

The Renewable Energy Review

Committee on Climate Change, May 2011

www.theccc.org.uk

Context:

This review was commissioned by the Government, to advise on the role of renewables and scope to increase ambition



Share of renewables in UK energy consumption

	2004	2005	2006	2007	2008	2009
<i>Heating and cooling</i>	0.7%	0.9%	1.0%	1.2%	1.4%	1.6%
<i>Electricity</i>	3.5%	4.1%	4.5%	4.8%	5.4%	6.6%
<i>Transport</i>	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)

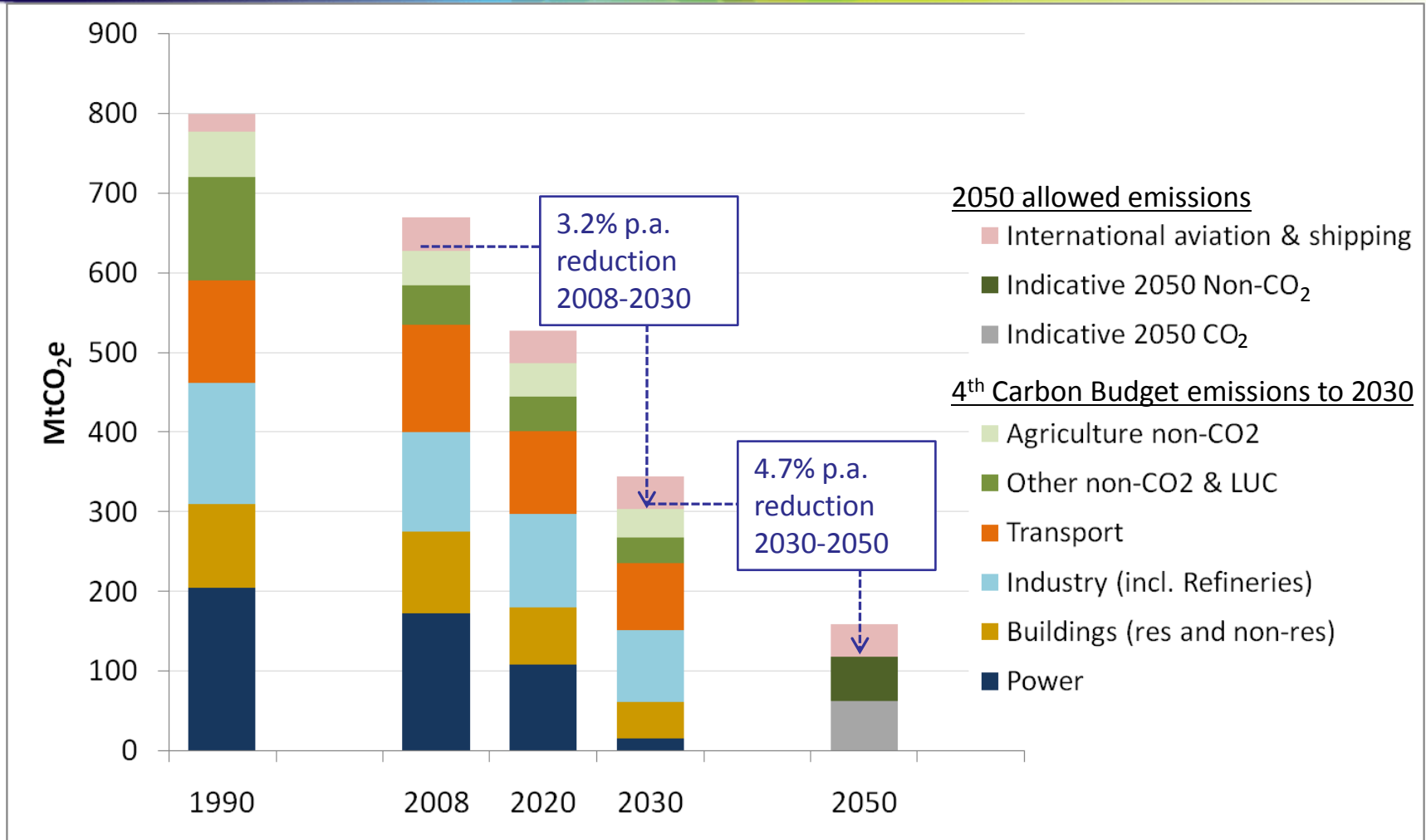
The Renewable Energy Review:

- 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

- 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) 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**

1. The decarbonisation challenge
2. The role for renewable energy in:
 - a. Power
 - b. Heat
 - c. Transport
3. Illustrative scenarios for renewable energy to 2030
4. Summary of recommendations

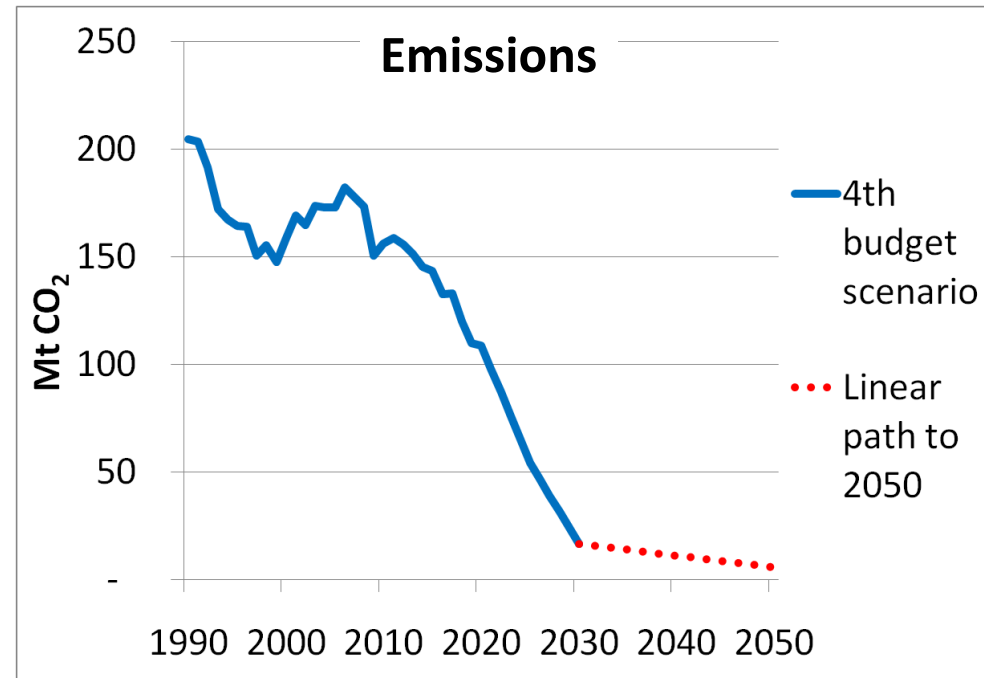
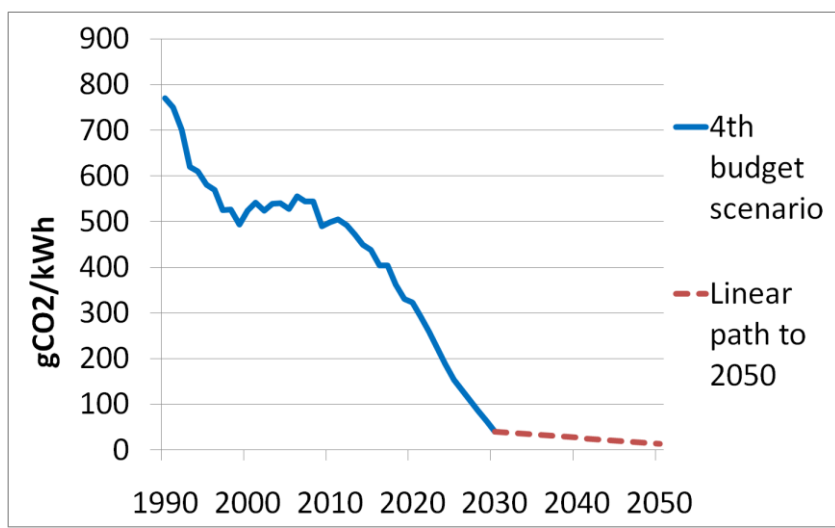
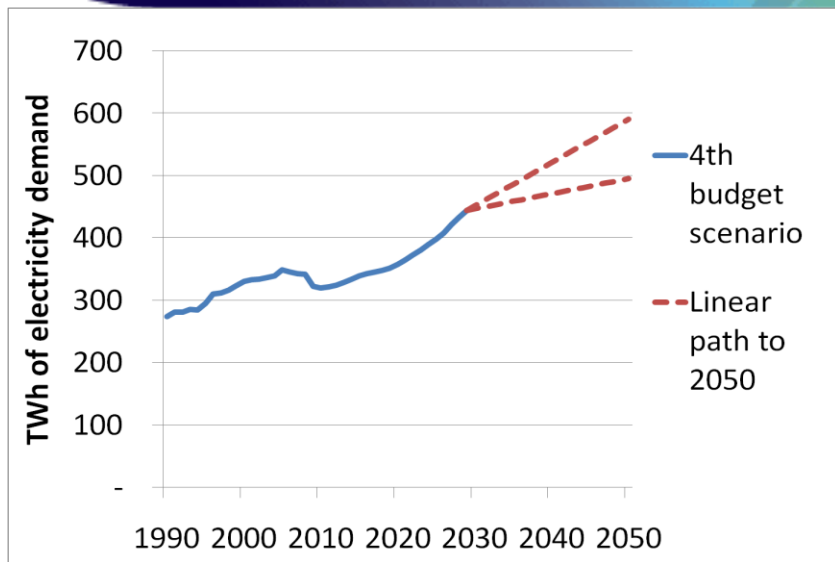
Large emissions reduction needed to 2050



Source: CCC (2010) The Fourth Carbon Budget

1. The decarbonisation challenge
2. The role for renewable energy in:
 - a. Power
 - i. Strategic importance
 - ii. Resource
 - iii. Intermittency
 - iv. Economics
 - v. Recommendations
 - b. Heat
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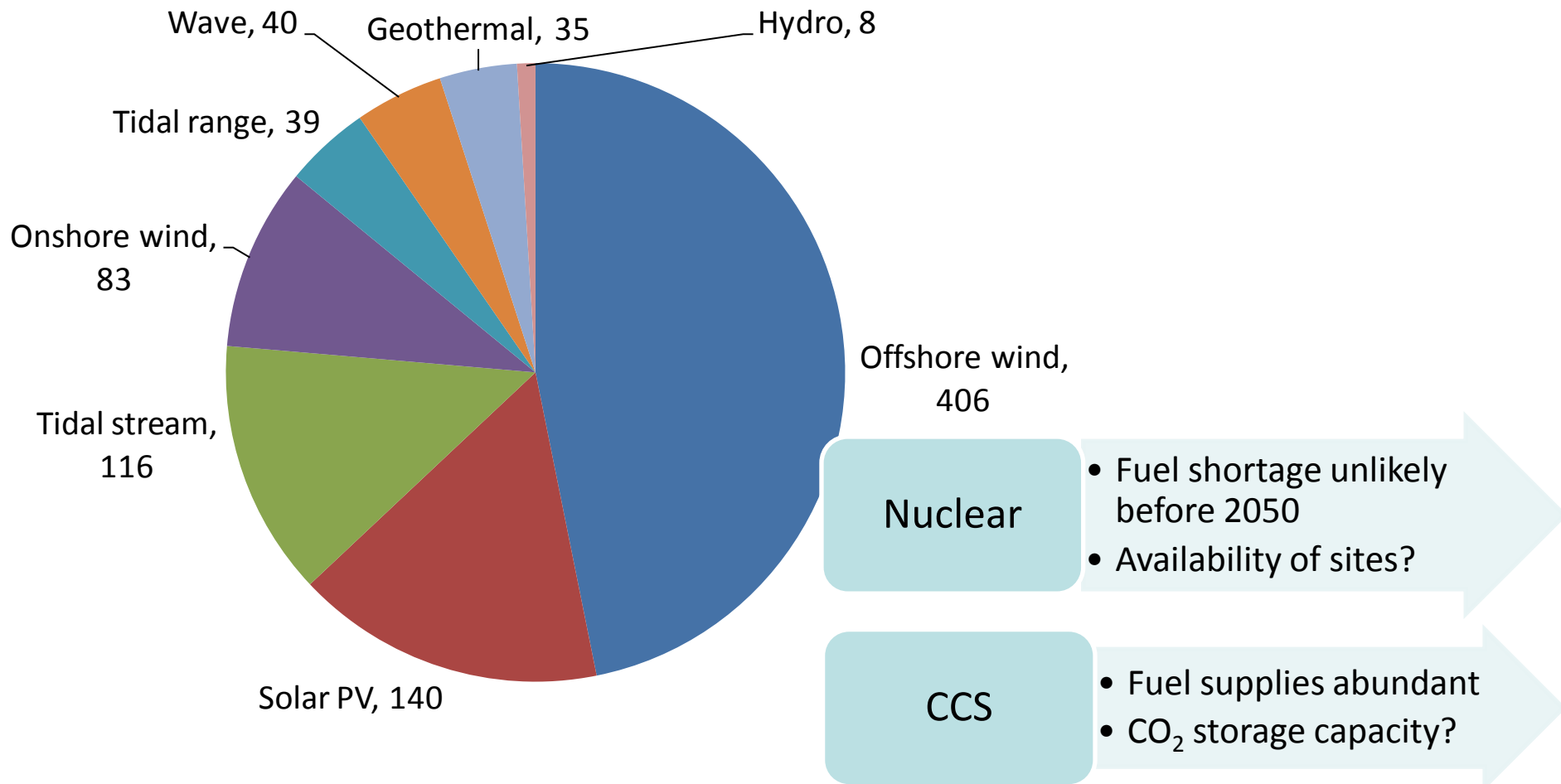
The power sector has a crucial strategic role in decarbonisation to 2050



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



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

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)

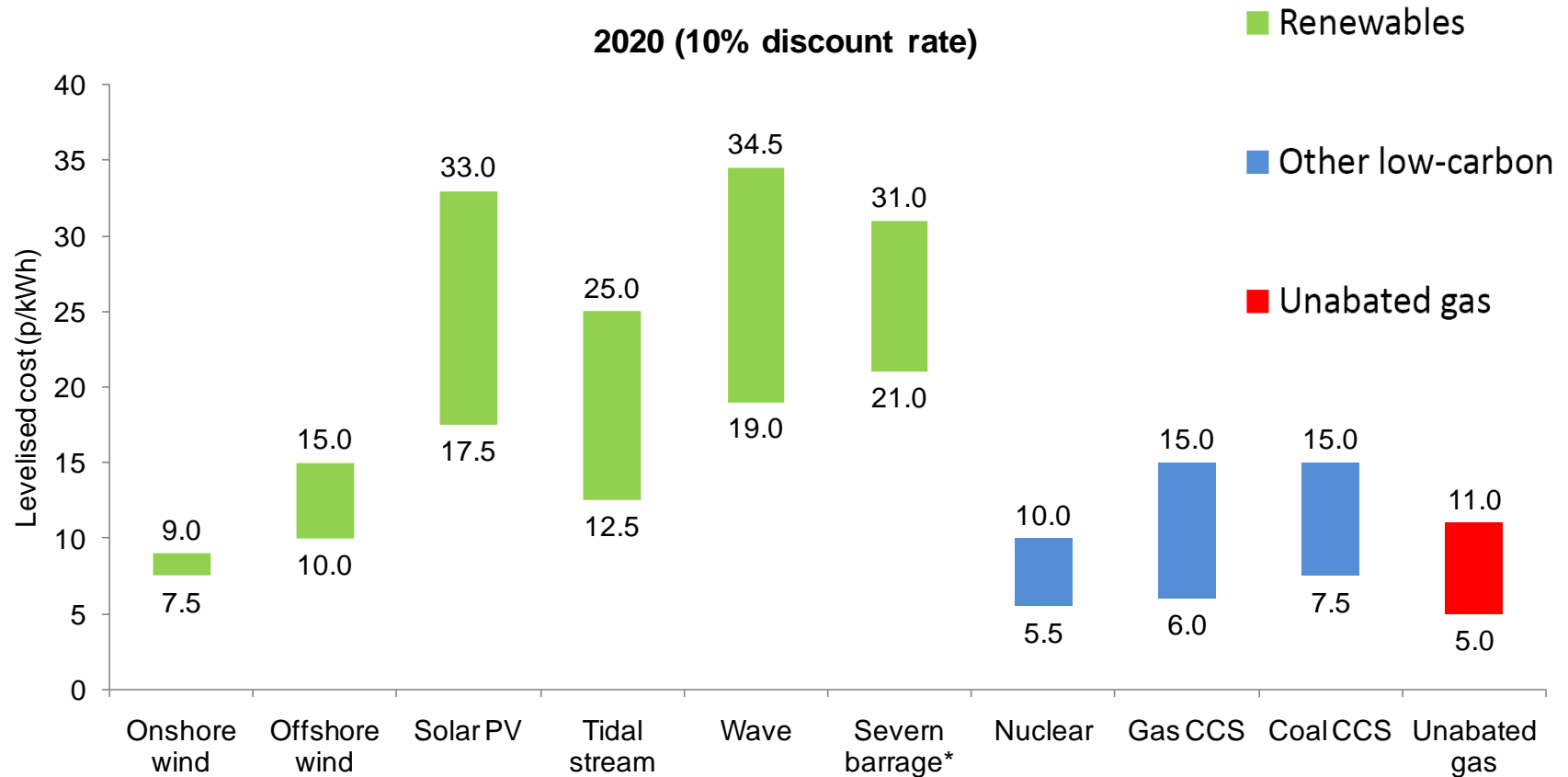
CCGT and other flexible generation ramps up



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

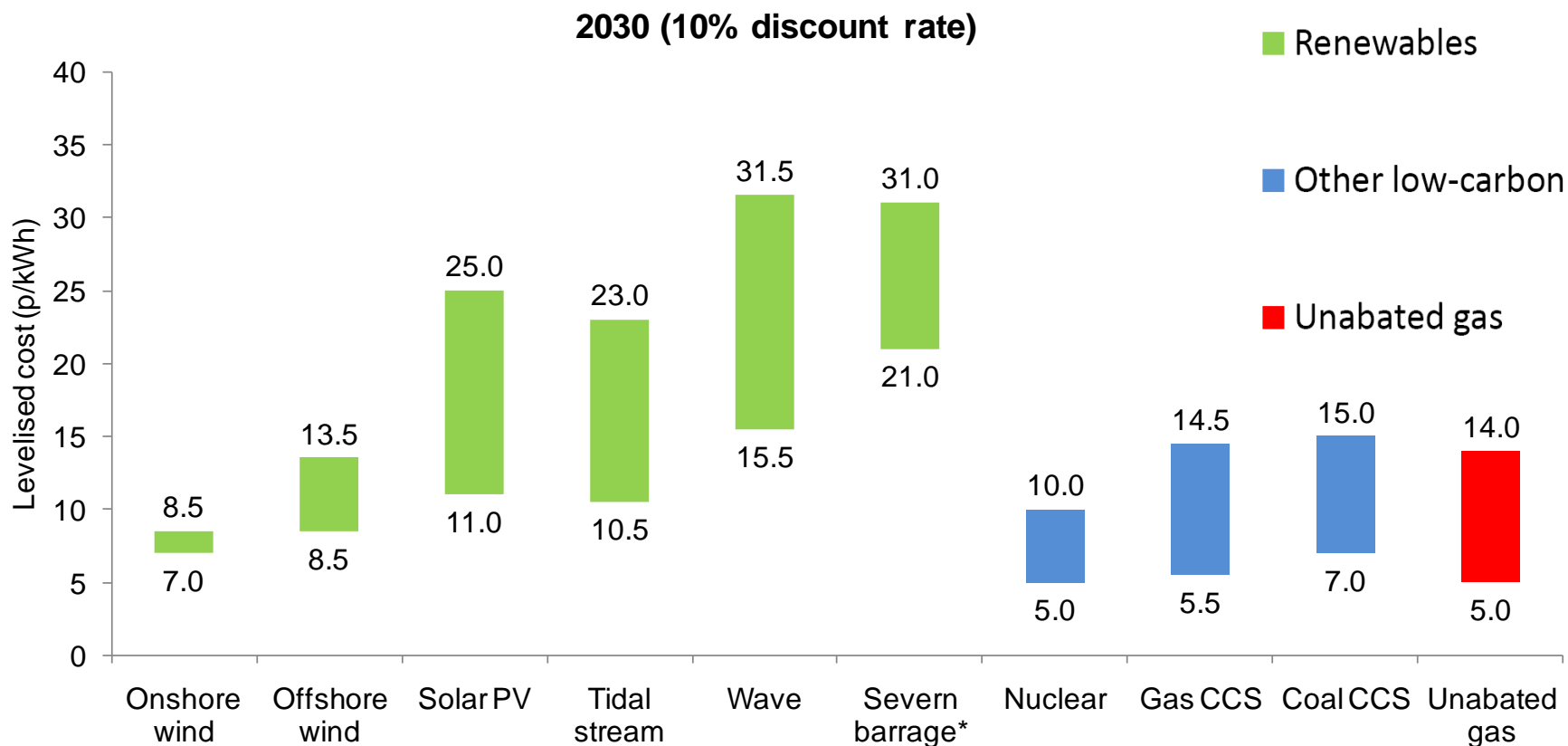
Economics of low-carbon technologies

2020 - 10% discount rate



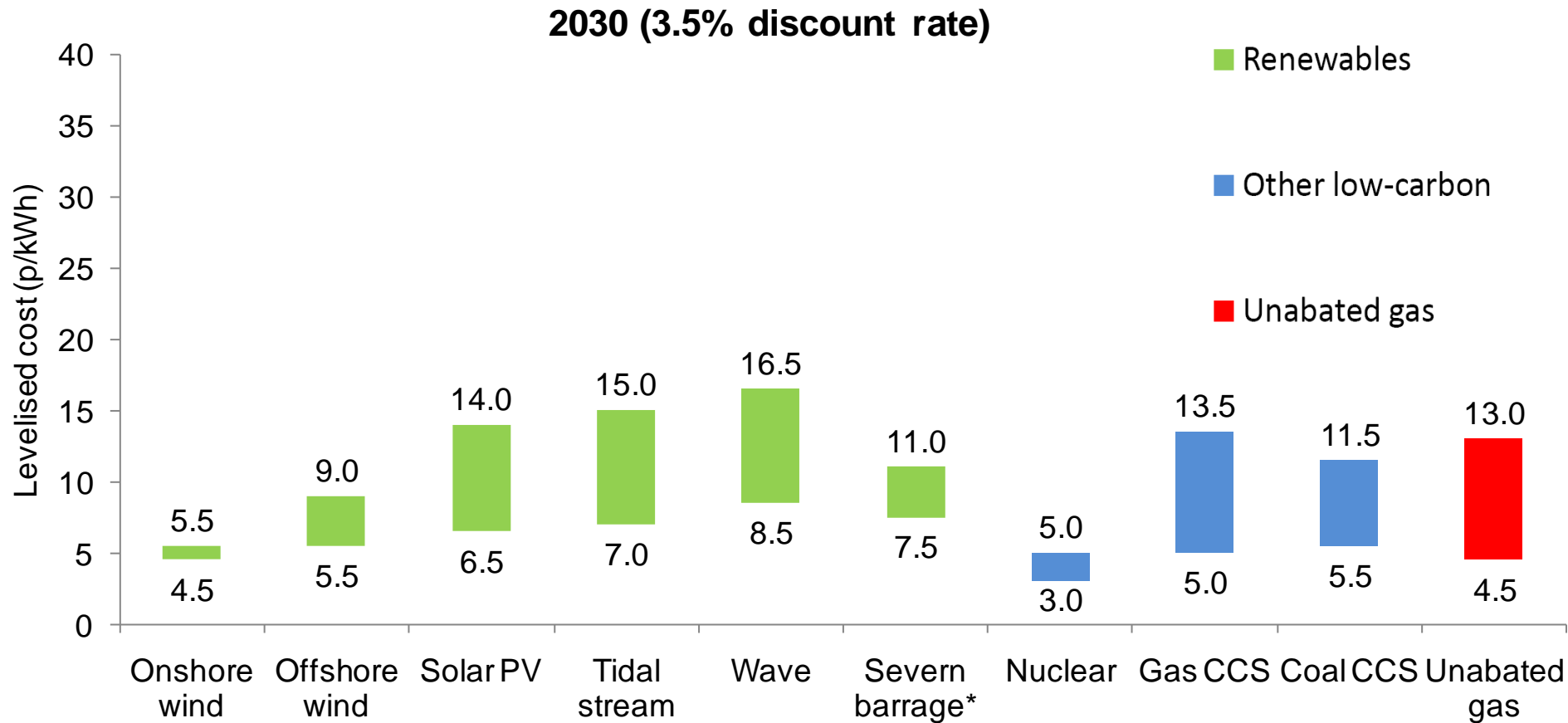
Note: 2010 prices. Source: CCC calculations based on Mott MacDonald (2011) *Costs of low-carbon technologies*, *Severn barrage costs (Cardiff Weston scheme) from DECC (2010) *Severn Tidal Feasibility Study*.

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*.

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*.

A portfolio approach is therefore appropriate for power sector decarbonisation

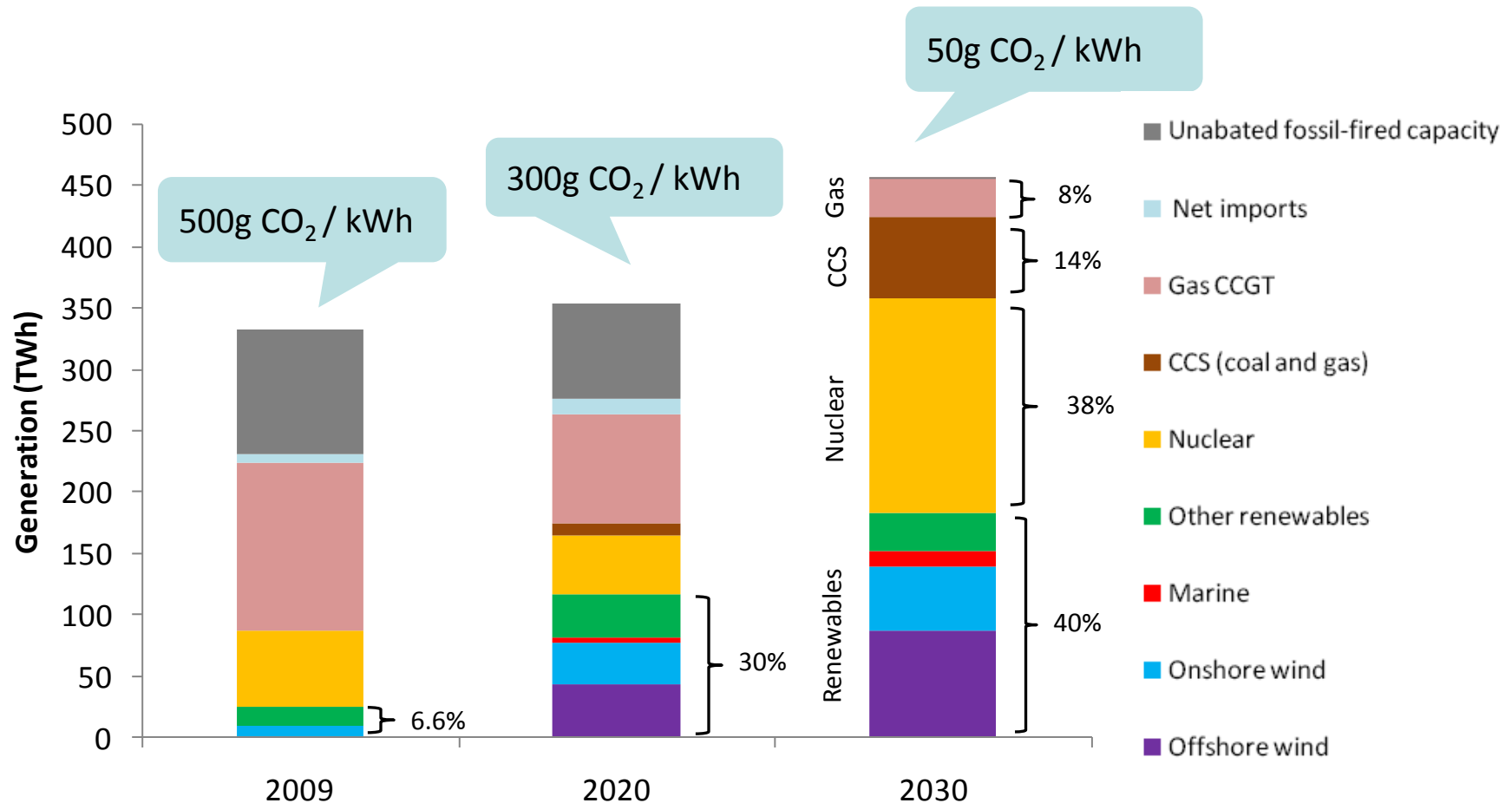
		Economics		Resource	Limitations / Risks
		Current	Future		
Likely to play major role	Nuclear	Appears lowest cost			Sites, waste storage, public attitudes
	Onshore wind				Acceptability (planning) constraints
	Offshore wind		?		
Could play major role, UK deployment important to developing option	CCS		?		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

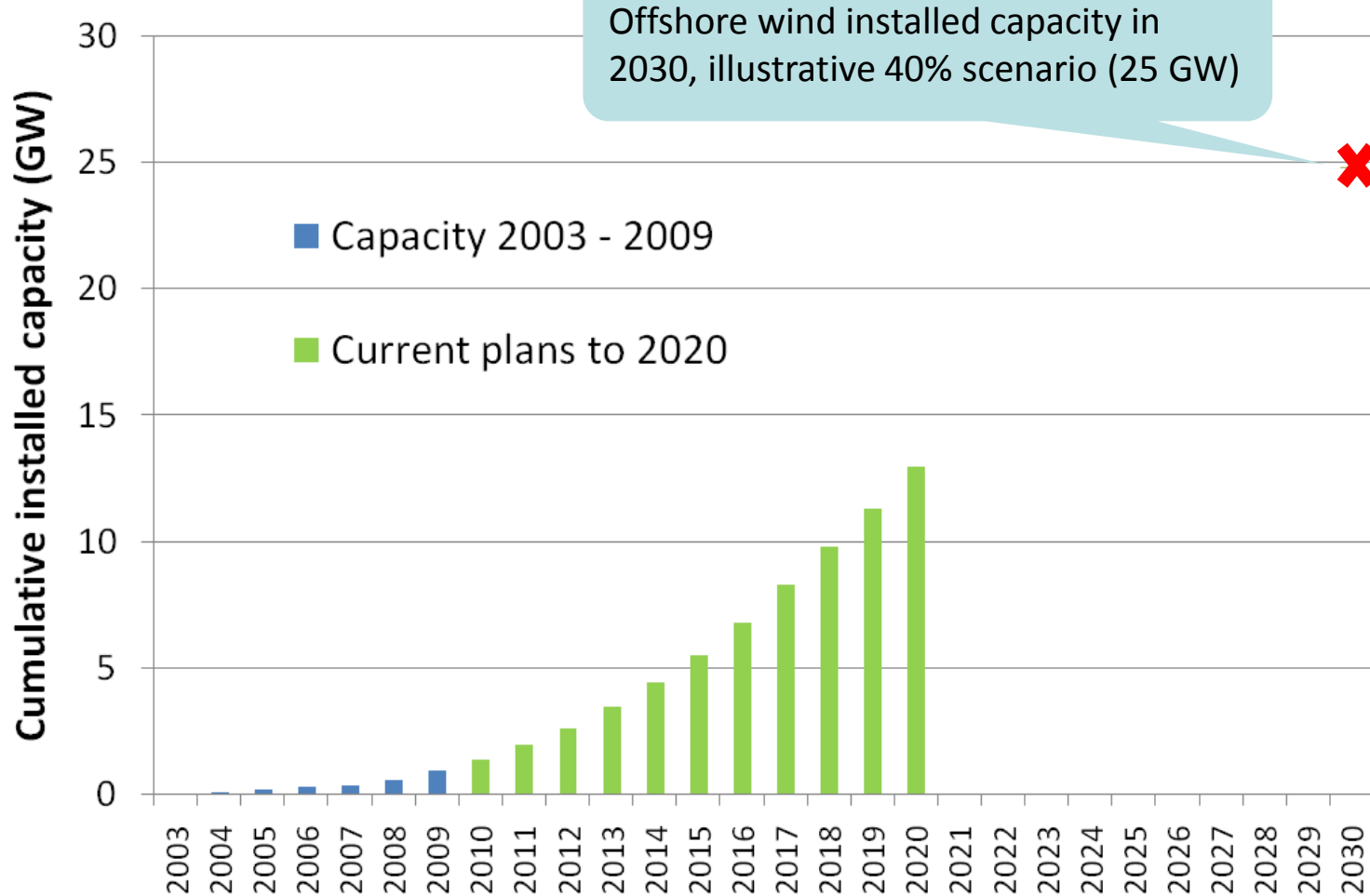
A portfolio approach: Firm minimum commitments on less mature technologies are required, alongside competitive investment in mature technologies.

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.

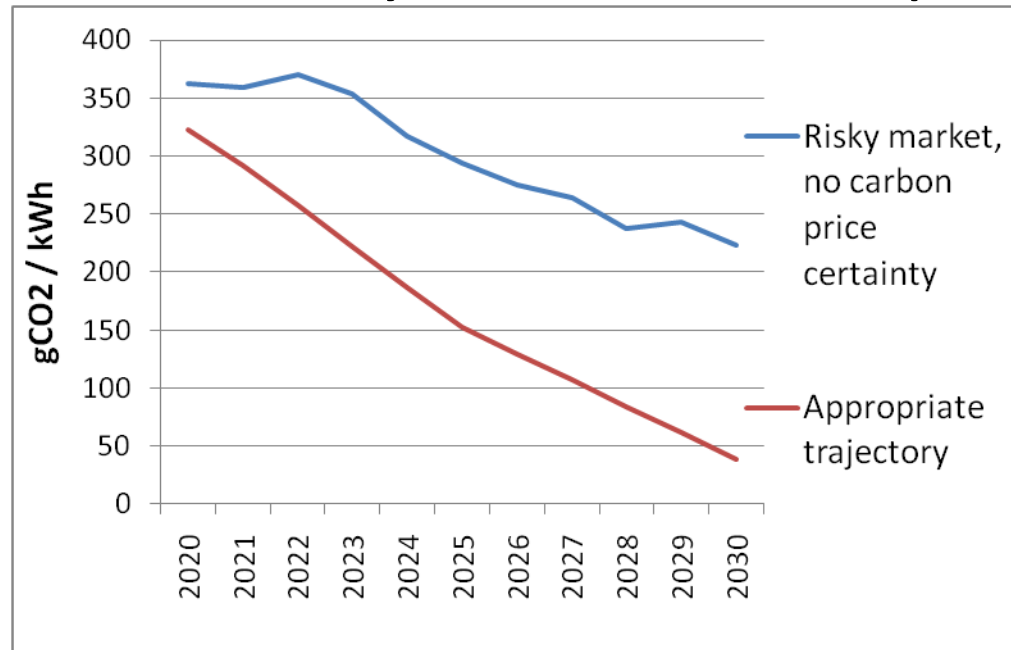
2030 commitments required to avoid stop-start investment cycles and provide confidence in long-term market.



Commitments should be built into new market arrangements

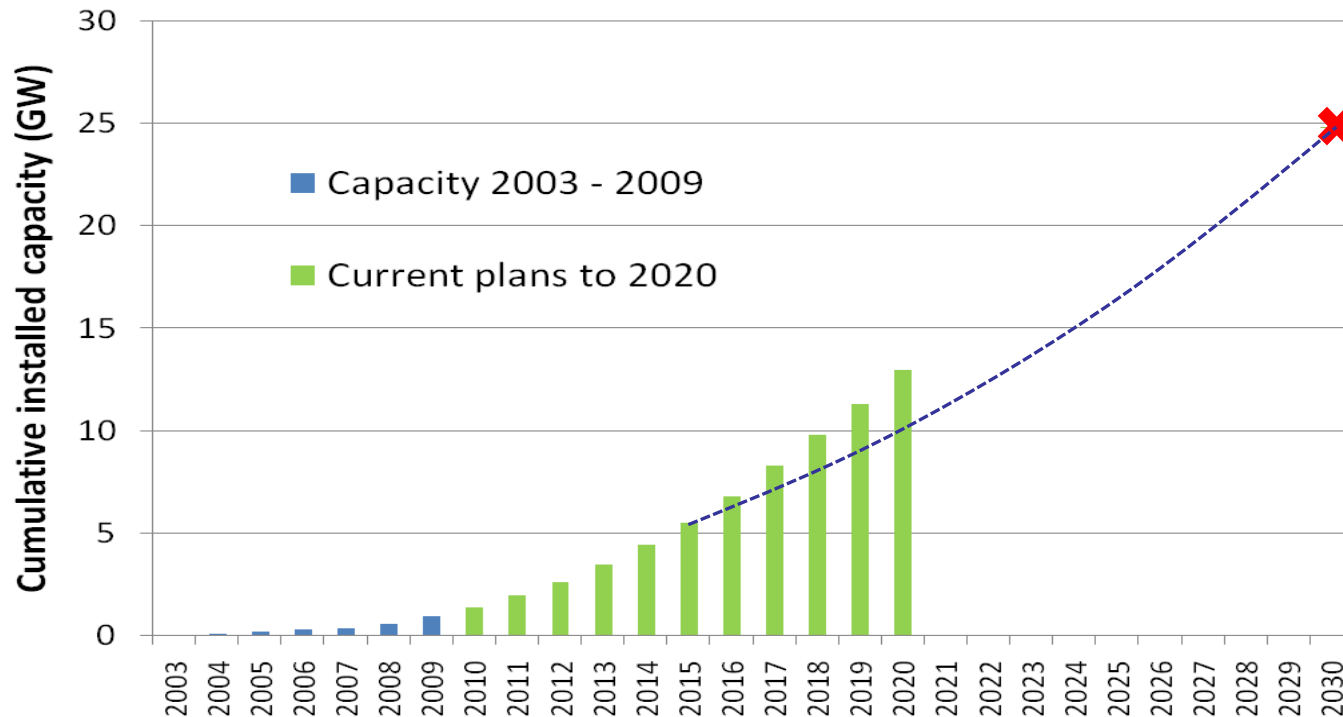
- Current market arrangements won't deliver required decarbonisation.

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 EU target -> a pragmatic approach is required



Lower-cost options for increased effort include:

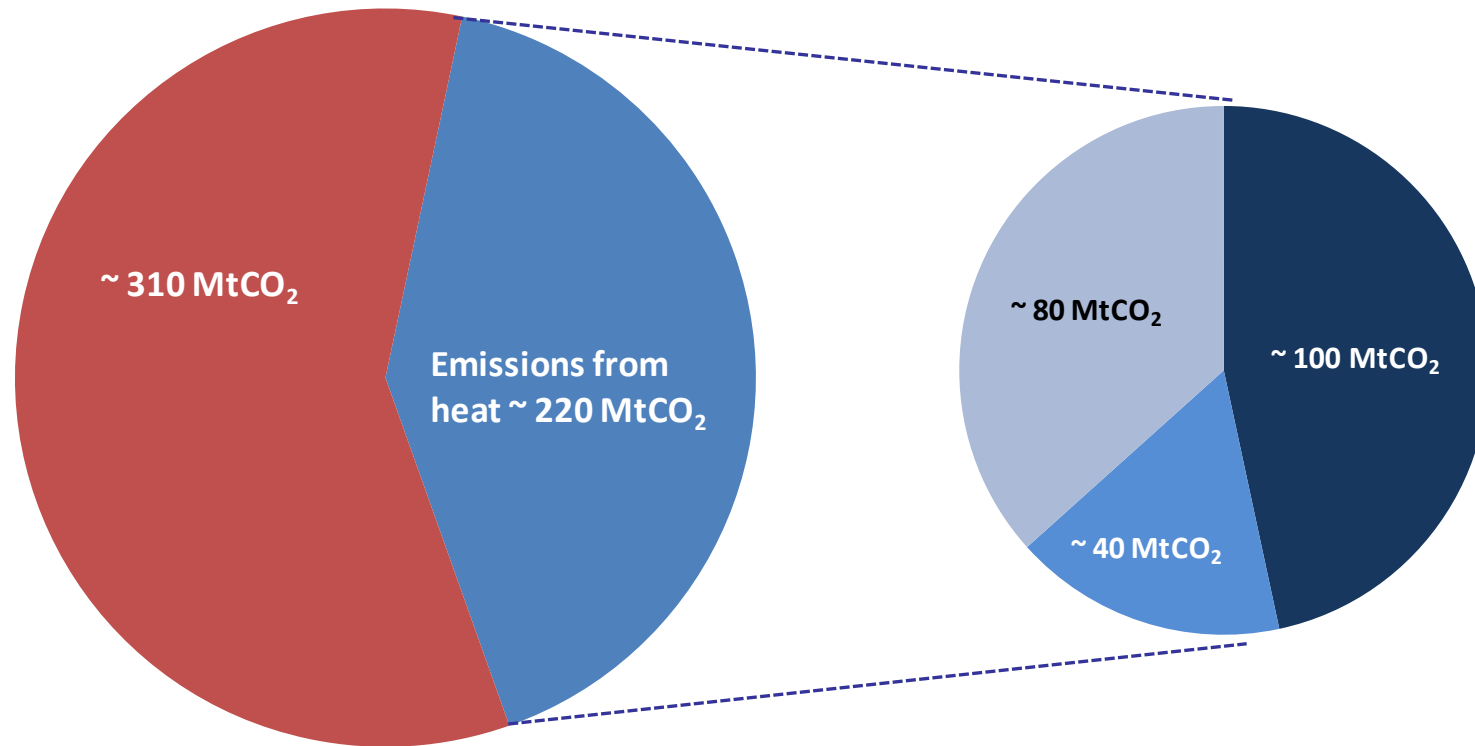
- More onshore wind, requiring greater community support
- More renewable heat, if supply chain bottlenecks overcome
- Imports, such as Concentrated Solar Power
- Renewable Energy Credits, allowed under the EU Directive

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Emissions from heating account for around 40% of UK CO₂ emissions, mainly from buildings

Total CO₂ emissions ~ 525 MtCO₂ (2008)

■ Residential ■ Non-residential ■ Industry



■ Emissions from heat ■ Other CO₂ emissions

Source: DECC data, 2008 emissions



Heat pumps (air-source and ground-source)

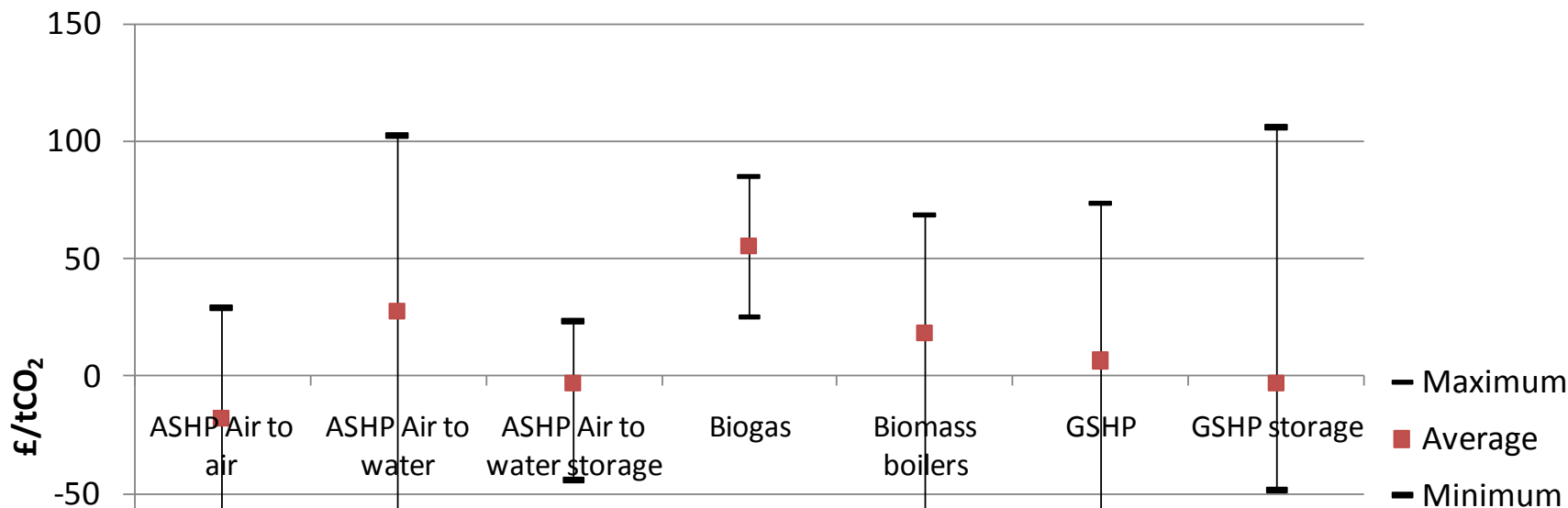


Biomass



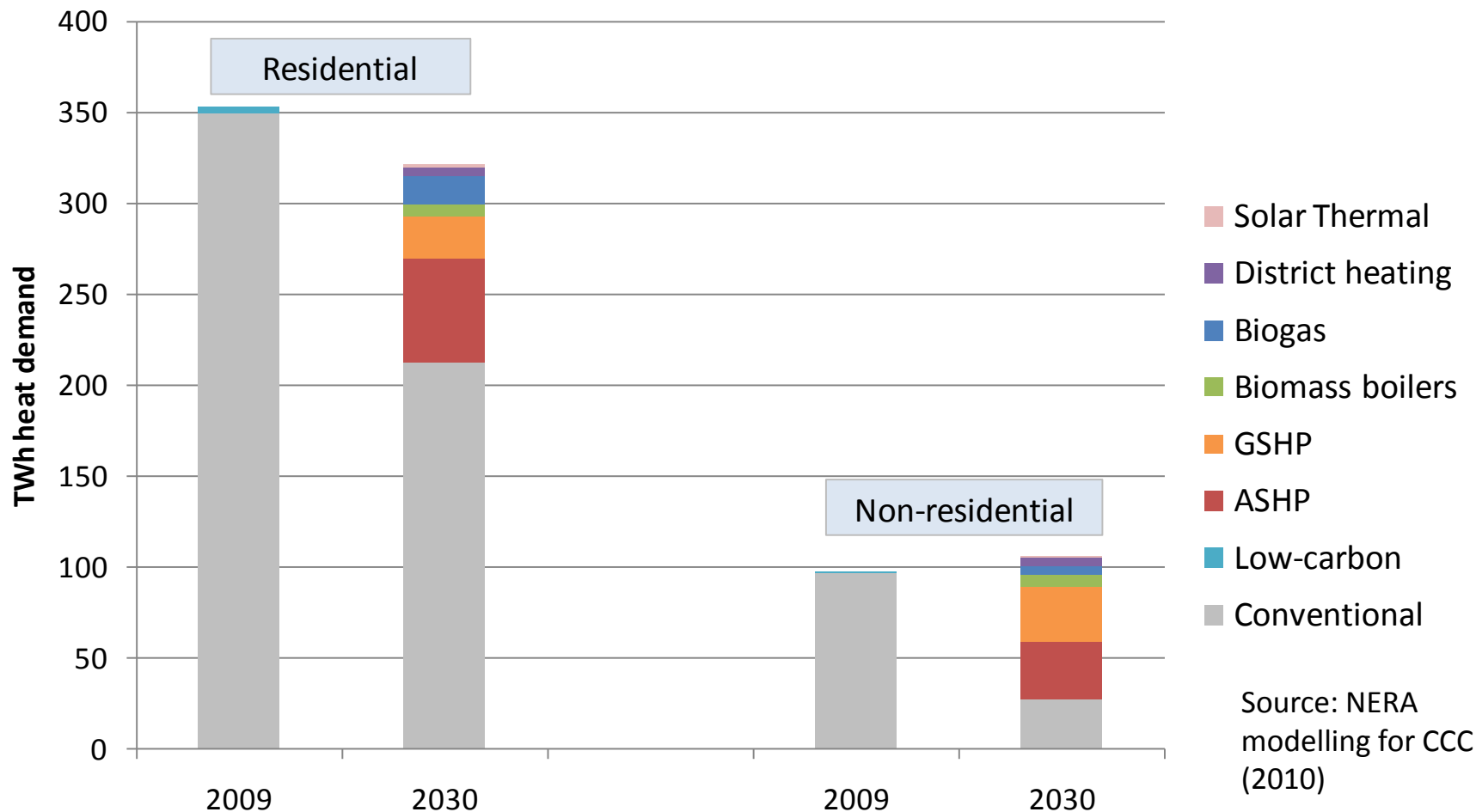
Biogas

Abatement costs of low-carbon heat technologies (2030)



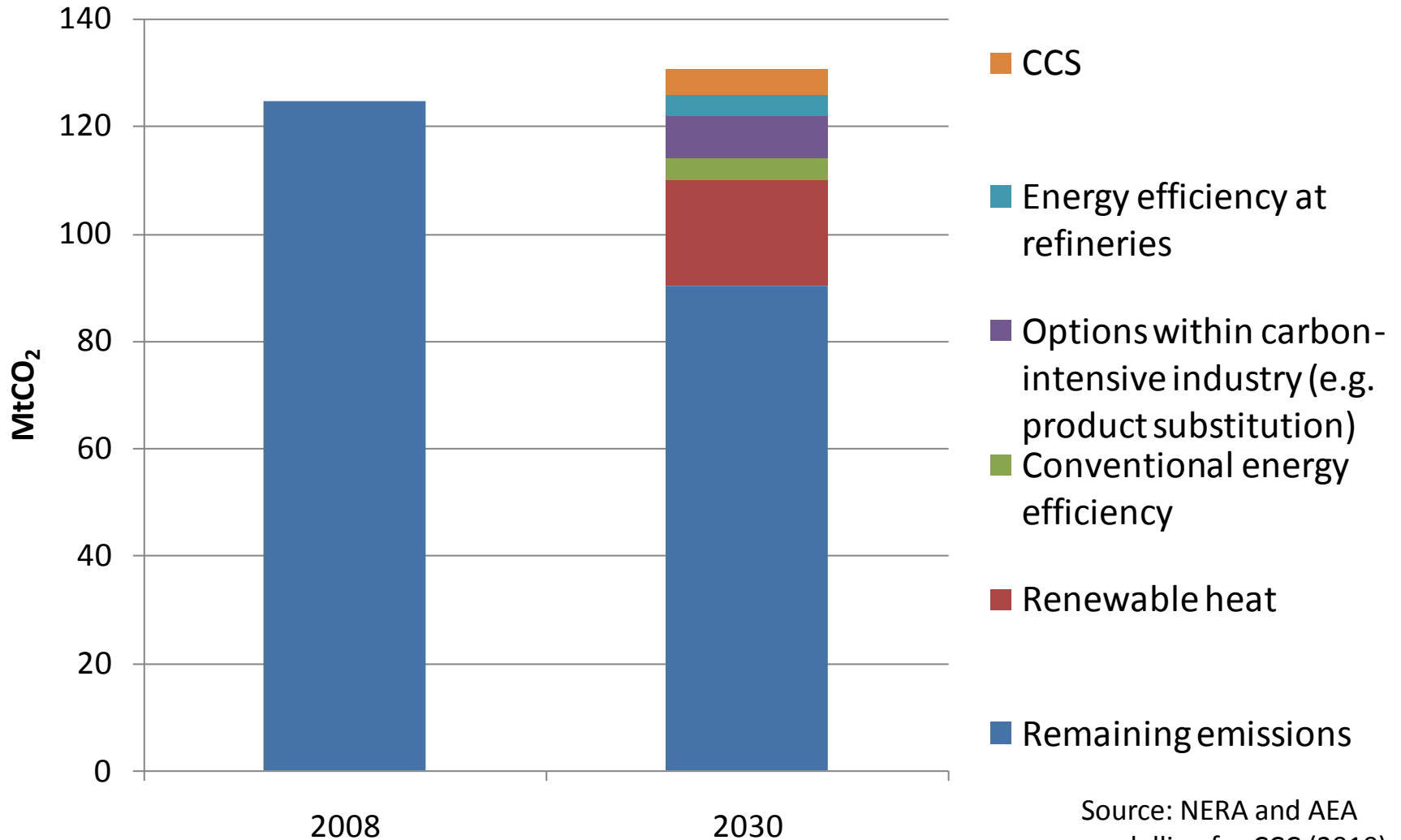
Source: CCC modelling; NERA (2010). Cost ranges reflect different demand segments

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



- 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

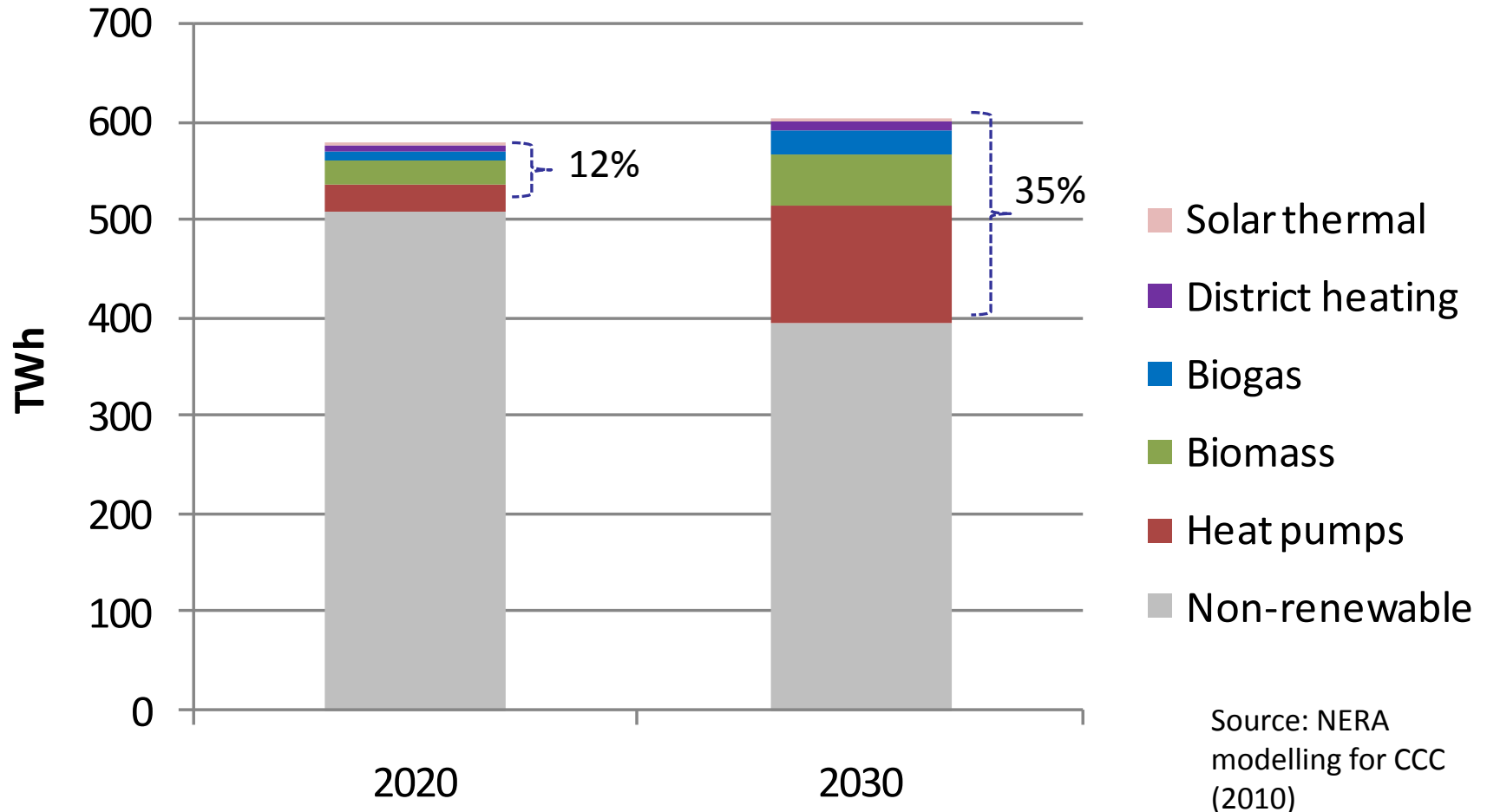
Industry emissions and 2030 abatement potential



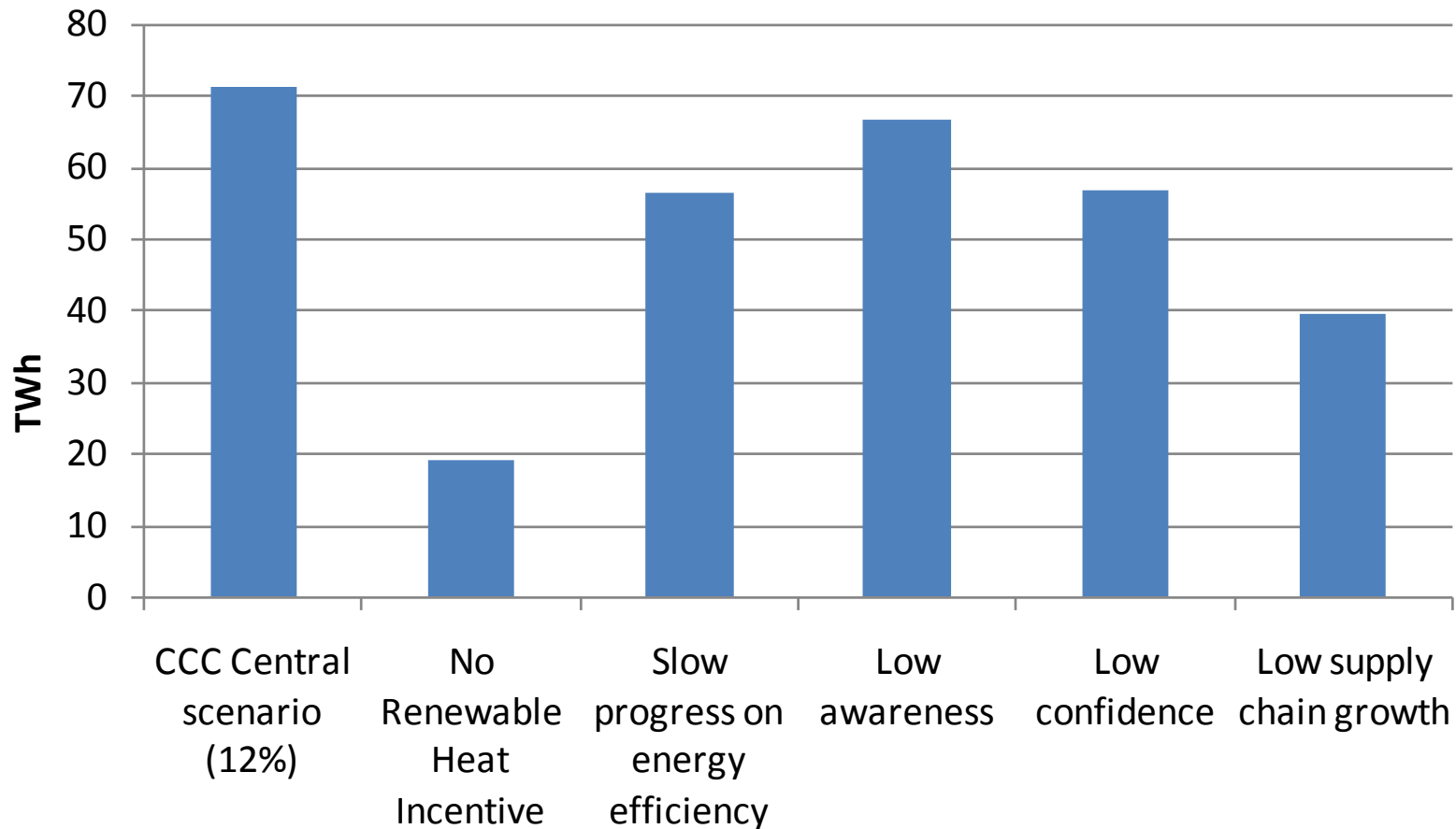
Source: NERA and AEA modelling for CCC (2010)

Progress is needed by 2020 on the path to 2030 ambition

All heat demand (buildings and industry)



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

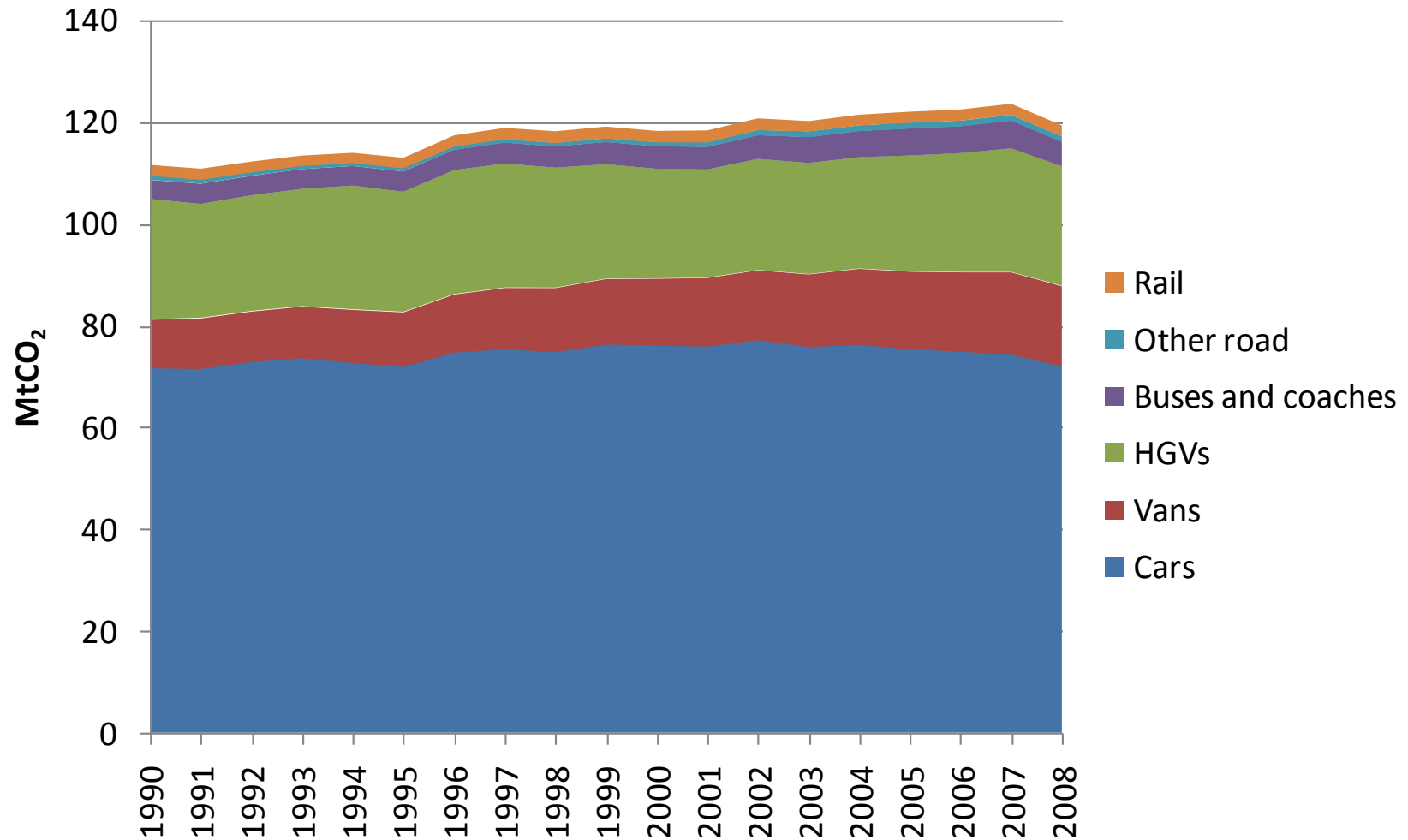
- Required to:
- Avoid supply chain bottlenecks
 - Increase consumer confidence

Integration of renewable heat and energy efficiency policies

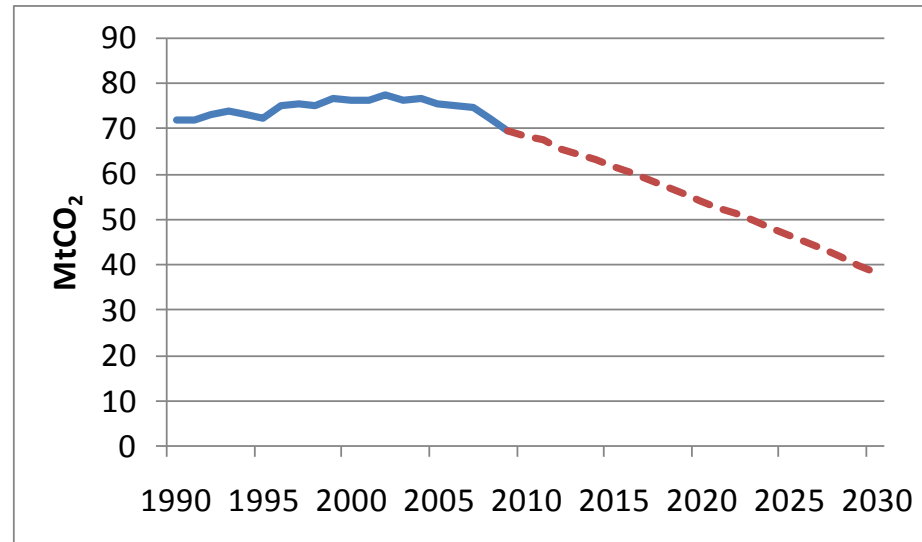
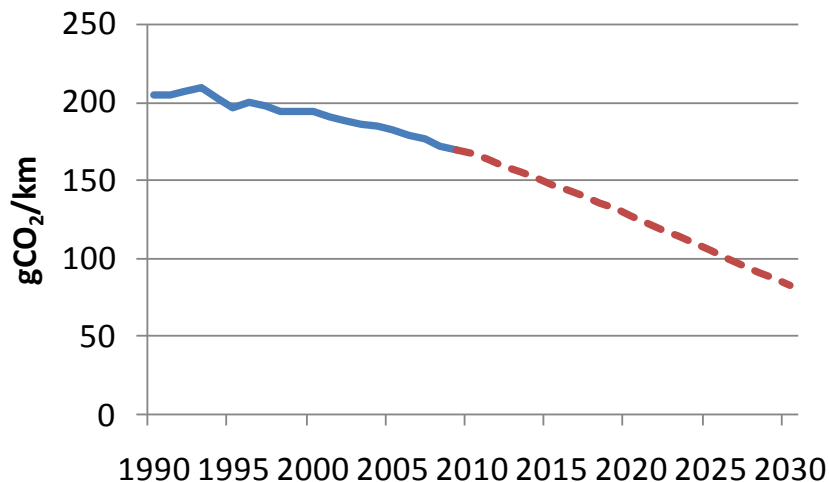
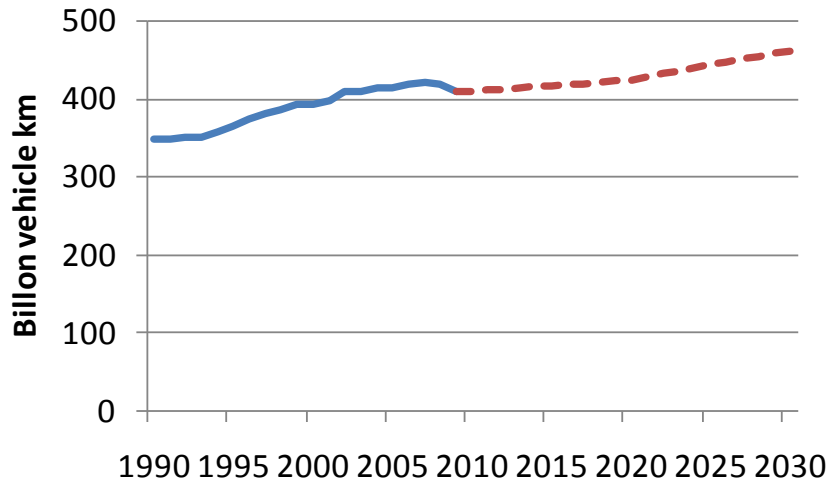
- Required to:
- Increase number of suitable buildings
 - Improve consumer confidence / information (one-stop shop / whole-house approach)
 - Provide possible source of up-front financing

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



Cars: Emissions reduction will come from reducing gCO₂/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

	<u>2030</u>			
	<u>Share of new car sales</u>	<u>Share of miles</u>	<u>Emissions Intensity</u>	
Conventional cars	40% →	70% ✗	80-125 g/km	<p><u>Average emissions intensity in 2030</u></p> <p>New cars purchased: 52g/km (versus 144g/km in 2010)</p> <p>All cars on road: 81 g/km (versus 169 g/km in 2009)</p>
Plug-in hybrids	40% →	20% ✗	50 g/km	
Pure electric vehicles	20% →	10% ✗	0 g/km	

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 will publish its bioenergy review before the end of 2011

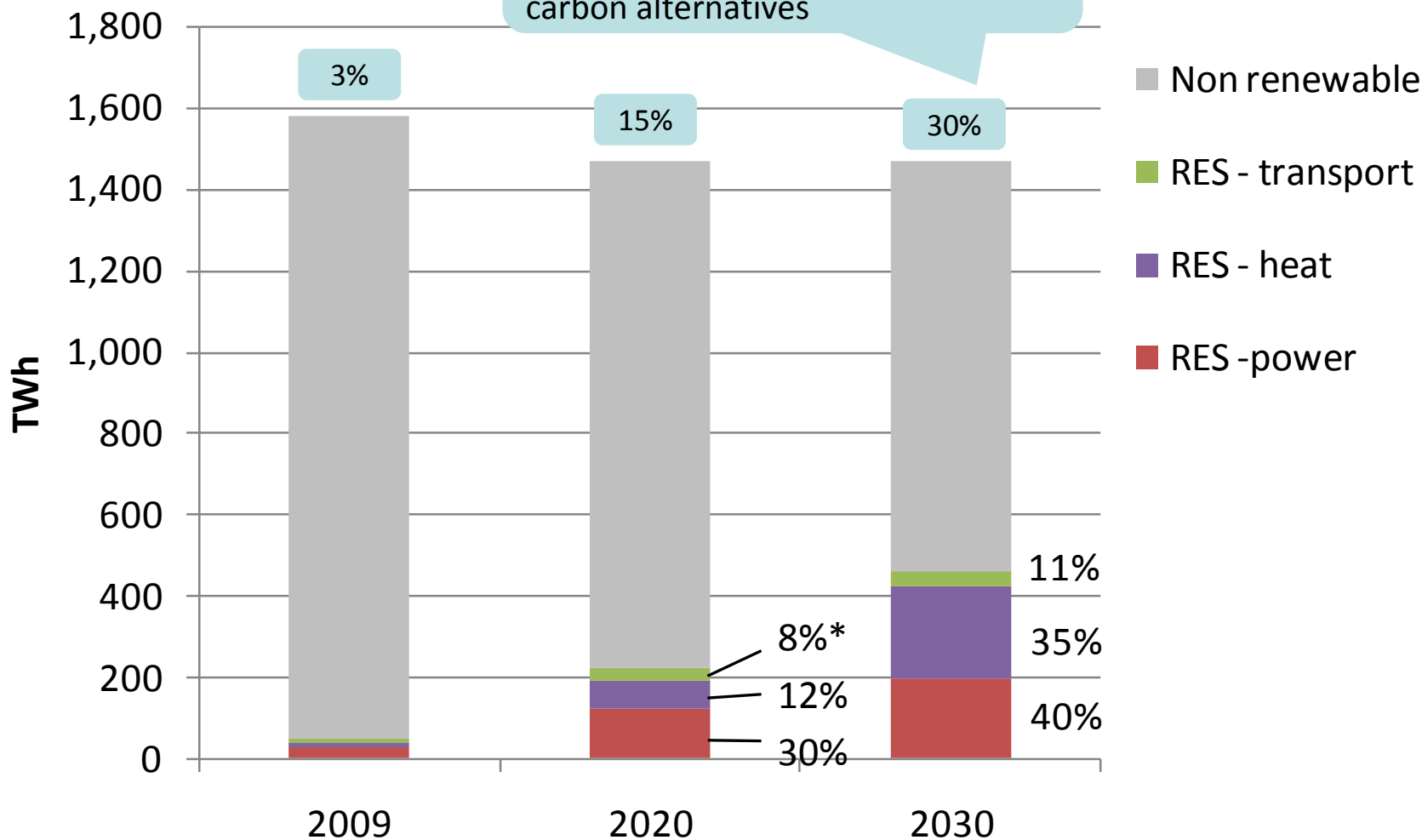
The review will:

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

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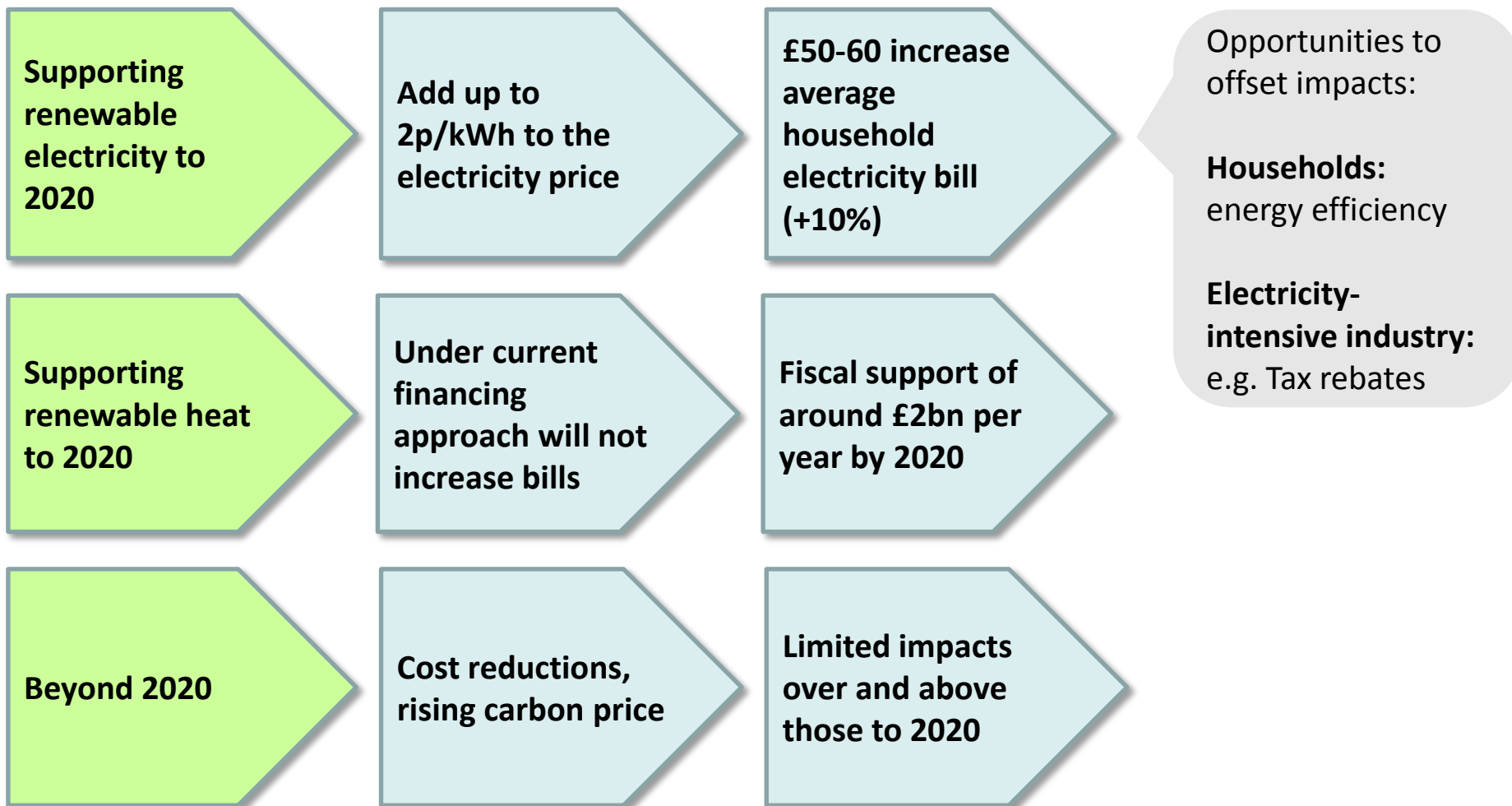
Illustrative economy-wide scenario for renewable energy

Up to 45% depending on cost reductions and limitations on low-carbon alternatives



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

Potential bill impacts of renewable energy ambition



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