Committee on Climate Change

Foresight and the value of models in energy policy-making

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ETSAP-WholeSEM workshop

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The Climate Change Act sets a framework to drive change

Committee on Climate Change

The Climate Change Act

1	**A goal**	**2050 Emissions Target**
2	**A pathway**	**Carbon budgets**
3	**A toolkit**	Requirement that Government brings forward **policies**
4	**A monitoring framework**	**Committee on Climate Change** to monitor progress and suggest changes

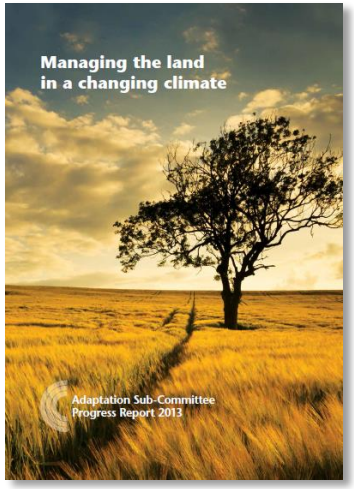
Committee on Climate Change – our role

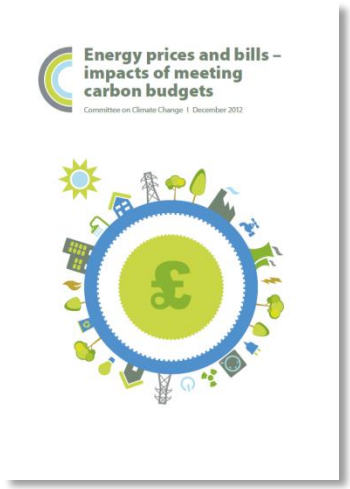
Established by the Climate Change Act 2008 to provide independent advice to Government and Parliament on:

- Emissions limits
- Annual progress
- Adaptation (through ASC)

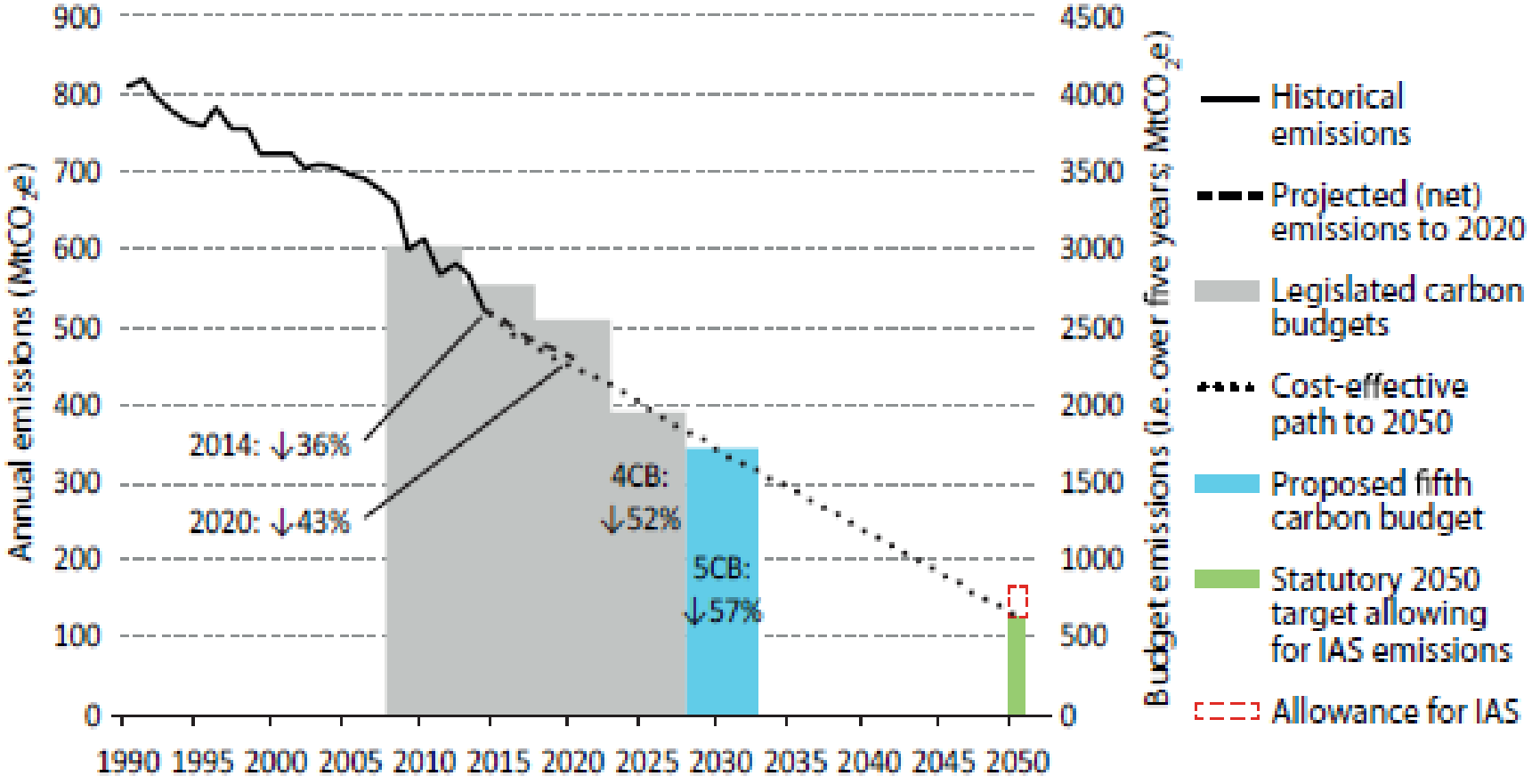
Lord Deben, Chairman

Prof Lord Krebs, Chairman ASC

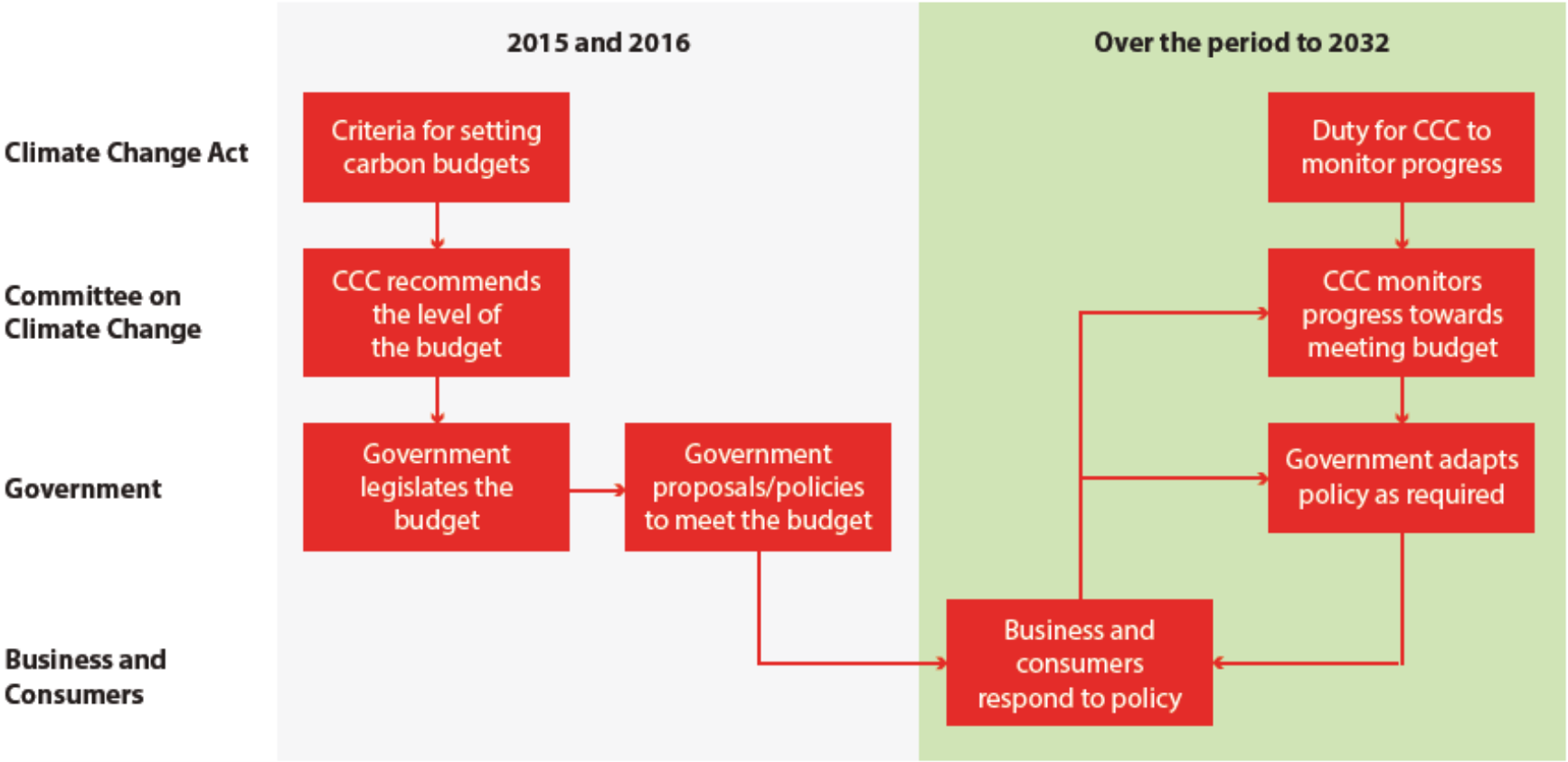




The Committee has recommended for the fifth carbon budget (2028-32) that emissions fall by 57% vs. 1990, on the path to a reduction by 2050 of at least 80%



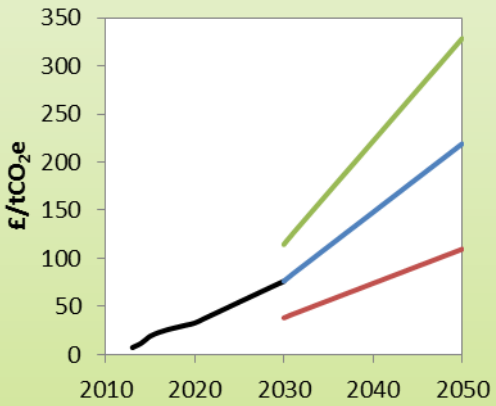
The Government will legislate the fifth carbon budget in June 2016 and then publish proposals and policies to meet it



CCC pathway building: our approach

Statically cost-effective measures

- Cost-saving vs. Gov't carbon price in near term

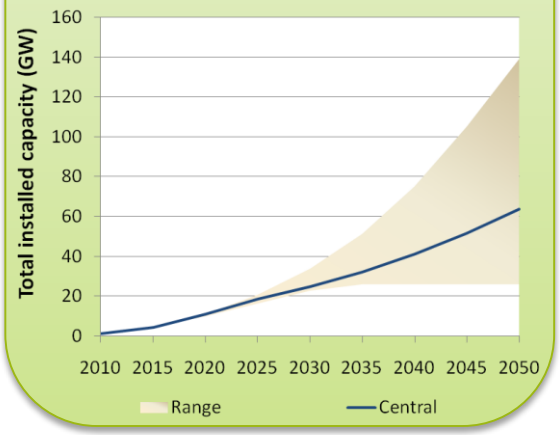


- Feasible deployment rates

e.g. energy & vehicle efficiency, nuclear power, some bioenergy

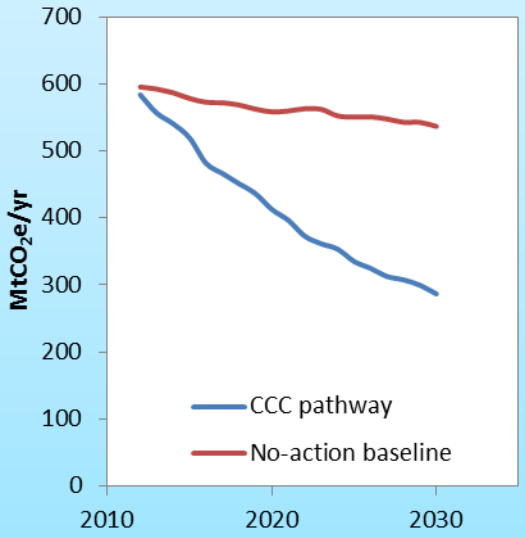
Dynamically cost-effective measures

- Become cost-saving vs. Gov't price projections for 2020-2050
- Enough build of key measures for upper end of 2050 levels if needed



e.g. offshore wind, electric vehicles, heat pumps

UK emission pathway



Why we build scenarios bottom-up, rather than just using an energy system model

- Can use more detailed sectoral models
- Include softer issues
- Energy system models don't do path-dependency fantastically well, e.g. tech costs
- Able to include insights from energy system modelling
- Include hedging strategies / value of option creation

Our scenarios to 2035 contain both measures that are cost-effective and those required on the path to 2050

Build rates

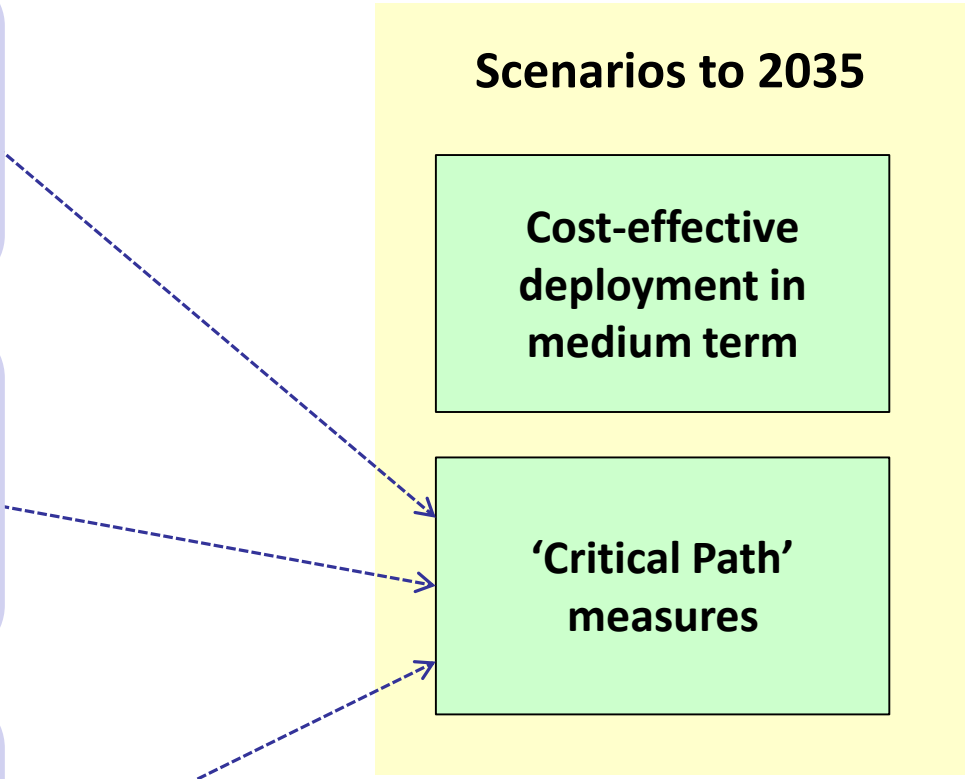
Ensure sufficient build of each key technology by 2030 to enable reaching **upper end of 2050 levels** if necessary; includes consideration of scrappage

Early-stage demonstration & deployment

RDD&D to drive down technology costs so that 2030-50 deployment is more cost-effective

Uncertainty and emerging evidence

Consideration of flexibility to emerging evidence in the period to 2030

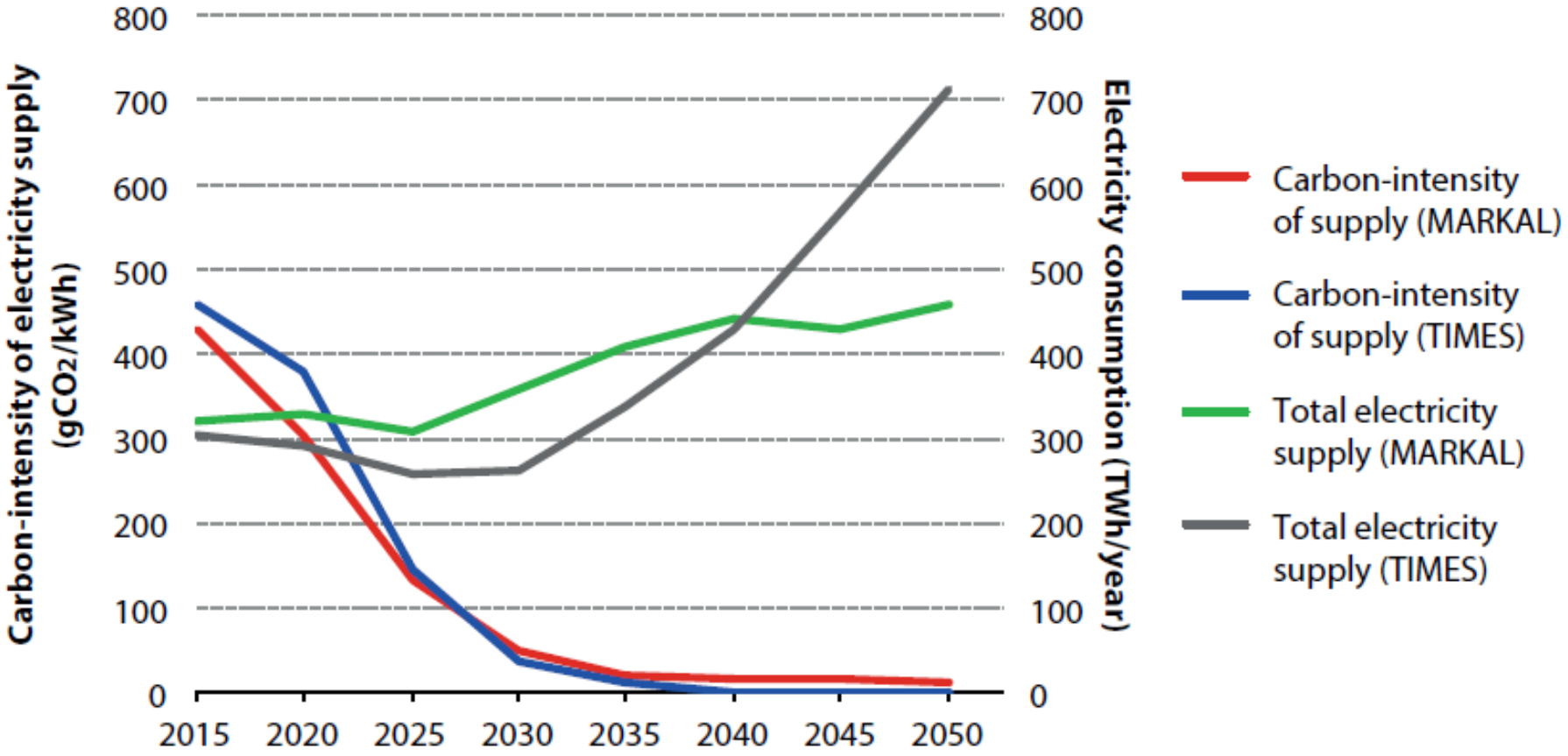


Key 'critical path' measures: CCS, offshore wind, electric vehicles, heat pumps, heat networks, [hydrogen]. Many of these become cost-effective during the 2020s.

CCC use of perfect foresight optimisation modelling on the path(s) to 2050 to inform our scenario building

- Since 2008, we have used least-cost optimisation 'perfect foresight' models of the UK energy system to explore pathways to 2050 (e.g. MARKAL, ESME, TIMES)
  - these tell us what 'should' happen over time to meet the 2050 target
  - we use these in 'what if' mode to explore possible solutions, look at trade-offs and generate insights
- We do not don't use these system-wide models as 'truth machines'. Rather, we use the insights from them to inform our more detailed sectoral bottom-up analysis to 2035, on the path to 2050, for the carbon budget scenarios
- Their should not be confused with a prediction, projection or even merely a recommendation – there are important aspects that are not modelled (many of these are simply not modellable)
  - real-world barriers to delivery
  - public acceptance (of technologies or policy approaches)
  - reliance on millions of individual decision-makers vs. a supply-side approach

UK MARKAL (2010) and UK TIMES (2015) modelling of the trajectory for the power sector to 2050



High-level messages on meeting the 2050 target

- The **power sector** is central to long-term decarbonisation, as low-carbon electricity can be used to decarbonise other sectors (e.g. transport, heat)
  - this requires the power sector to be largely decarbonised by 2030
  - however, the path for power sector emissions is more certain than the appropriate mix of technologies to achieve this
- **Carbon capture and storage (CCS)** is crucial in achieving long-term emissions reductions (both in the UK and globally), due to its potential roles in power, heavy industry, hydrogen production, as well as use with bioenergy
- **Bioenergy** is very useful, but limited resource means it can only be a small part of UK energy supply, and should be used primarily with CCS in the long-term if possible
- The UK should put itself in a position to **meet the 2050 target domestically**, although use of international credits at the margin may turn out to be appropriate
- **The path to 2050 is uncertain**, and it is therefore sensible to keep in play a range of ways to meet the 80% target

The path to 2050 is not certain – it is not prudent to rely on a single scenario to achieve the 80% target

- Meeting the 80% target is a huge challenge, and subject to several categories of uncertainty:

Low-carbon **technology costs & performance**

Fossil fuel prices

Emerging scientific evidence on **allowed emissions**

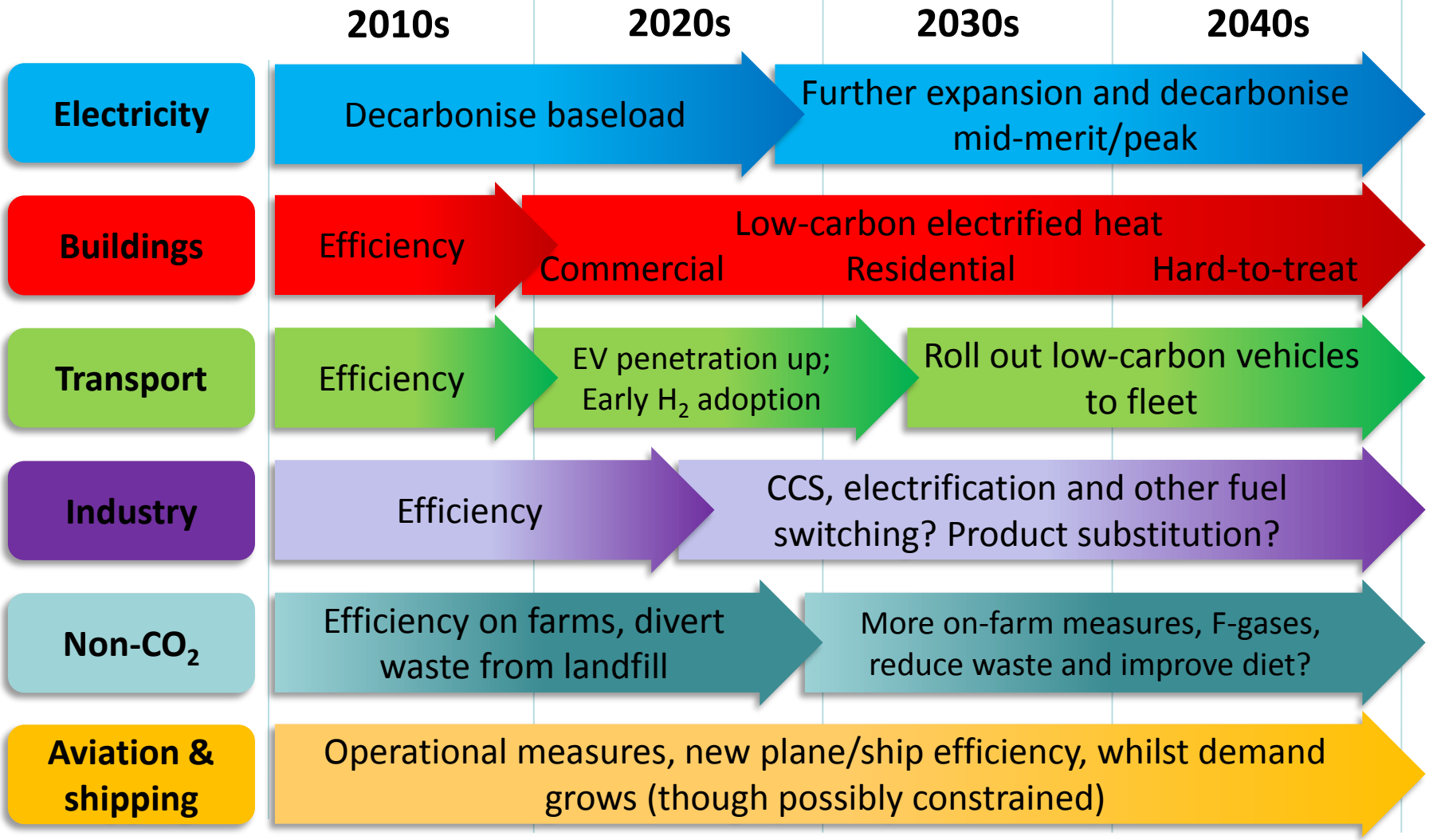
Public acceptability of key low-carbon options

Demand / behaviour change

(... and unknown unknowns!)

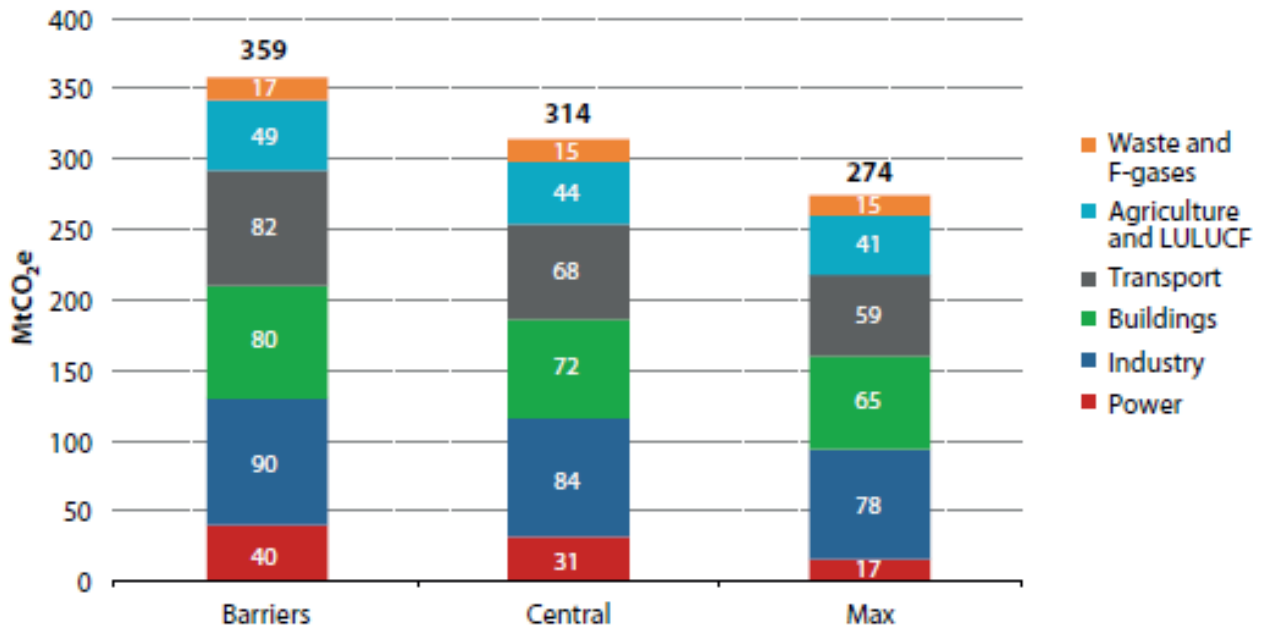
- Aiming for any single scenario is likely to result in falling short of meeting the 2050 target, as there are many potential ways in which this could be derailed
- So it is important to take an approach that keeps a range of sensible options in play, without excessive cost

The broad story behind our scenarios to 2050



Our analytical approach to developing sectoral scenarios allows for different balances of technologies and behaviour change

Figure 3.11: Total emissions under Barriers, Central and Max scenarios in 2030



Source: CCC analysis.

Barriers scenario: allows for difficulties in implementing some of the low-carbon measures in the Central scenario

Max scenario: more is achieved, for example because some outcomes prove quicker or less costly to deliver than currently anticipated

Alternative scenarios: these deliver the same emissions reduction as the Central scenario but in a different way (e.g. more behaviour change or a greater role for hydrogen)

Does myopic optimisation really mimic the policy process?

- The policy process is generally quite short-termist, which clearly does not lend itself to arriving at results that are optimal from a long-term perspective
- But it is also important to ask whether introducing myopia is sufficient…
  - Policy decisions are not always based on evidence, even for their near-term benefits
  - Government's have a range of priorities, some of which can be readily modelled (e.g. affordability) and some less so (e.g. political populism)
  - They also have preferences over particular instruments (e.g. markets good, regulation bad)
- Removing the assumption of perfect foresight moves us more towards a simulation approach, which are useful as they (should) get closer to reality
  - Can limited foresight optimisation models provide a bridge between simulation and perfect foresight, or do they fall between the two stools?
- But the real prize for energy policy is generating hedging strategies – acting in a 'least-regrets' way under uncertainty

Towards better energy policy and what this means for modelling

- **Addressing the behaviour challenge head-on**
  - incorporating insights on people's behaviour into policy design is crucial – ideally this would be well supported by modelling insights
- **How to take action under uncertainty**
  - the world is uncertain, but there is a need to act now… how do we do so in a 'least-regrets' way
  - this implies not just limited foresight optimisation but also hedging strategies in response to that limited foresight
  - how to design strategies for the next two decades that are robust to uncertainties and keep in play a range of longer-term solutions
- **Generating a range of solutions**
  - the policy process is not always based on analysis of the 'best' path
  - sometimes it is very useful to have a range of options that might be broadly sensible, rather than a single one