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Long-term UK energy policy and modelling challenges

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Overview

1 Current policy framework

2 Future policy challenges

3 Challenges for energy system modelling

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1 Current policy framework

a Long-term decarbonisation goal and carbon budgets

b Power sector decarbonisation

c Renewable heat and building efficiency

d Decarbonisation of road transport

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There are many potential pathways to deliver the 80% emissions cut by 2050 required by the Climate Change Act, but also many common actions

1	Ambitious per capita energy demand reduction is needed – but is not sufficient
2	Electricity supply needs to be almost totally decarbonised, while supply may also need to double
3	Substantial electrification of heating, transport and industry is needed
4	A growing level of variable renewable generation increases the challenge of balancing the electricity grid
5	Sustainable bioenergy is a vital part of a low carbon energy system
6	Reduction in emissions from agriculture, waste, industrial processes and international transport will be necessary by 2050
7	Fossil fuels will continue to play an important role

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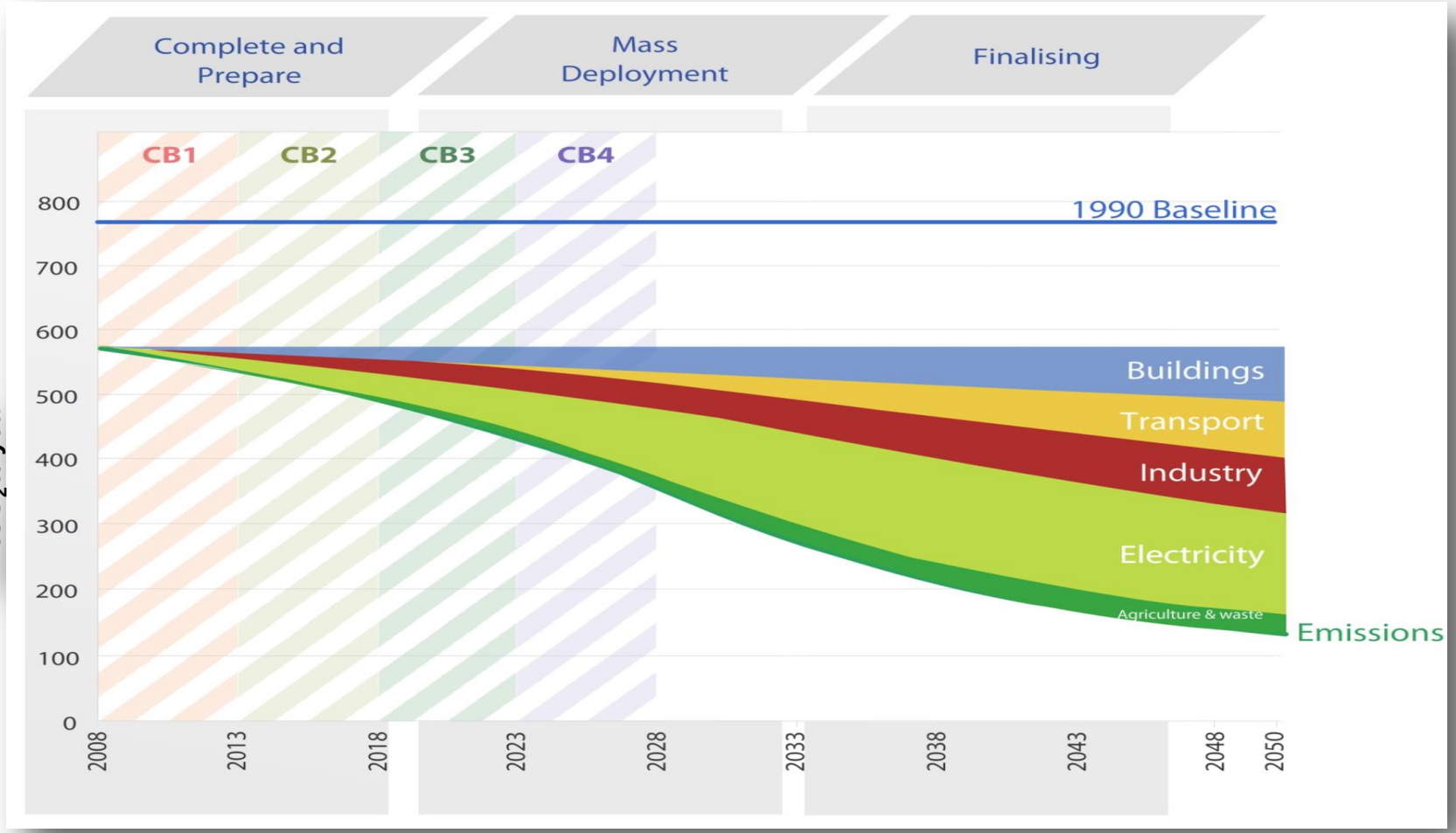
Carbon Budgets shape the pathway to 2050 and the Carbon Plan sets out the Government's policy strategy for meeting the budgets



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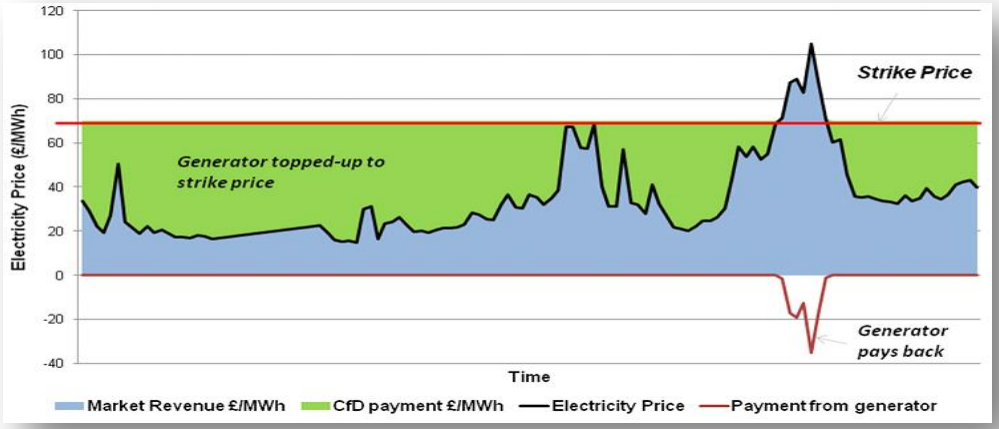
Electricity Market Reform and RO, Feed-in-tariffs, CCS Commercialisation and New Nuclear aim to decarbonise the power sector while maintaining security of supply and affordability



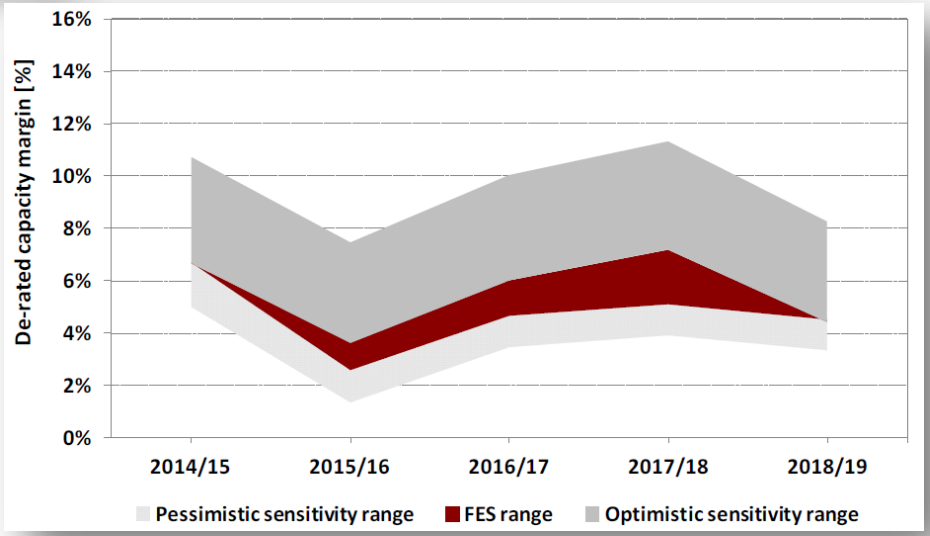
Contracts for Difference:

Illustrative strike price

Ensuring security of supply:

Derated capacity margin

Source: Ofgem, June 30 2014
Based on National Grid's forthcoming Future Energy Scenarios



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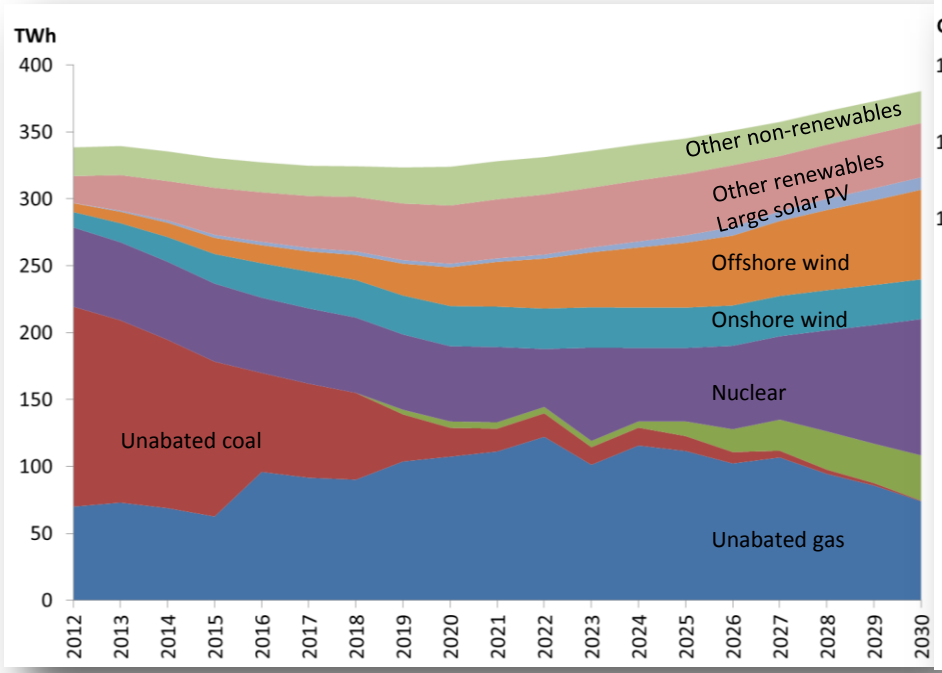
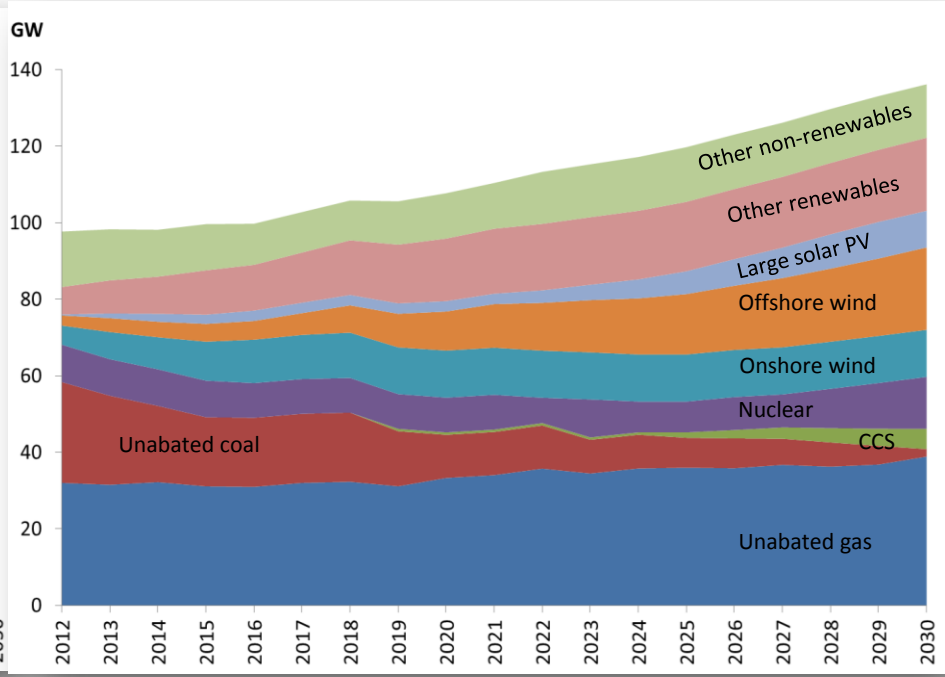
The first EMR Delivery plan projects the future supply mix to expand into nuclear, wind and other low carbon power sources

Actual and projected generation, 2012-30



Actual and projected capacity, 2012-30



Source: DECC, December 2013 “EMR Delivery Plan”, 100g 2030 scenario with central fossil fuel price projections and demand

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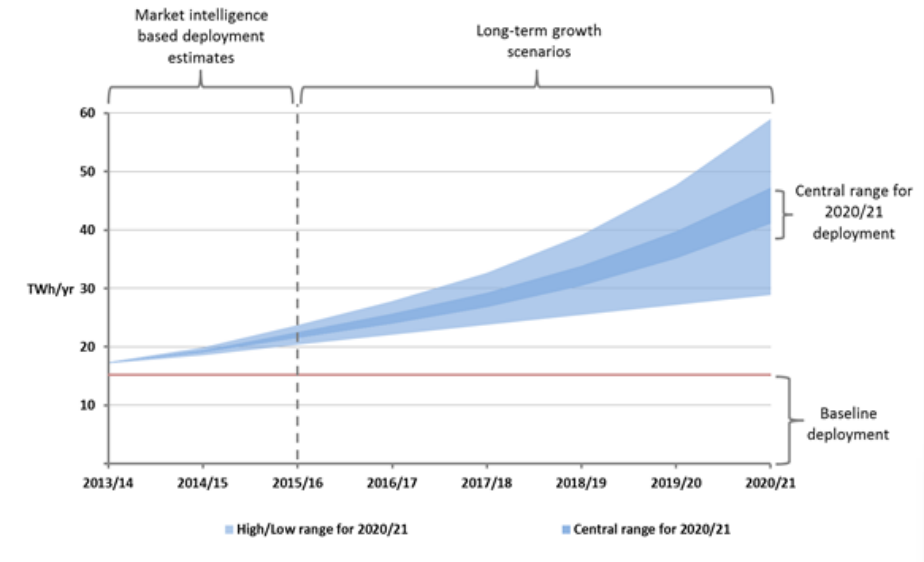
Energy Company Obligation and Green Deal, Renewable Heat Incentive, Smart Meters, EU Product Standards and targeted measures for commercial efficiency aim to decarbonise buildings

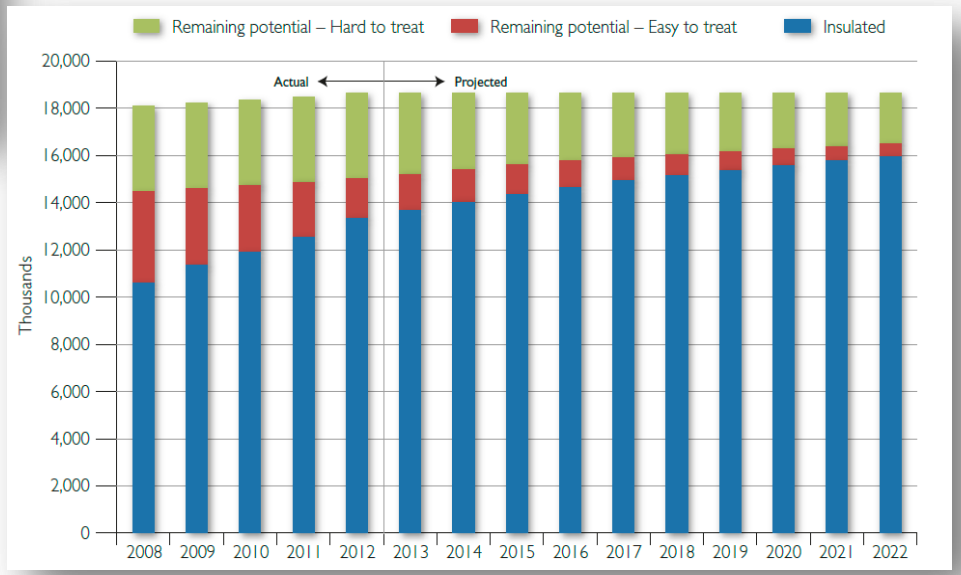


Deployment of renewable heat

Source: DECC RHI Impact Assessment

Deployment of cavity wall insulation

Source: Government's response to the Fifth Annual Progress Report of the CCC



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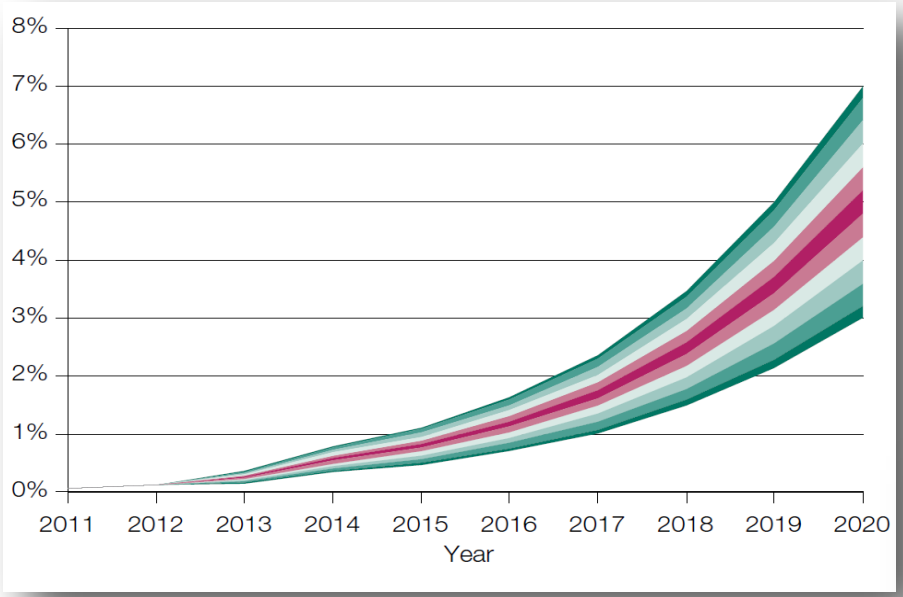
In transport, decarbonising road transport through emission standards, bio-fuels and EV infrastructure support are key

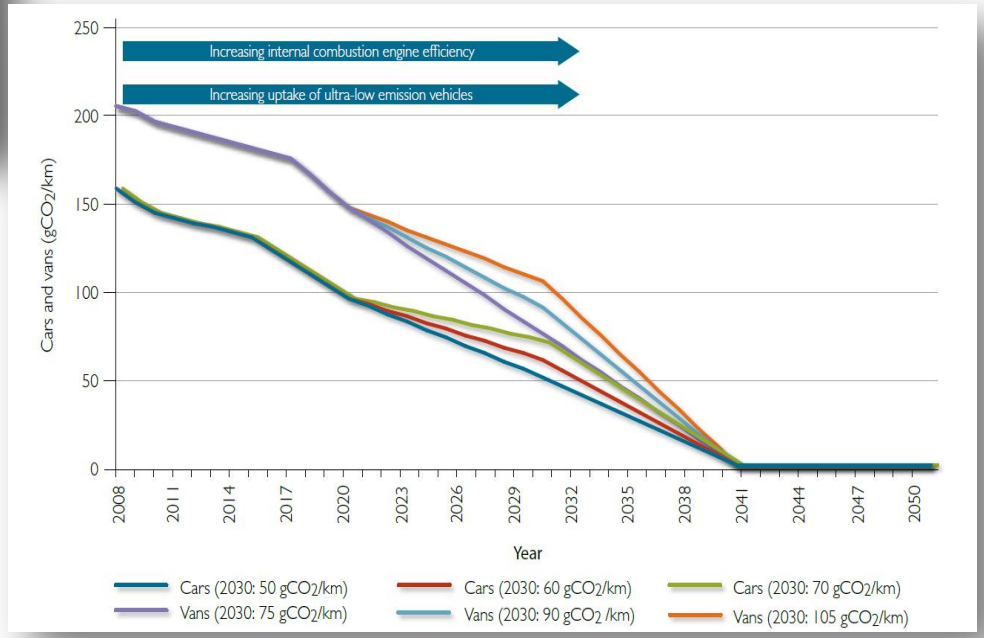


Projected ULEV car sales as a proportion of all car sales

Source: Department for Transport modelling

EU average new car and van emission standards to 2020 and then illustrative ranges

Source: DECC Carbon Plan



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2 Future Policy Challenges

a **Setting the 5th Carbon Budget**

b **Policies to deliver the 4th Carbon Budget – building efficiency and low carbon heat**

c **Allocation of LCF budget and next EMR delivery plan**

d **EU 2030 framework and EU ETS reform**

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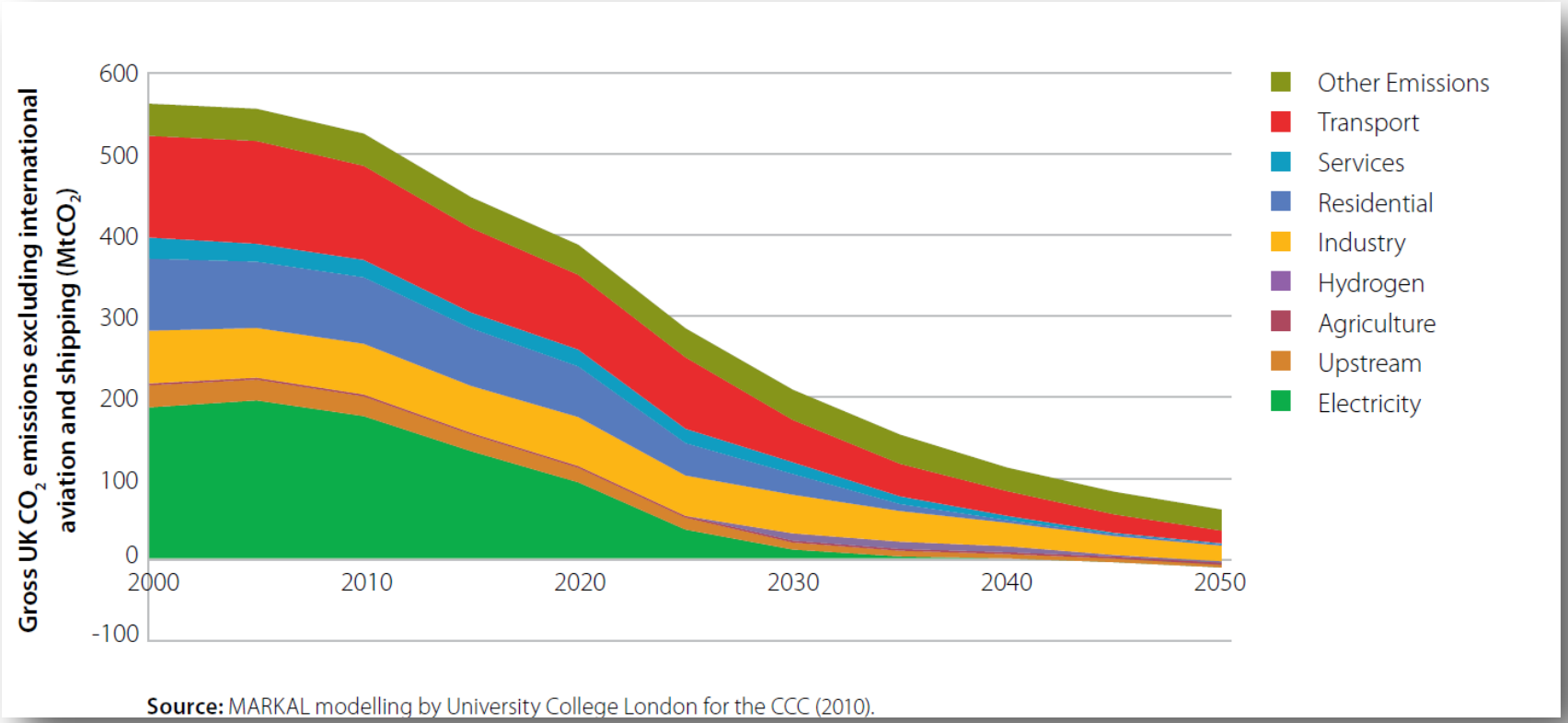
Based on CCC recommendations, 5th Carbon Budget to be set by 2016 on a cost effective pathway to the 2050 emissions target

MARKAL possible emissions trajectory to 2050



Source: MARKAL modelling by University College London for the CCC (2010).

- Insights into dynamic impacts of abatement though MARKAL modelling.
- Plus bottom-up modelling based on detailed analysis of scope of technology roll-out.

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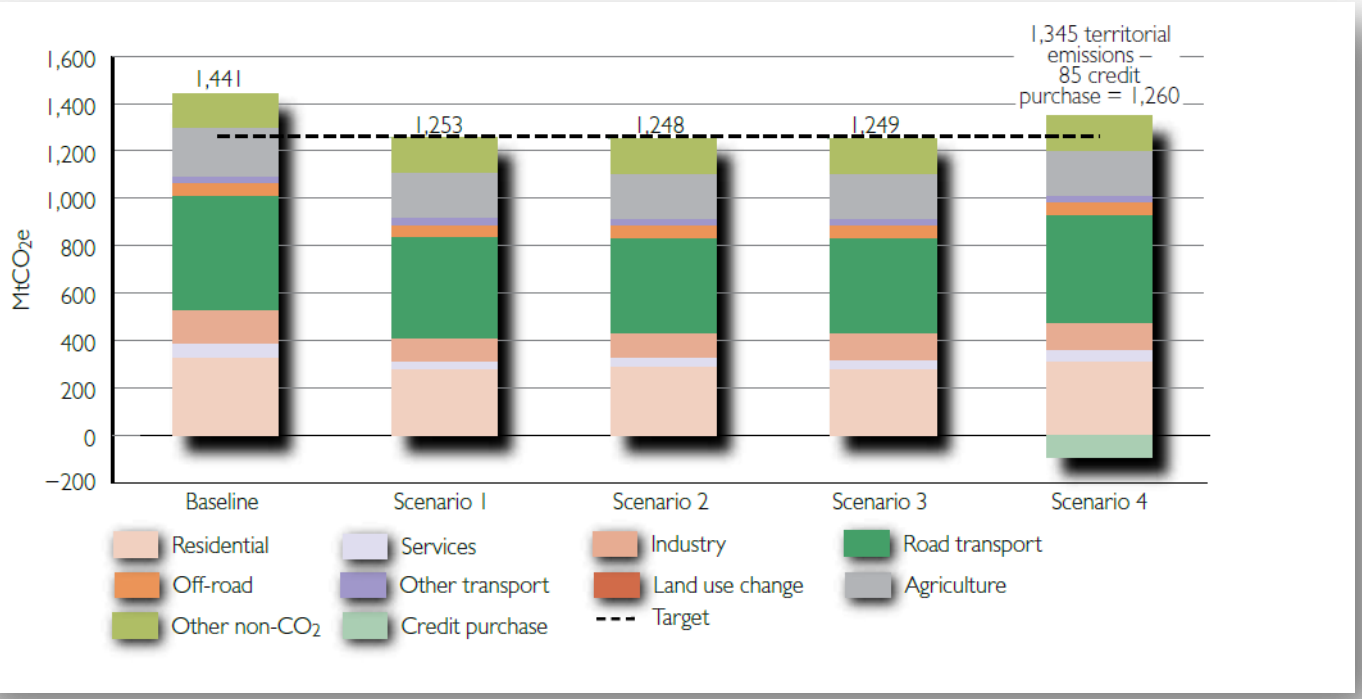
Pathways to meet the 4th Carbon Budget level (1,950 $MtCO_2e$) as set out in the Government's Carbon Plan



Non-traded GHG emissions: illustrative scenarios to meet the 4th Carbon Budget, 2023-27

Source: DECC, *Carbon Plan* (2011)

- Four scenarios in the non-traded sector complemented with two in the traded sector
- Bottom-up approach adopted by picking measures in each sector that aim to balance static and dynamic cost effectiveness, feasibility and deliverability, and public acceptance

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Next EMR delivery plan and LCF Budget must balance static and dynamic efficiency goals

Levy control framework for the first EMR delivery plan period

£2013/14m	2015/16	2016/17	2017/18	2018/19
Levy control framework cap	4508	5137	5871	7339
Renewable obligation, small scale FiTs and CfDs for non-renewable technologies	4448	4675	4833	4921
Early CfDs for renewables*	31	296	553	848
Estimated budget for other CfDs	29	167	486	996

*Based on projects' full capacity estimates and target commissioning date. The estimated commitment under these contracts in 2020/21 is £1183m against an overall LCF cap of £7968m and projected other LCF spending of £6151m.

- Least cost deployment of renewables to meet 2020 target, which means around 30% share of renewables in power generation
- Support for scalable low carbon technologies such as offshore wind, new nuclear and CCC that can make a substantial contribution to long-term decarbonisation of the power sector to reduce costs in future

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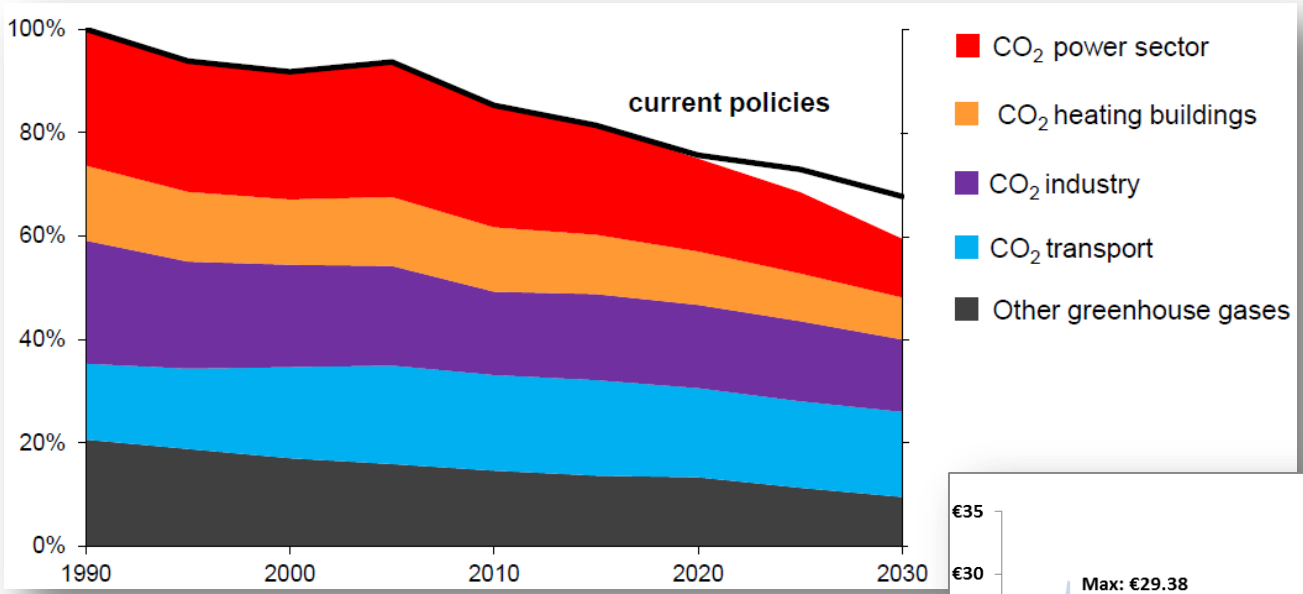
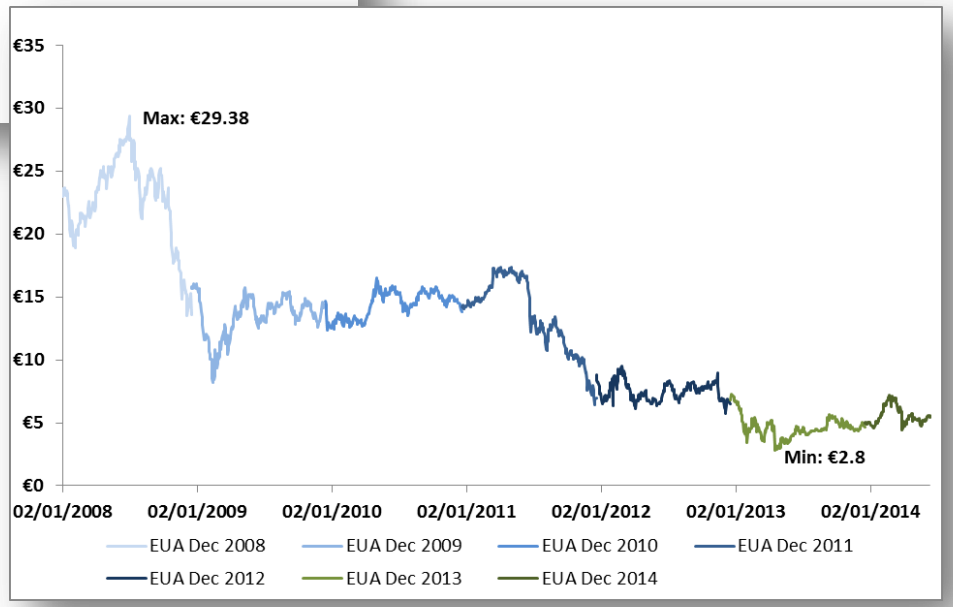
EU 2030 Framework and reform of the EU Emissions Trading System will have a significant impact on traded sector emissions



EU28 GHG emissions trajectory to 2030

Source: European Commission. *Communication on 2030 framework for climate and energy policies*



Price of EUAs (2008-2014)

Source: Thomson Reuters Point Carbon

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3 Challenges for Modelling

a **Multiple objectives, including affordability and energy security**

b **Uncertainties such as technology costs and deployment rates as well as fossil fuel prices**

c **Optimising within and across energy systems**

d **Actual versus modelled behaviour of businesses and households**

e **Broader macroeconomic and distributional impacts of change**

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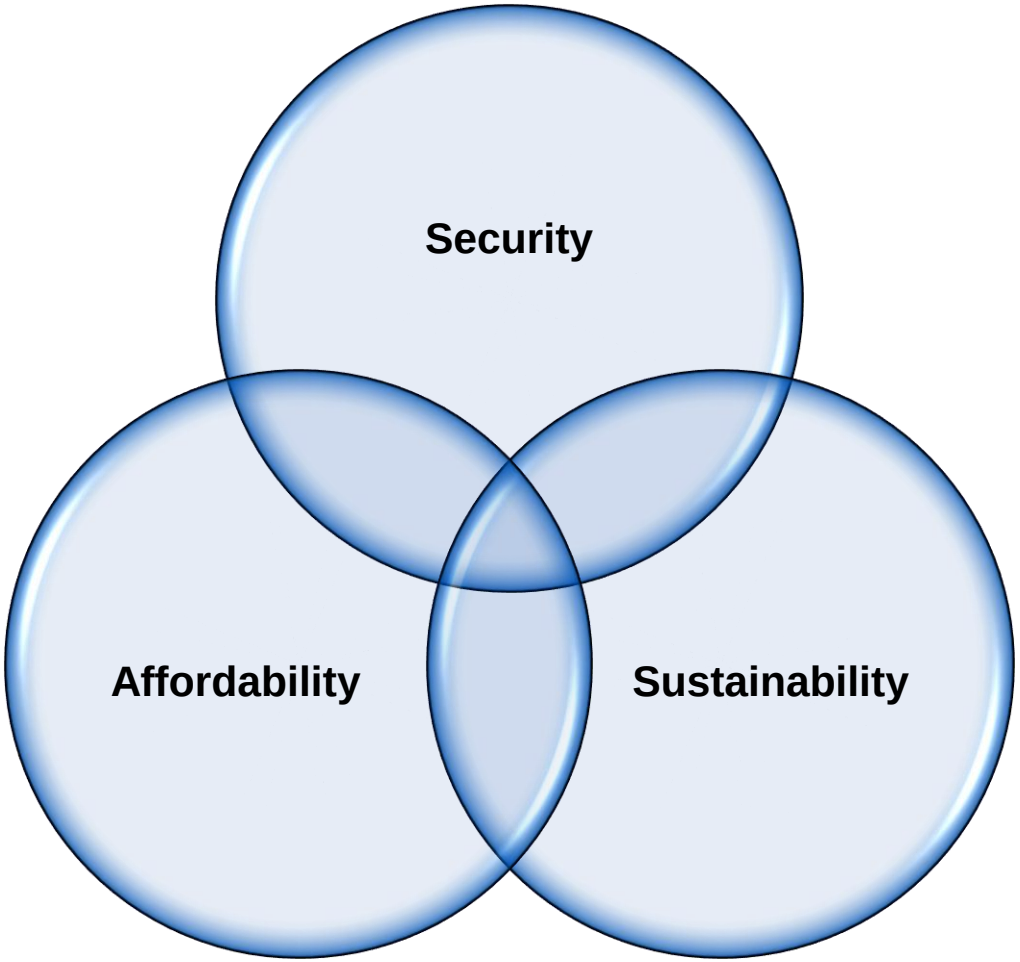
Designing energy and climate policy requires balancing multiple objectives – the Energy Trilema



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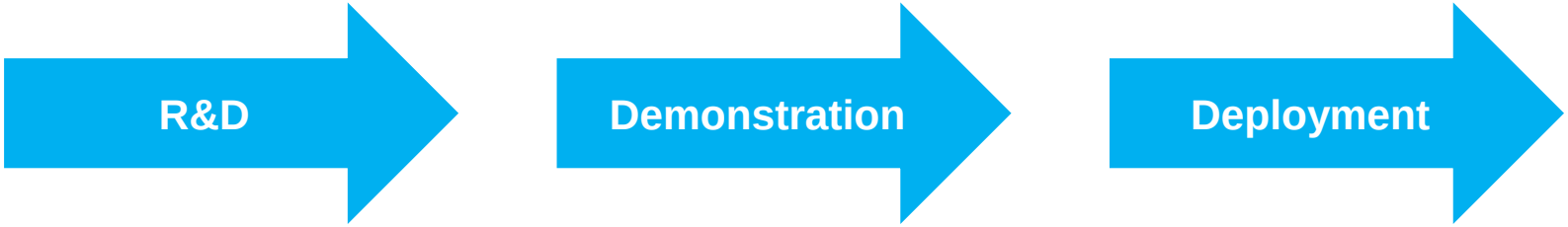
Dealing with significant technology cost and fossil fuel price uncertainties as well as availability and system constraints

- **Technology costs**: which technologies matter and do costs decrease with greater deployment?
- **Availability of technology**: unknown new technologies; immature technologies may not work
- **Supply chain**: speed of development through deployment?
- **Fossil fuel and carbon prices**: high, low or somewhere in between?
- **Infrastructure and systems:** changes in how they interact given technological change and the need to optimise within and across systems



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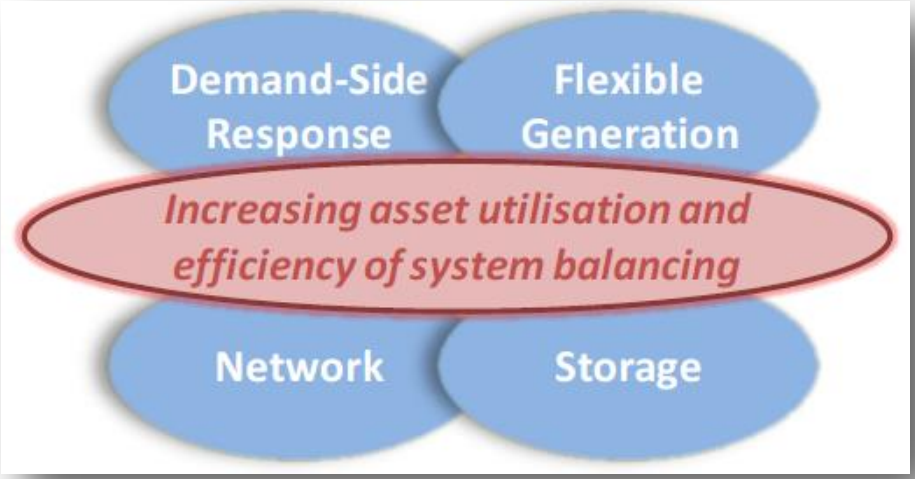
Optimising within the power system and across the power and gas systems as heat and power are decarbonised are key long-term challenges

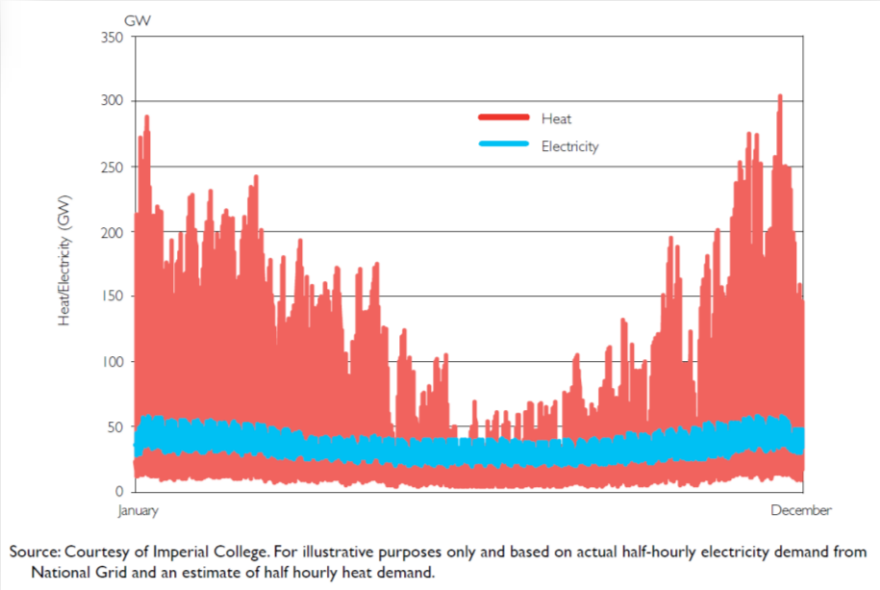


Alternative power system balancing technologies, including interconnection

Source: Imperial College and NERA, Understanding the balancing challenge, August 2012

Comparison of heat and electricity demand variability in 2010, domestic and commercial

Source: Imperial College



Source: Courtesy of Imperial College. For illustrative purposes only and based on actual half-hourly electricity demand from National Grid and an estimate of half hourly heat demand.

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Understanding how businesses (and households) make choices is also central, including investment decisions

Hurdle Rates under CFDs (pre-tax, real)

%	Offshore wind	Biomass conversion	Onshore wind
NERA illustrative range under CfDs*	9.3% - 11.2%	10.4% - 11.8%	6.6% - 8.0%
EMR delivery plan hurdle rate assumptions	10.1%	10.9%	7.1%

*Includes "EMR novelty risk premium
Sources: NERA, Changes in Hurdle Rates for Low Carbon Generation Technologies, December 2013, and National Grid, EMR Analytical Report, December 2013

- Perceptions of investment risk and investor risk appetite
- Bounded rationality versus perfect foresight regarding fossil fuel prices, future policies and carbon prices, and future technology costs
- Path dependencies in technology choices

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Understanding macroeconomic and distributional impacts of energy and climate change policies

- **Economic growth** – investment and productivity impacts associated with energy infrastructure and energy efficiency
- **Impacts on fiscal and external balances** – green taxes and substitution of capital for imported fossil fuels
- **New supply chains** – offshore wind and new nuclear
- **Adverse competitiveness impacts** – energy intensive industries and leakage
- **Impacts on fuel poverty** – role of energy efficiency in mitigating fuel poverty

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Thank you