Committee on Climate Change

Renewable Energy and the CCC Renewables Review

Presentation to the EPRG Spring Conference

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Professor Michael Grubb

Faculty of Economics, Cambridge University

Context: a rich body of new analysis!

- Books …
- IEA studies
- IPCC Special Report on Renewable Energy, adopted May 2011
- Climate Change Committee Renewables report
  - Background
  - October letter of advice on 2020 target
  - May 2011 report

European context: the UK expected to 'catch up' in context of EU 20% renewables target …

Share of renewables in UK energy consumption

	2004	2005	2006	2007	2008	2009
Heating and cooling	0.7%	0.9%	1.0%	1.2%	1.4%	1.6%
Electricity	3.5%	4.1%	4.5%	4.8%	5.4%	6.6%
Transport	0.1%	0.2%	0.5%	0.9%	2.0%	2.5%
Total	**1.1%**	**1.4%**	**1.6%**	**1.8%**	**2.4%**	**3.0%**

By 2020:
15% renewables
(EU Directive)

The Renewable Energy Review:

- Builds on our fourth budget work looking to 2030 and beyond
- Sets out new technical and economic analysis
- Presents scenarios for renewable energy
- Considers implications for 2020 ambition
- Assesses key enabling factors

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2. The role for renewable energy in:
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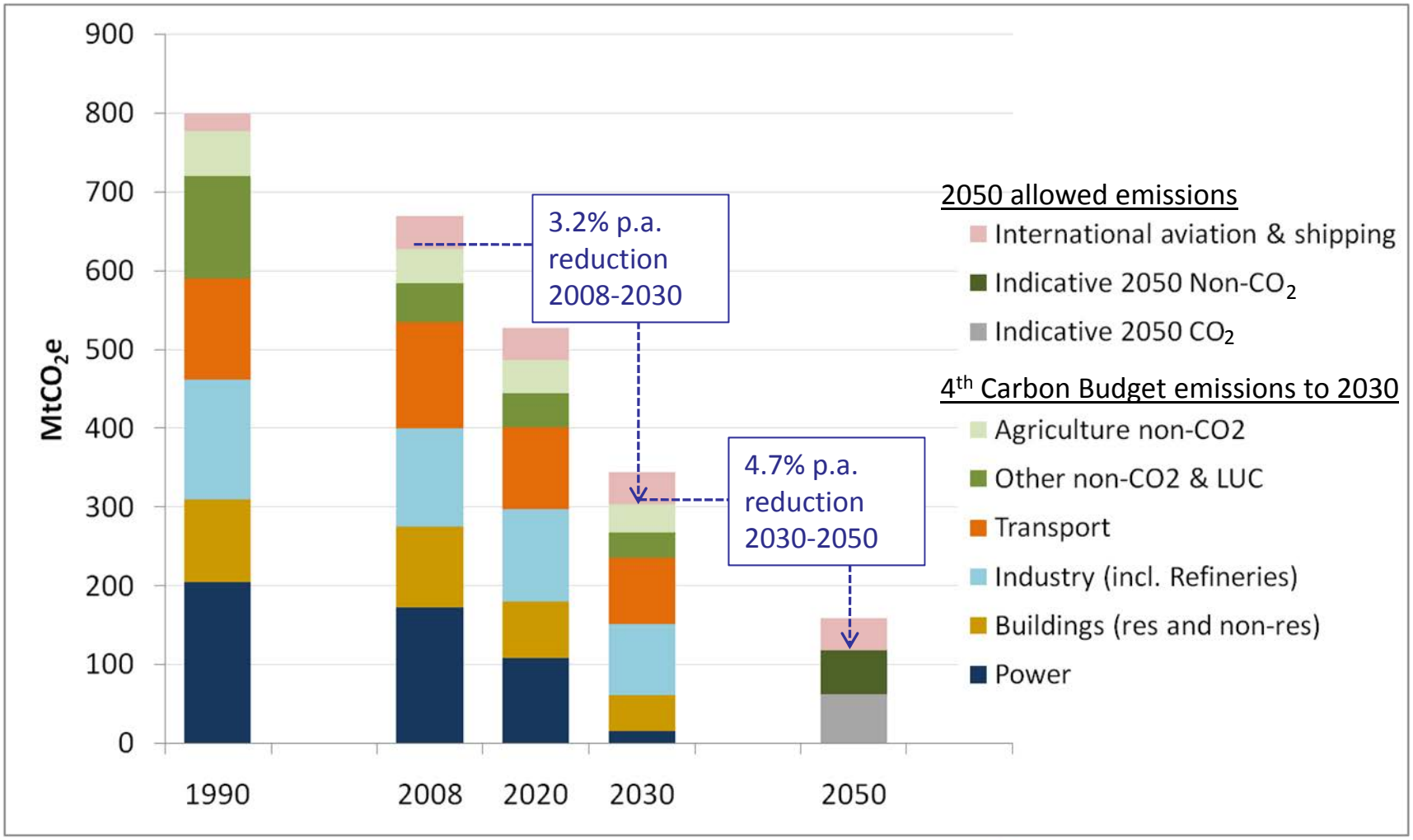
Large emissions reduction needed to 2050



Source: CCC (2010), Fifth Fourth Carbon Budget

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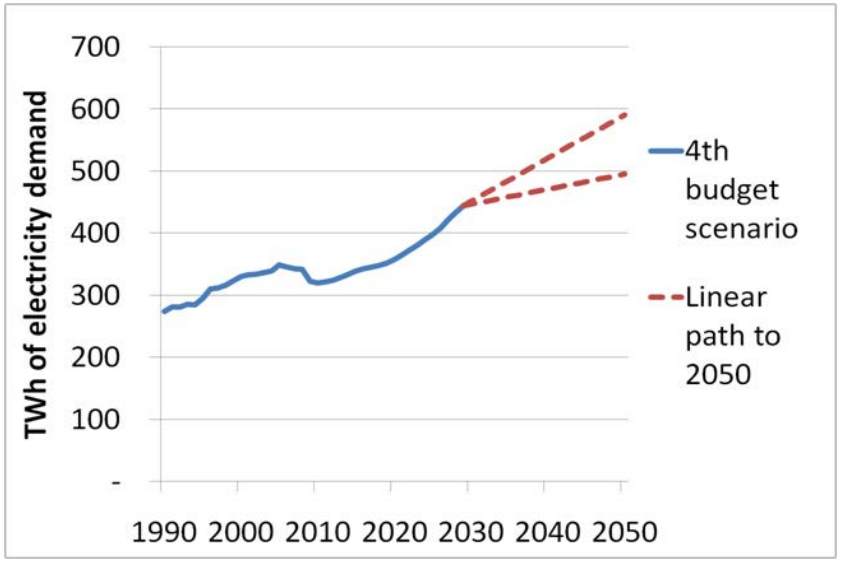
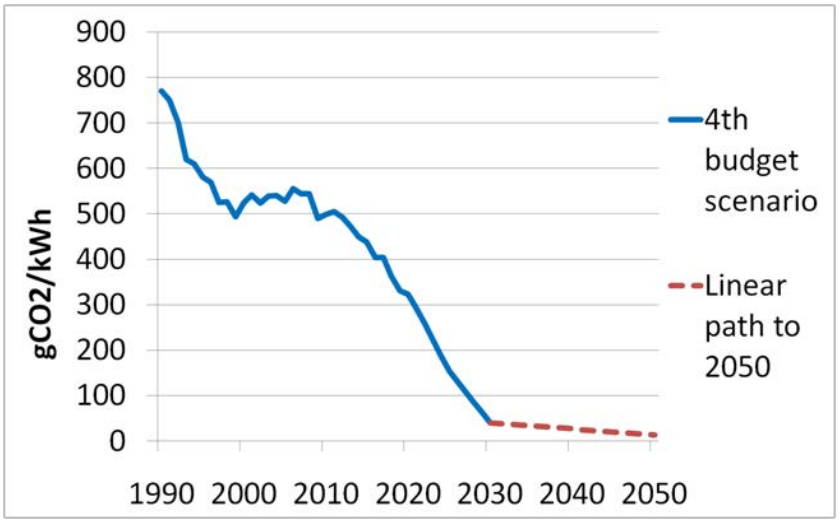
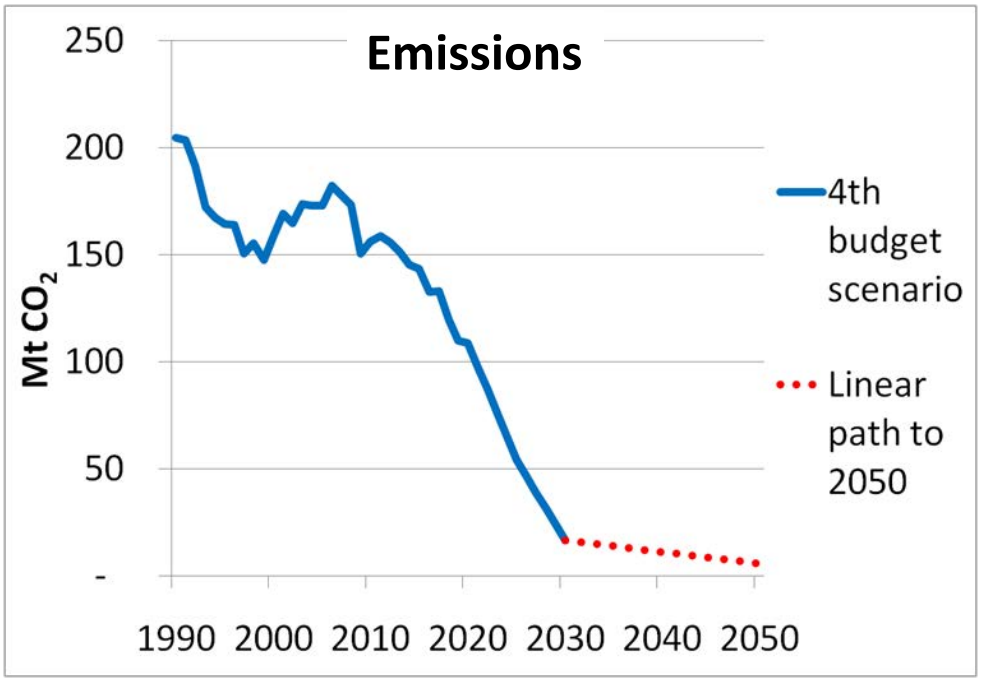
The power sector has a crucial strategic role in decarbonisation to 2050



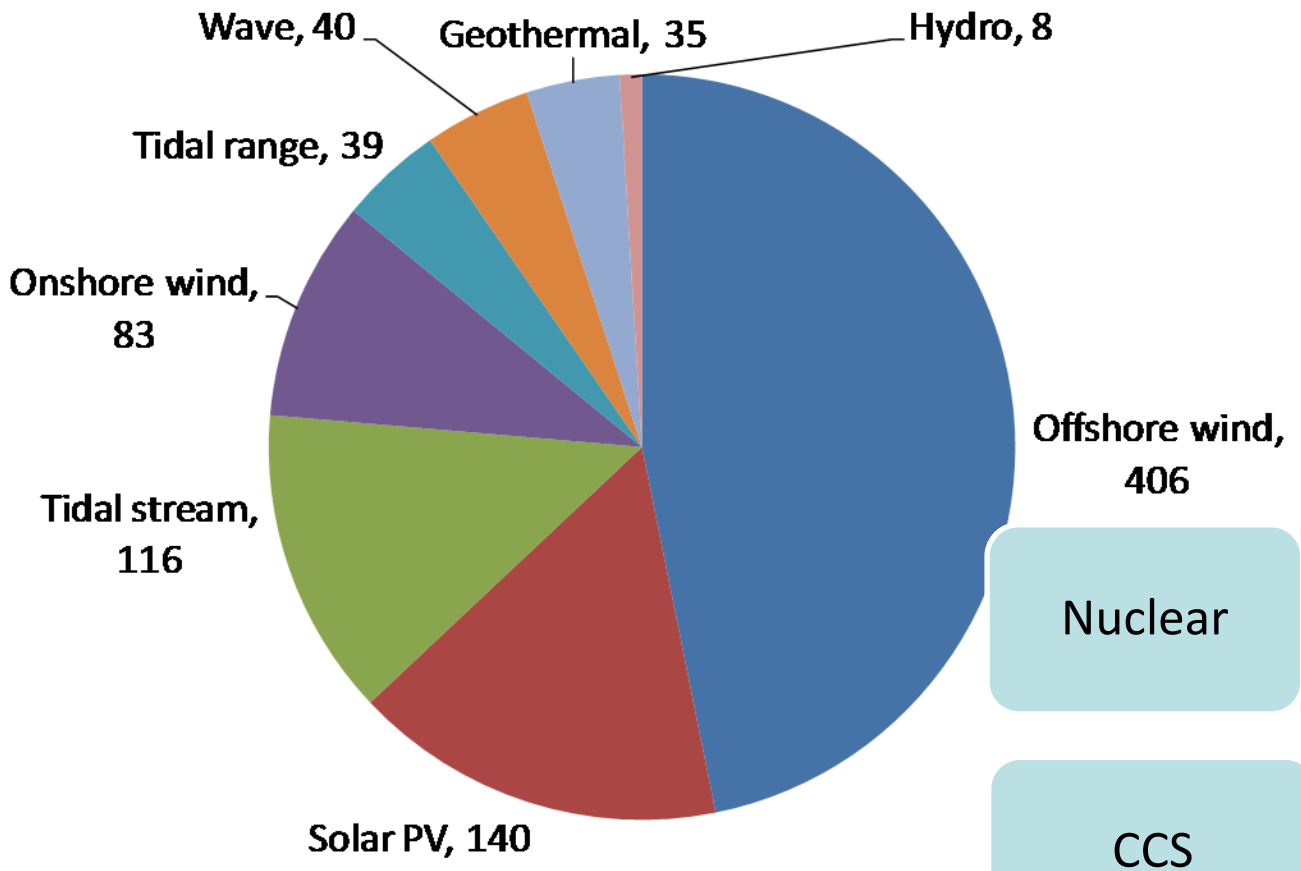




Source: Medium scenario and range of MARKAL model runs for CCC (2010) The Fourth Carbon Budget

There is abundant UK renewable resource

Estimated practical resource for UK renewables = ~860 TWh per year
> Electricity demand = c. 350 TWh today, 500-600 TWh in 2050



Nuclear

- Fuel shortage unlikely before 2050
- Availability of sites?

CCS

- Fuel supplies abundant
- CO_2 storage capacity?

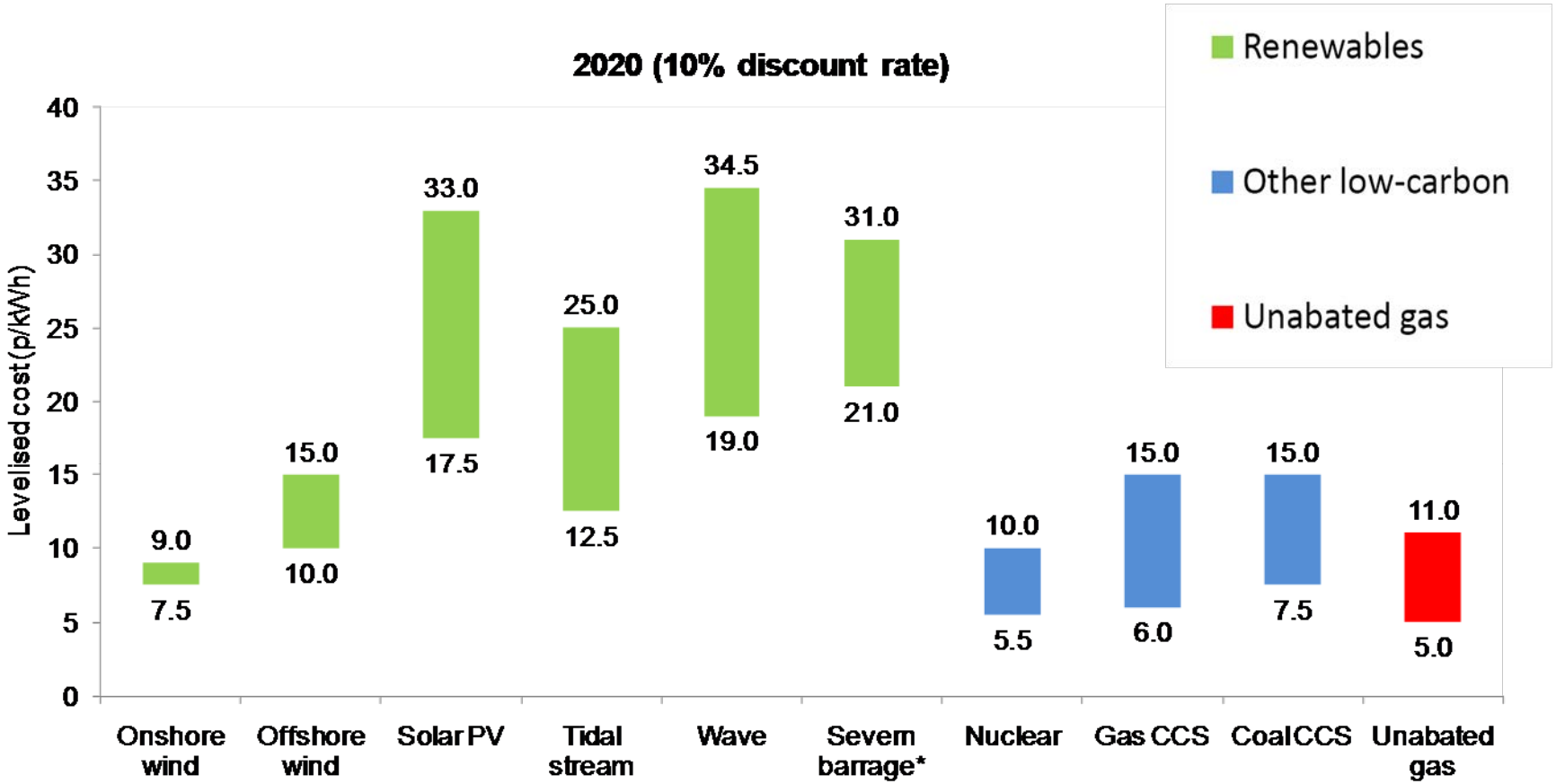
Intermittency: There are a range of flexibility options to 'keep the lights on' when the wind does not blow (and fully utilise low-carbon resources when it does)

E.g. when wind doesn't blow:

- Movable demand shifts to overnight
- Interconnector swings into import mode
- Generation from storage where available (e.g. bulk storage, vehicle-to-grid)
- CCGT and other flexible generation ramps up

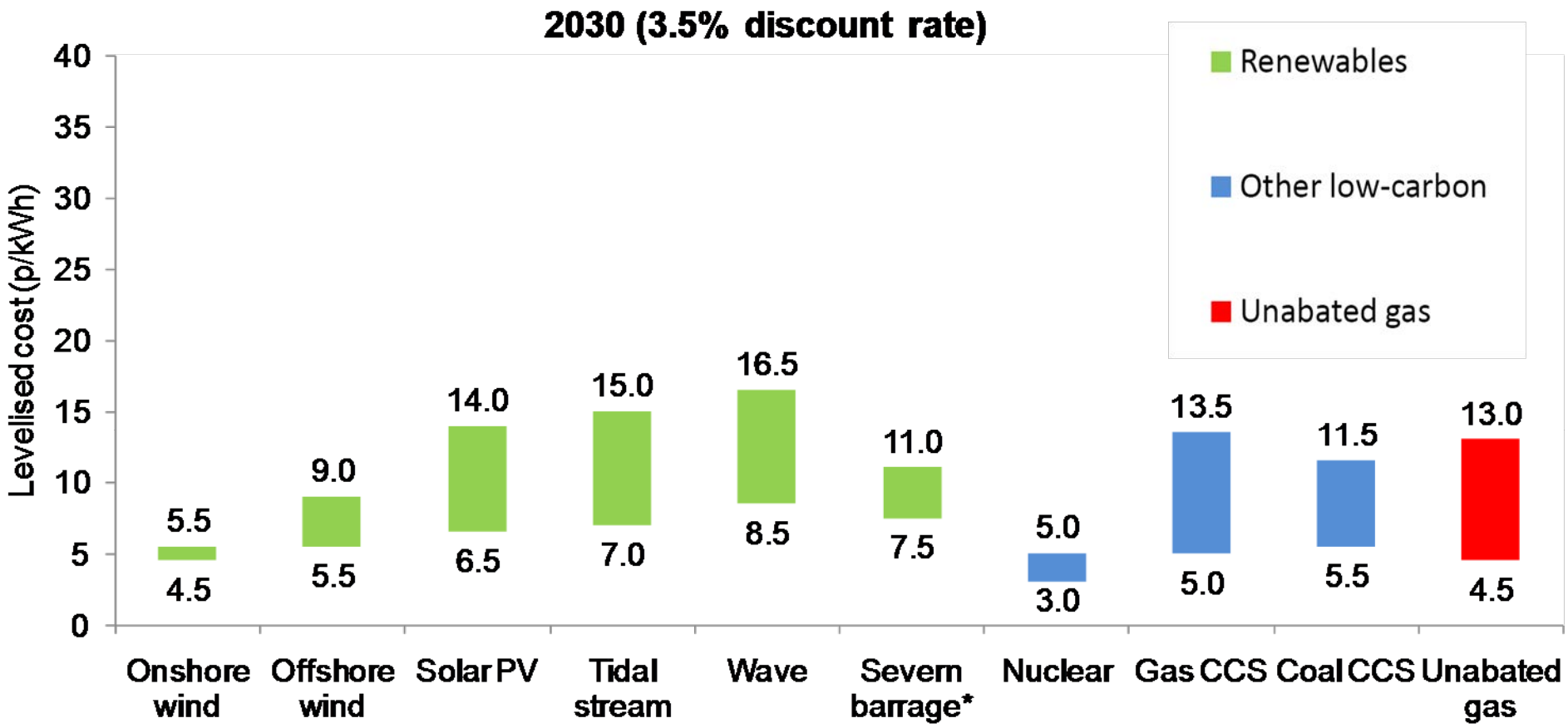
→ Renewable shares up to 65% in 2030 and 80% in 2050 could be managed at a cost likely to be low relative to the cost of generation

Economics of low-carbon technologies 2020 - 10% discount rate



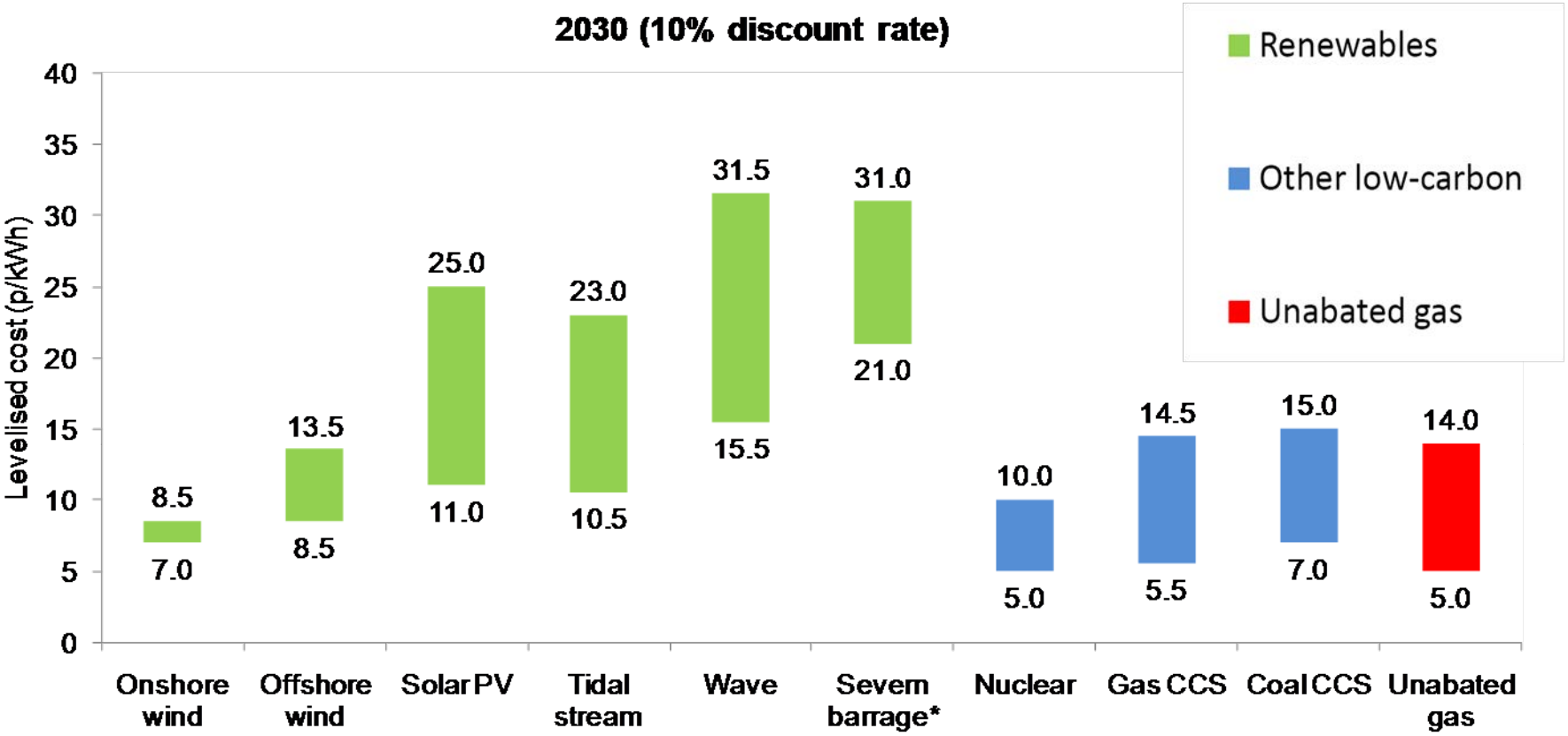
Note: 2010 prices. Source: CCC calculations based on Mott MacDonald (2011) *Costs of low-carbon technologies*, *Severn barrage costs (Cardiff Weston scheme) from DECC (2010) *Severn Tidal Feasibility Study.*

Relative economics of capital-intensive low-carbon technologies improve at a lower discount rate (e.g. 3.5%)



Note: 2010 prices. Source: CCC calculations based on Mott MacDonald (2011) *Costs of low-carbon technologies*, *Severn barrage costs (Cardiff Weston scheme) from DECC (2010) *Severn Tidal Feasibility Study.*

2030: Wide range of low-carbon technologies likely to be cheaper than unabated fossil fuel facing a carbon price of £70/t, but uncertain which will be cheapest in long-term



Note: 2010 prices. Source: CCC calculations based on Mott MacDonald (2011) *Costs of low-carbon technologies,* *Severn barrage costs (Cardiff Weston scheme) from DECC (2010) *Severn Tidal Feasibility Study.*

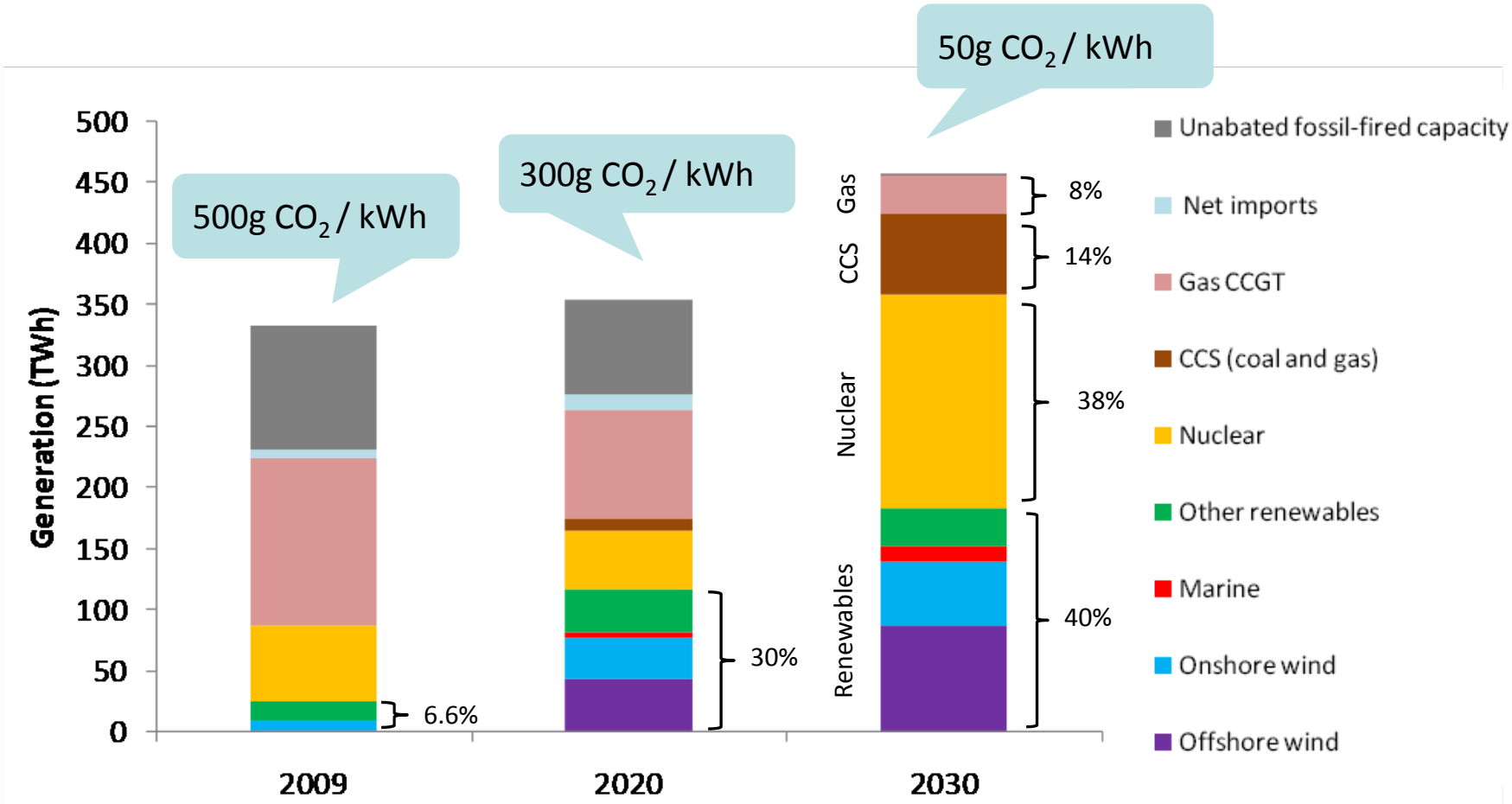
A portfolio approach is therefore appropriate for power sector decarbonisation

		Economics		Resource	Limitations / Risks
		Current	Future		
Likely to play major role	**Nuclear**	Appears lowest cost			Sites, waste storage, public attitudes
	Onshore wind				Acceptability (planning) constraints
	Offshore wind		?		
Could play major role, UK deployment important to developing option	**CCS**		?		Access to storage Subject to demo success
	Tidal stream and wave		?		Subject to demo success
May play role, UK deployment not required to drive down costs	**Solar PV**	Globally driven	?		Can buy in if costs fall globally
	Tidal barrage	Limited scope for costs to fall			Useful option if others constrained/expensive

= favourable outlook = uncertain, potentially favourable

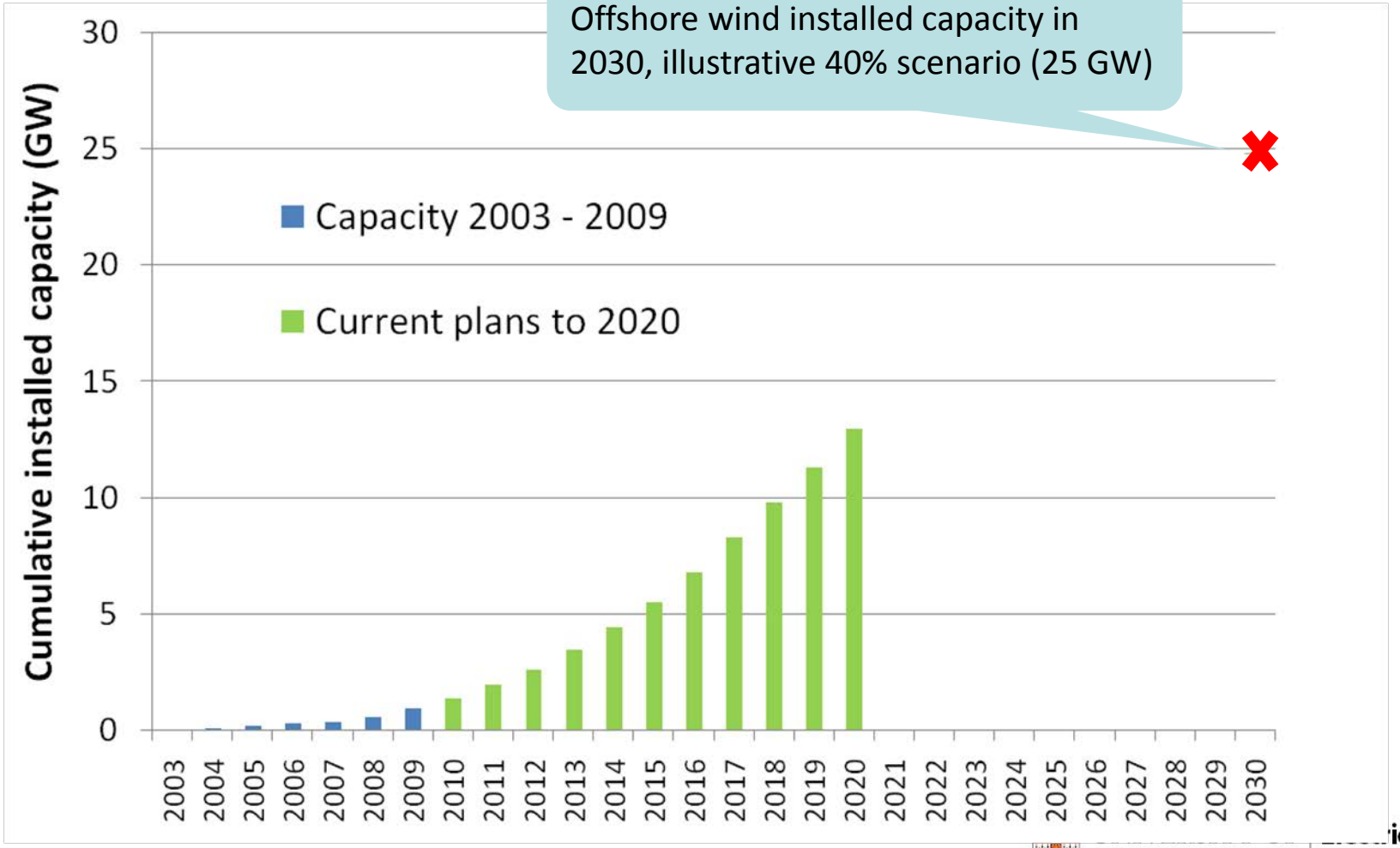
A portfolio approach: Firm minimum commitments on less mature technologies are required, alongside competitive investment in mature technologies.

An illustrative scenario for power sector decarbonisation to 2030 – 40% renewable, 40% nuclear



Source: DUKES (2010), CCC Calculations, based on modelling by Pöyry Management Consulting.
Includes losses, excludes generator own-use and autogeneration.

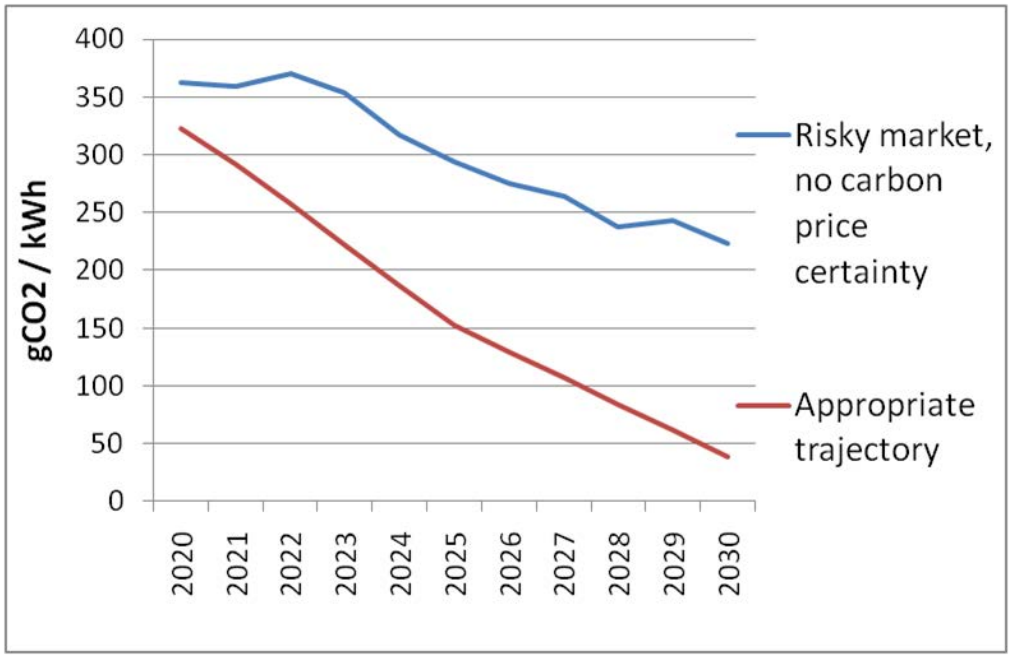
2030 commitments can avoid stop-start investment cycles and provide confidence in long-term market.



Commitments should be built into new market arrangements to minimise cost of capital

- Current market arrangements won't deliver required decarbonisation.

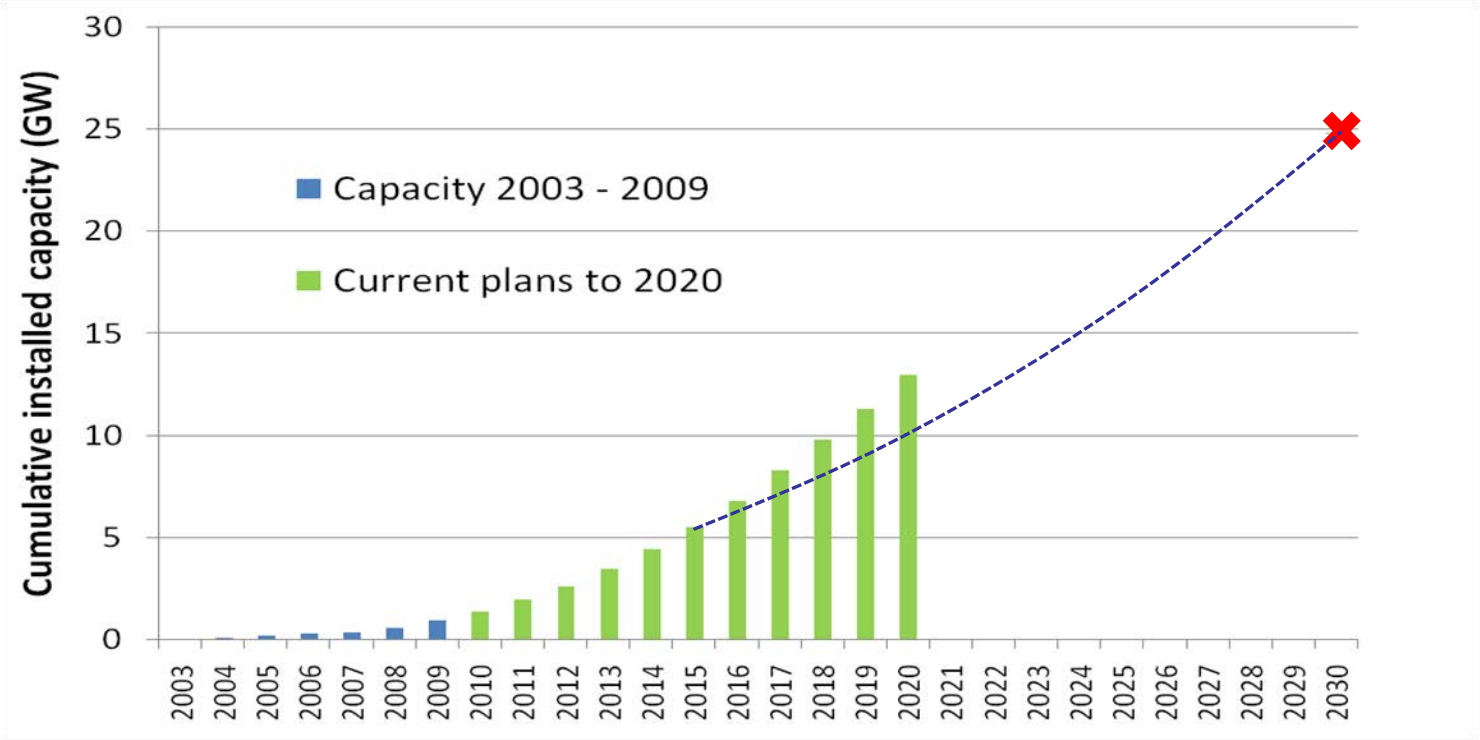
Emissions intensity – current market v. required



- Government has proposed **long-term contracts** for low-carbon generation based on a Contract for Difference model
- **Portfolio approach:** Reserve a minimum number of contracts for the emerging technologies (offshore wind, marine, CCS)

There may be scope to smooth the path of offshore wind to 2020, whilst still meeting the UK's EU renewables target

-> a pragmatic approach is required



Lower-cost options for increased effort include:

- More onshore wind, requiring greater community support
- More renewable heat, if supply chain bottlenecks overcome
- Imports, such as Concentrated Solar Power
- Renewable Energy Credits, allowed under the EU Directive

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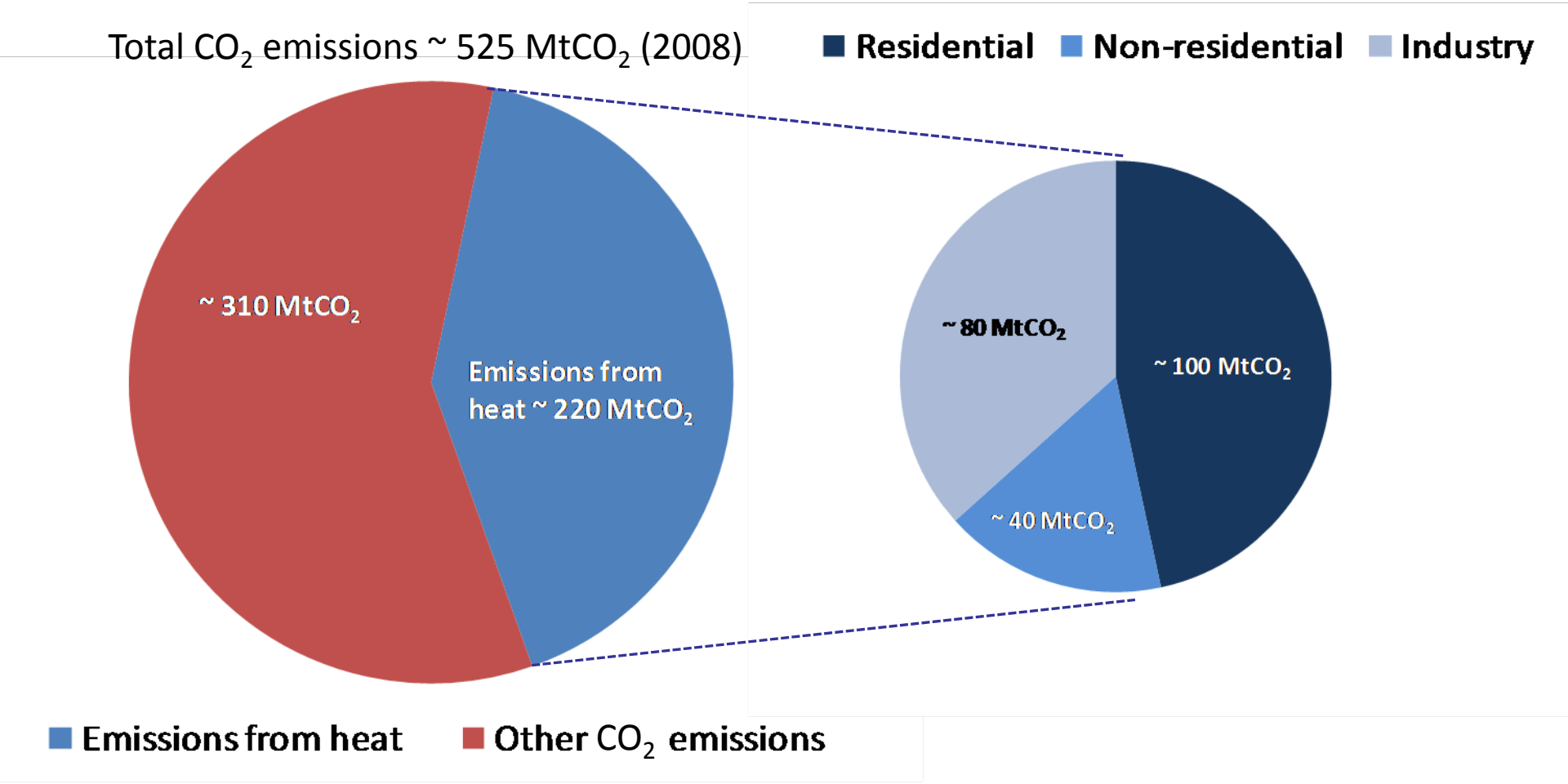
Emissions from heating account for around 40% of UK CO_2 emissions, mainly from buildings



Source: DECC data, 2008 emissions

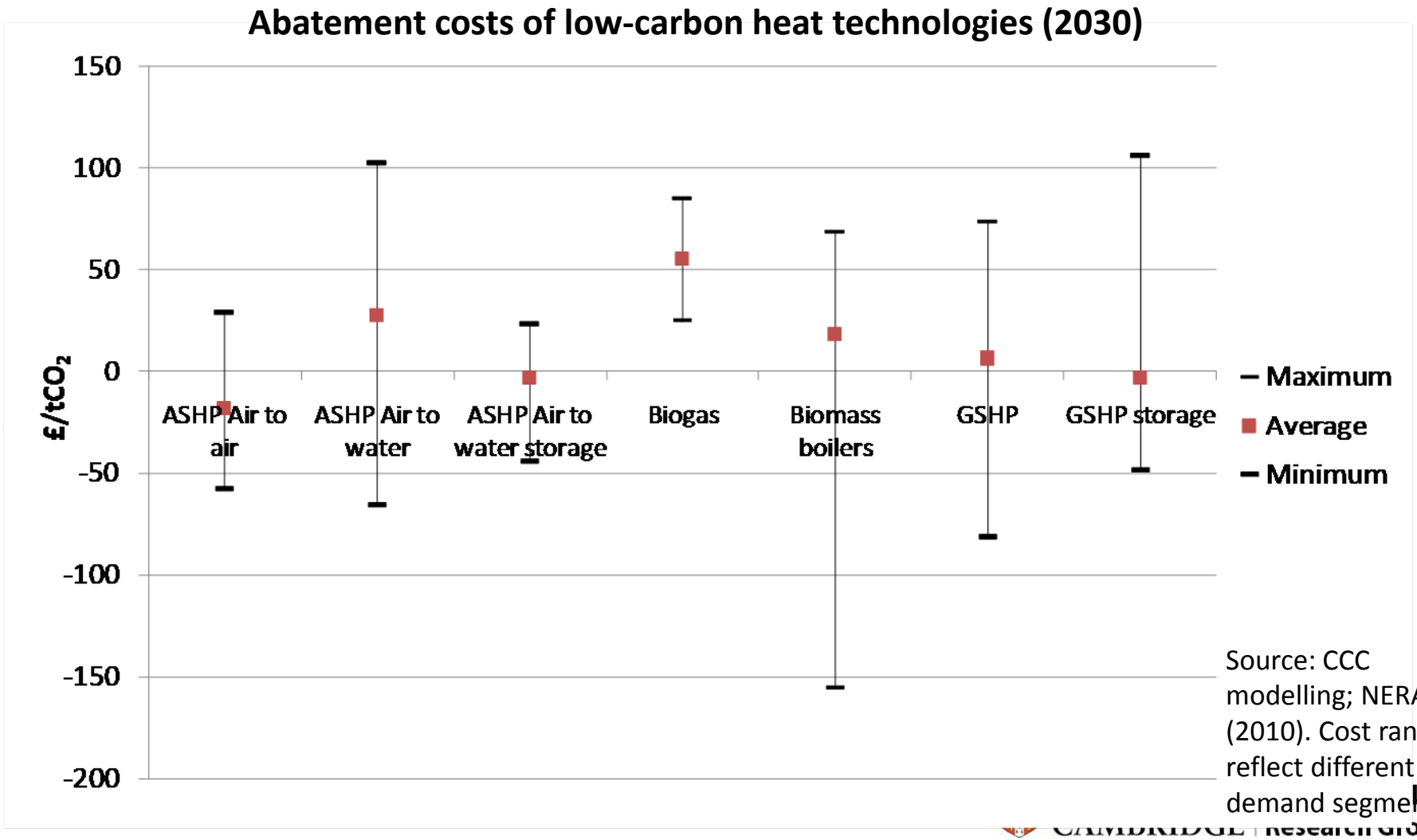
Options for decarbonising heat

Heat pumps (air-source and ground-source)

Biomass

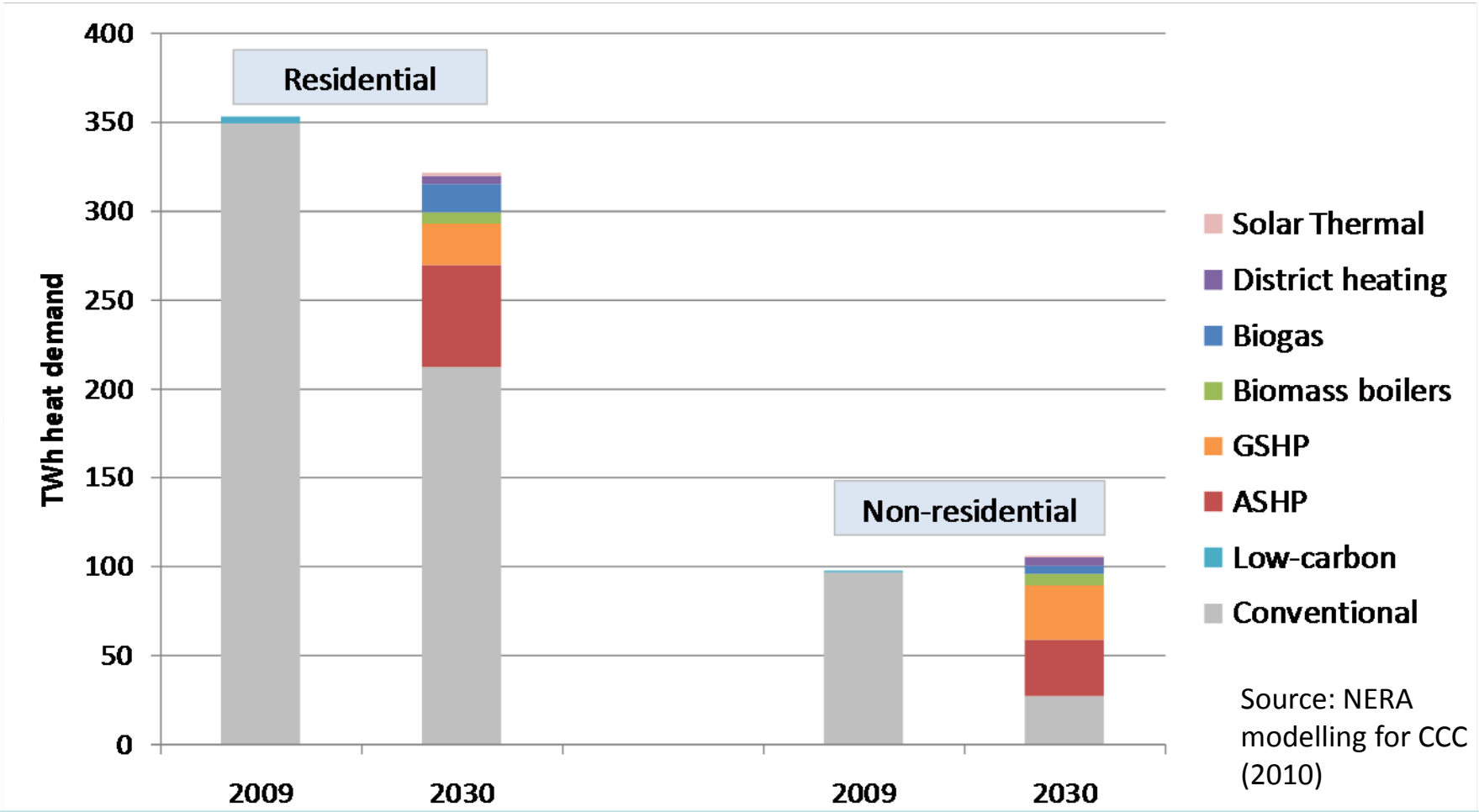
Biogas

Economics of renewable heat technologies



Source: CCC modelling; NERA (2010). Cost ranges reflect different demand segments

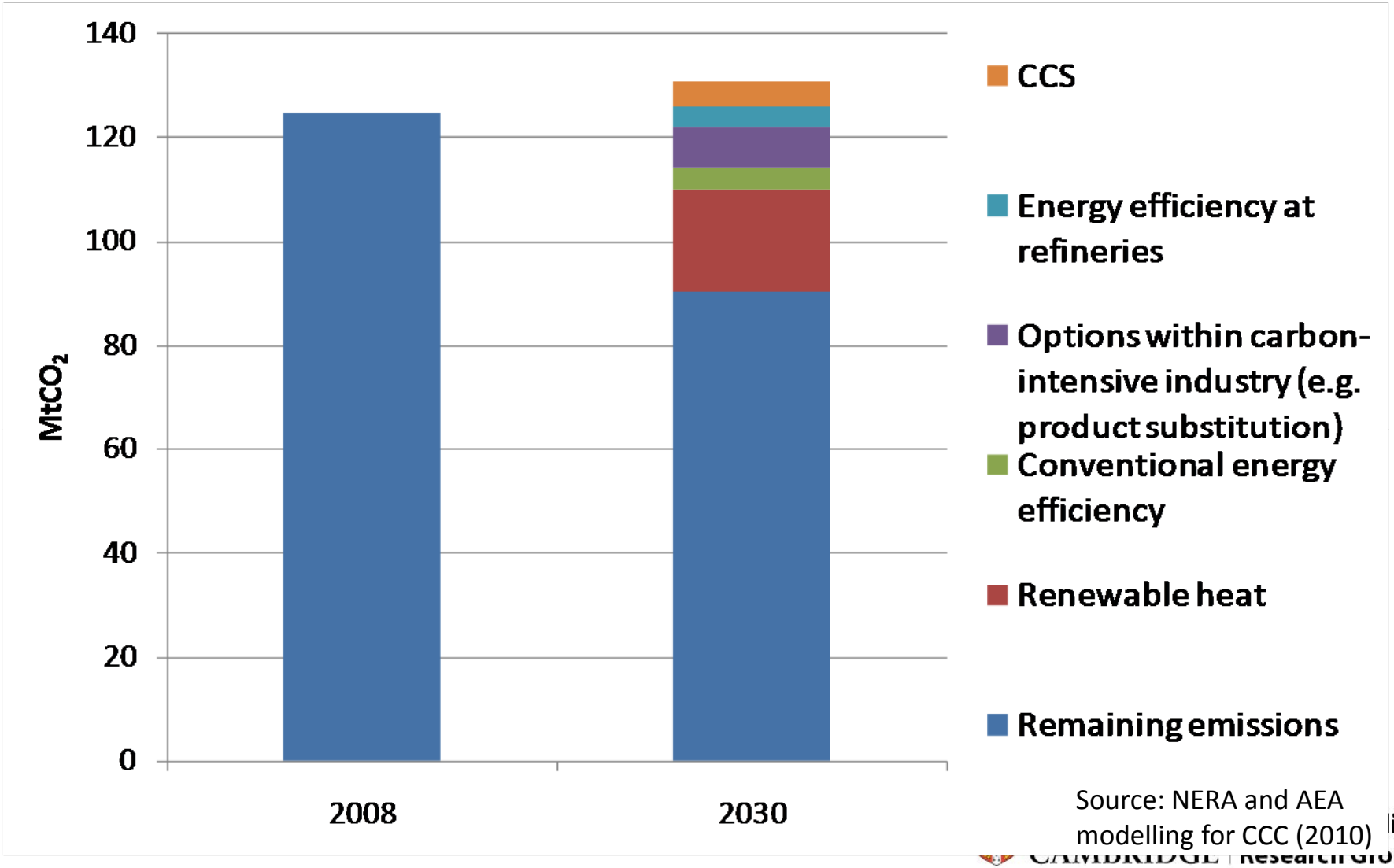
Heat demand in buildings:
Significant opportunity to reduce emissions to 2030, with major role for heat pumps



Source: NERA modelling for CCC (2010)

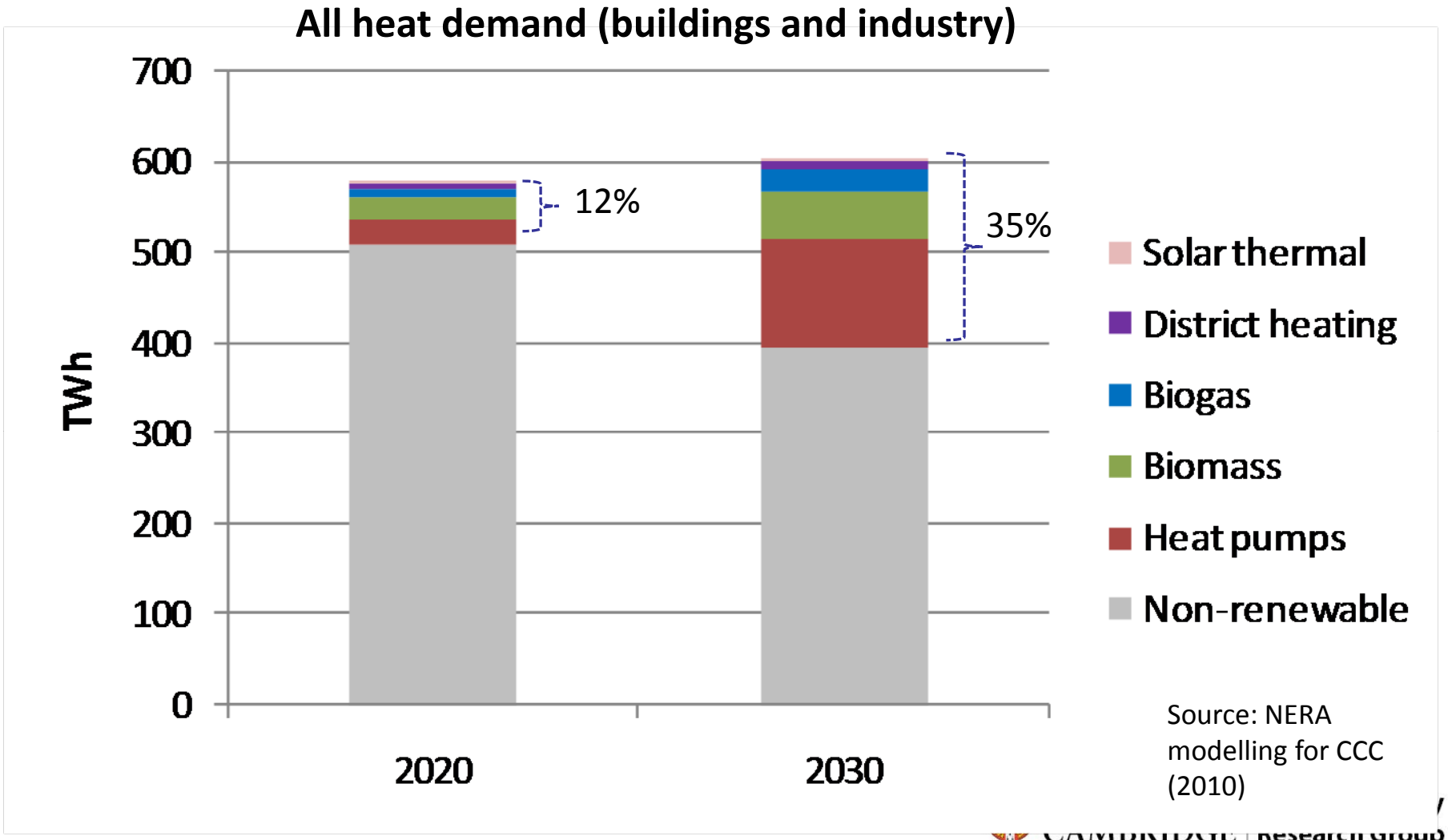
- Demand reductions from efficiency improvements, including 3.5 million solid walls by 2030 in residential buildings
- Low-carbon sources reach ~35% of residential heat demand and ~75% of non-residential heat demand in 2030

Industry emissions and 2030 abatement potential



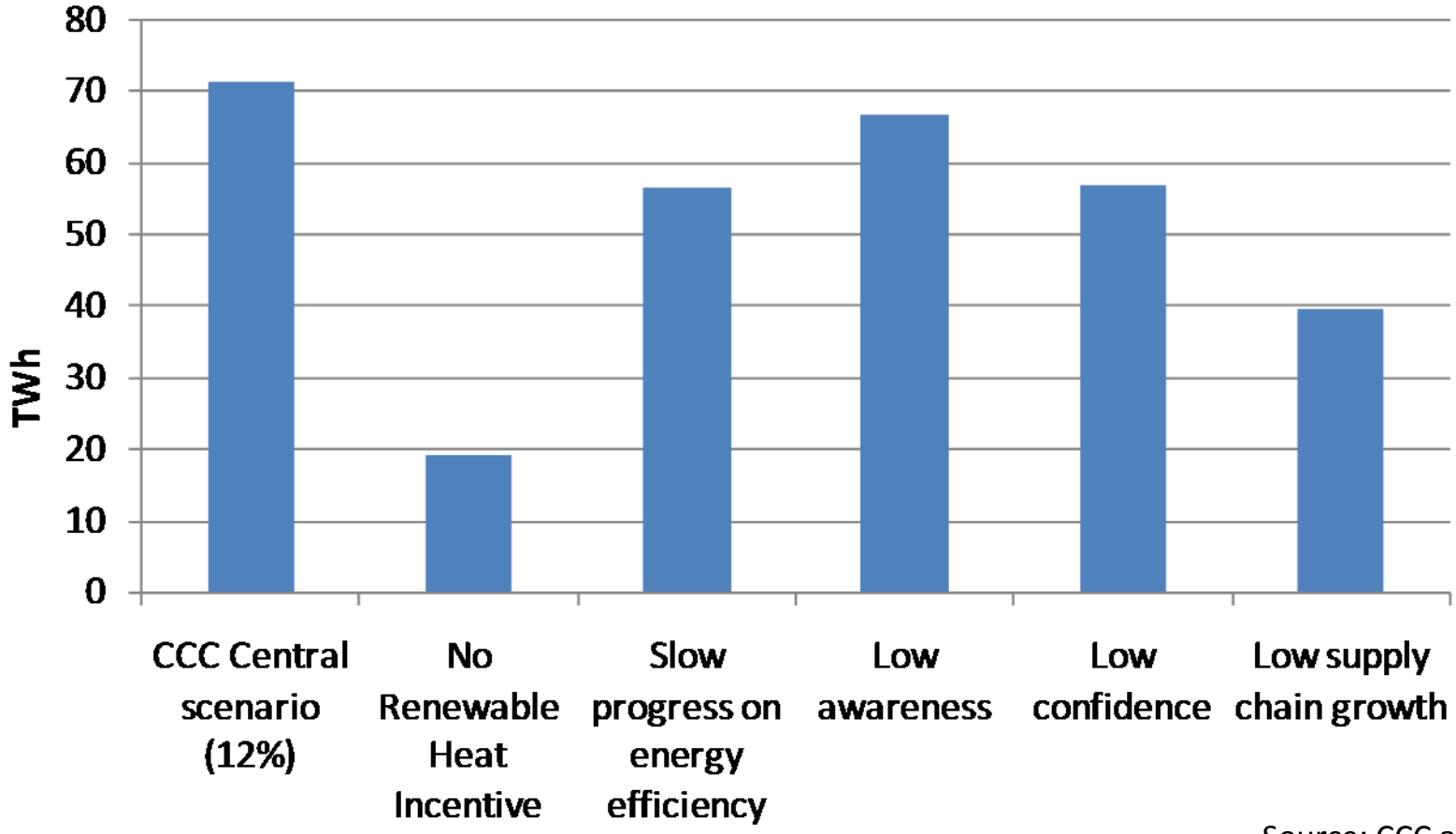
Source: NERA and AEA modelling for CCC (2010)

Progress is needed by 2020 on the path to 2030 goals



Source: NERA modelling for CCC (2010)

Delivery of 2020 (and 2030) renewable heat ambition will require removal of barriers



Source: CCC analysis based on modelling by Element Energy/NERA (2011)

Removing barriers will require policy intervention

Ongoing financial support

- Announced support to 2015 broadly appropriate
- Increased funding will be required beyond 2015
- Further support required in 2020s
- Must cover domestic heat pumps

Accreditation and training of installers and suppliers

Required to:
- Avoid supply chain bottlenecks
- Increase consumer confidence

Integration of renewable heat and energy efficiency polices

Required to:
- Increase number of suitable buildings
- Improve consumer confidence / information (one-stop shop / whole-house approach)
- Provide possible source of up-front financing

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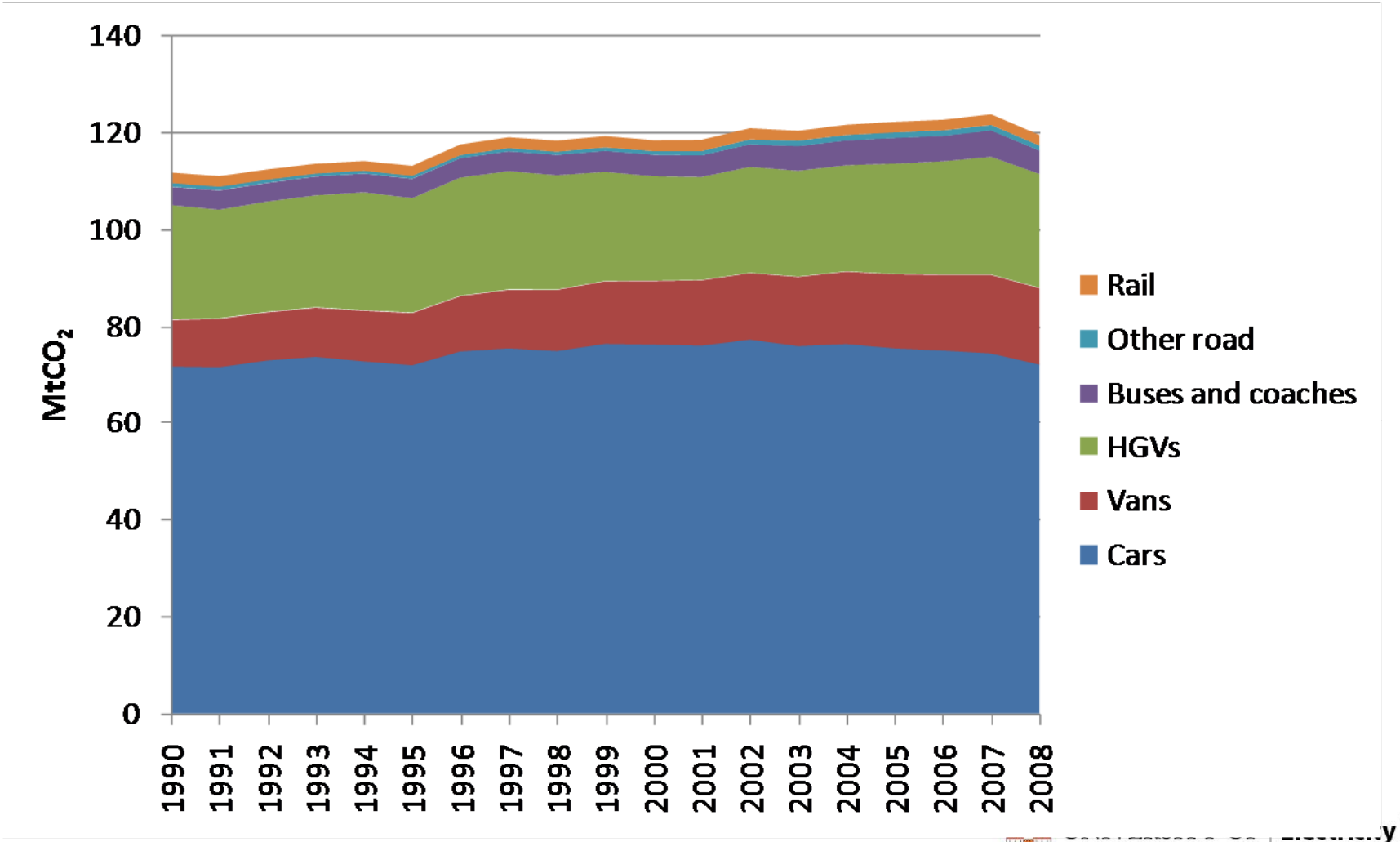
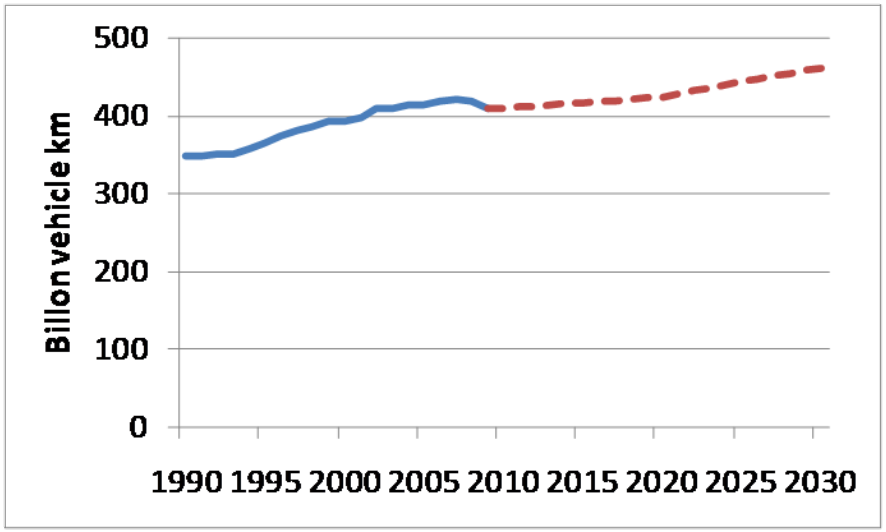
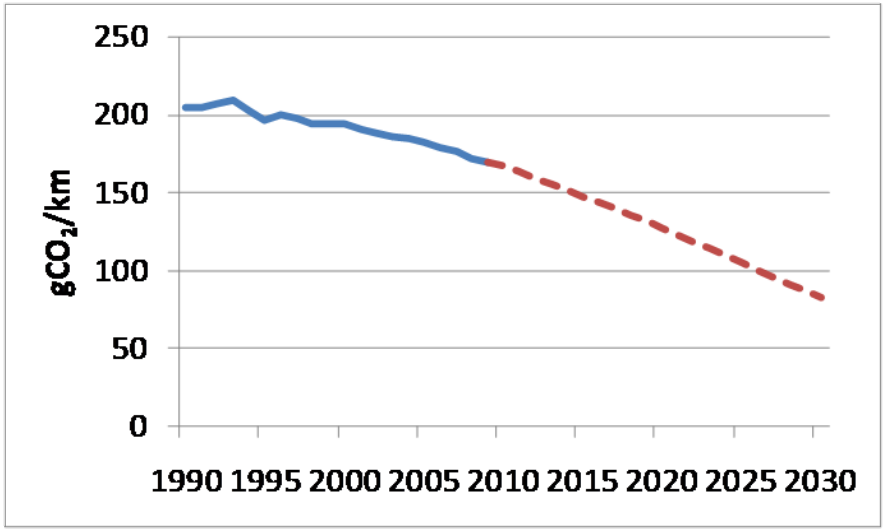
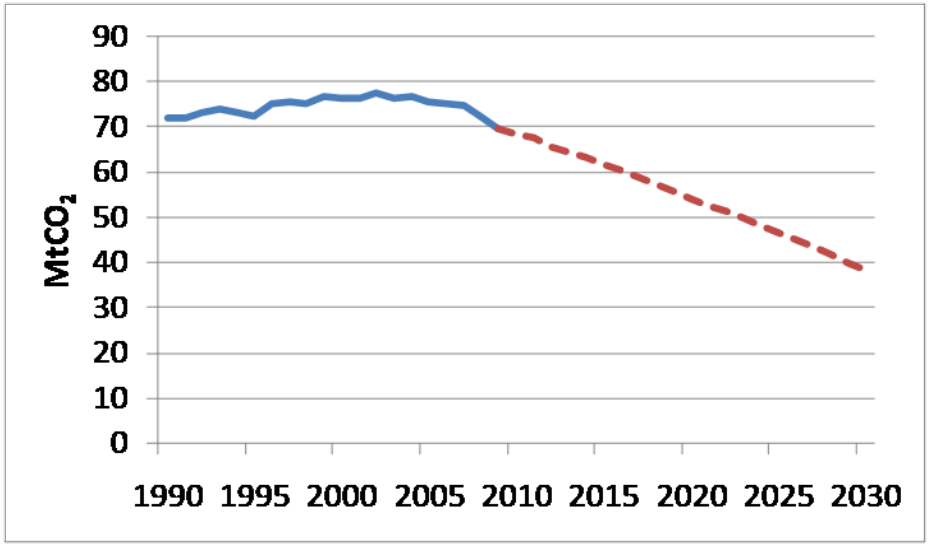
Transport: Cars dominate emissions, with vans and HGVs also important



Cars: Emissions reduction will come from reducing gCO_2/km, while km likely to increase







Source: DECC (2009), UK emissions statistics: 2008 final UK figures; DfT (2010), Transport Statistics Great Britain 2009; DfT (2010) Road Traffic and Congestion in Great Britain

Cars: Low-carbon vehicles need to be 60% of new sales in 2030

	2030			
	Share of new car sales		Share of miles	Emissions Intensity
Conventional cars	40%	→	70%	× 80-125 g/km
Plug-in hybrids	40%	→	20%	× 50 g/km
Pure electric vehicles	20%	→	10%	× 0 g/km

Average emissions intensity in 2030

New cars purchased: 52g/km (versus 144g/km in 2010)

All cars on road: 81 g/km (versus 169 g/km in 2009)

The role for biofuels in surface transport

Renewable Transport Fuel Obligation (RTFO)

5% of road transport fuels (by volume) from renewable sources by 2013/14 (2009 = ~3%)

Gallagher Review

Appropriate ambition 5-8% (by energy) in 2020

Cautious approach appropriate

Our scenarios reflect Gallagher Review conclusions

The Committee's Bioenergy Review

The Committee will publish its bioenergy review before the end of 2011

The review will:

- Develop scenarios for availability of sustainable bioenergy
- Consider where available sustainable bioenergy would best be used

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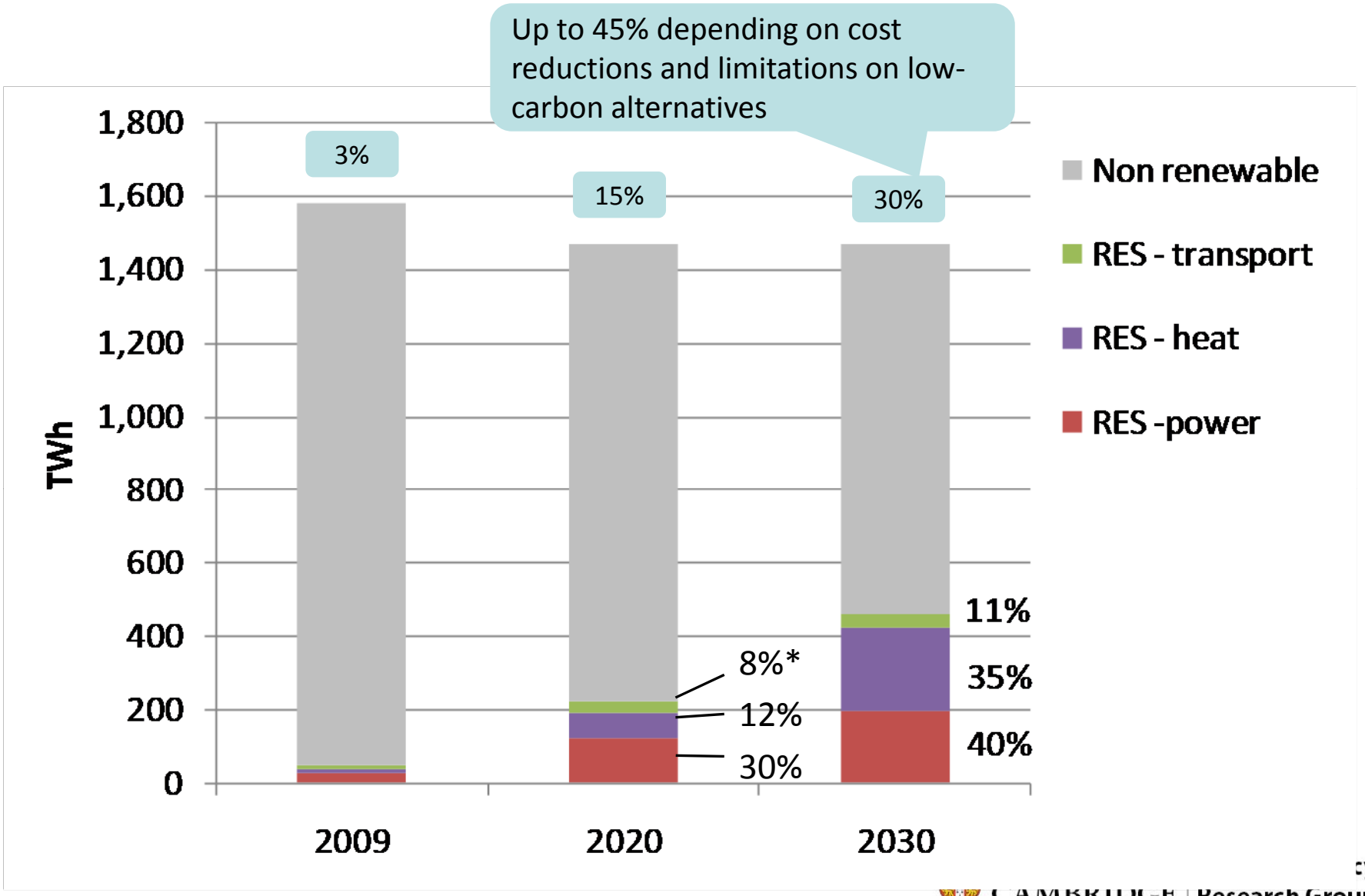
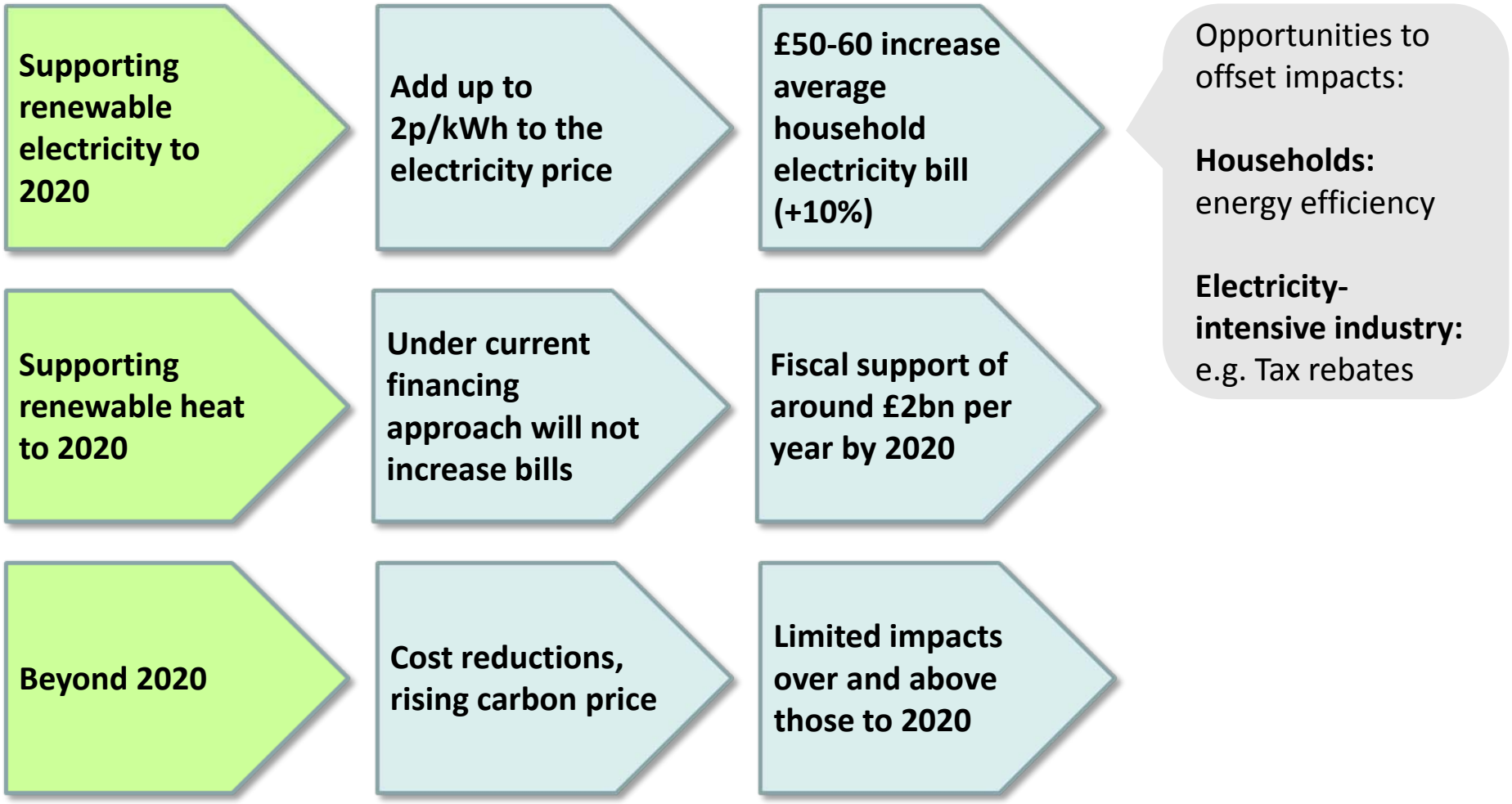
Illustrative economy-wide scenario for renewable energy



* 2020 ambition still meets 2020 transport sub-target of 10% given accounting rules

Potential bill impacts of renewable energy supports



Net impacts depend on what would happen under 'reference' scenario(s)

- Reference case: current market structure likely to deliver low-capital, low-investment-risk
  - gas, which has added investor advantage that cost risk can be passed directly through to power prices
  - Current central gas price estimates suggest this easily the cheapest
- As current coal & nuclear fleet retires, gas rises to dominate power (as well as heating): UK energy almost entirely dependent upon gas and petroleum
- To meet CO2 budgets then involves massive retrofit of CCS on the gas fleet - Risks on technology cost, viability and acceptability
- Alternate of (even more) nuclear-intensive future
  - Cannot help deliver much in this decade
  - Extremely rapid increase in 2020s
  - Lower diversity

Key issues include:

- Learning (and deferred learning) effects
- Option value of more diverse investment paths (and outcomes)
- Inertia and lock-in effects
- Short-run least cost *vs* strategic risk management

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Key messages

- Renewables are part of a **range of promising options** for decarbonisation

- Renewables should play a **major role in decarbonisation** – e.g. reaching 30% of energy (460 TWh) / 40% of electricity by 2030 in a central case, and up to a maximum of 45% (680 TWh)

- A **portfolio approach** is appropriate for power sector decarbonisation
  - Firm commitments on support for **offshore wind** and **marine** to 2030 should be made now as part of new electricity market arrangements

- The key challenge for renewable heat is **delivery**

- Sustainability concerns require a cautious approach to **transport biofuels**