meet first two carbon budgets, further effort needed beyond
- Some key technologies – CCS, (some) bioenergy, electric vehicles
- Shale gas is not necessarily a bad thing over the next couple of decades (but not a long-term solution without CCS)
- Switching away from fossil fuel may well provide significant further benefits for health and the environment

Further info

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