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Where now for the UK energy system…?

Progressing towards a low carbon future – some thoughts to provoke a debate

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The ‘logical’ economic route forward for the UK is clear

But implementation is not just about logic and risk – it’s political and societal

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- In a world where we ……
  - Require energy security
  - Need to deliver affordability
  - Aspire to meet climate change targets including nett zero emissions

- The logical economic route forward is clear …..
  - Decarbonise **electricity** by 2030 – gas, CCS, nuclear, renewables (wind), bioenergy
  - Then accelerate decarbonisation of **heat** (electricity, non-fossil gases, CHP, efficiency) and **transport** (efficiency, biofuels, electricity, hydrogen)
  - Retain centralised grids but ‘smarter’

- BUT …..
  - All groups considering UK energy strategy, policy and economics are essentially working from the same assumptions and the same key data – challenge is needed
  - Failure to deliver a secure energy system is ‘not an option’
  - Uncertainties are increasing
  - Consumer led solutions are on the increase but integration is haphazard
  - Political will is needed to deliver any direction of change at scale and at speed ……

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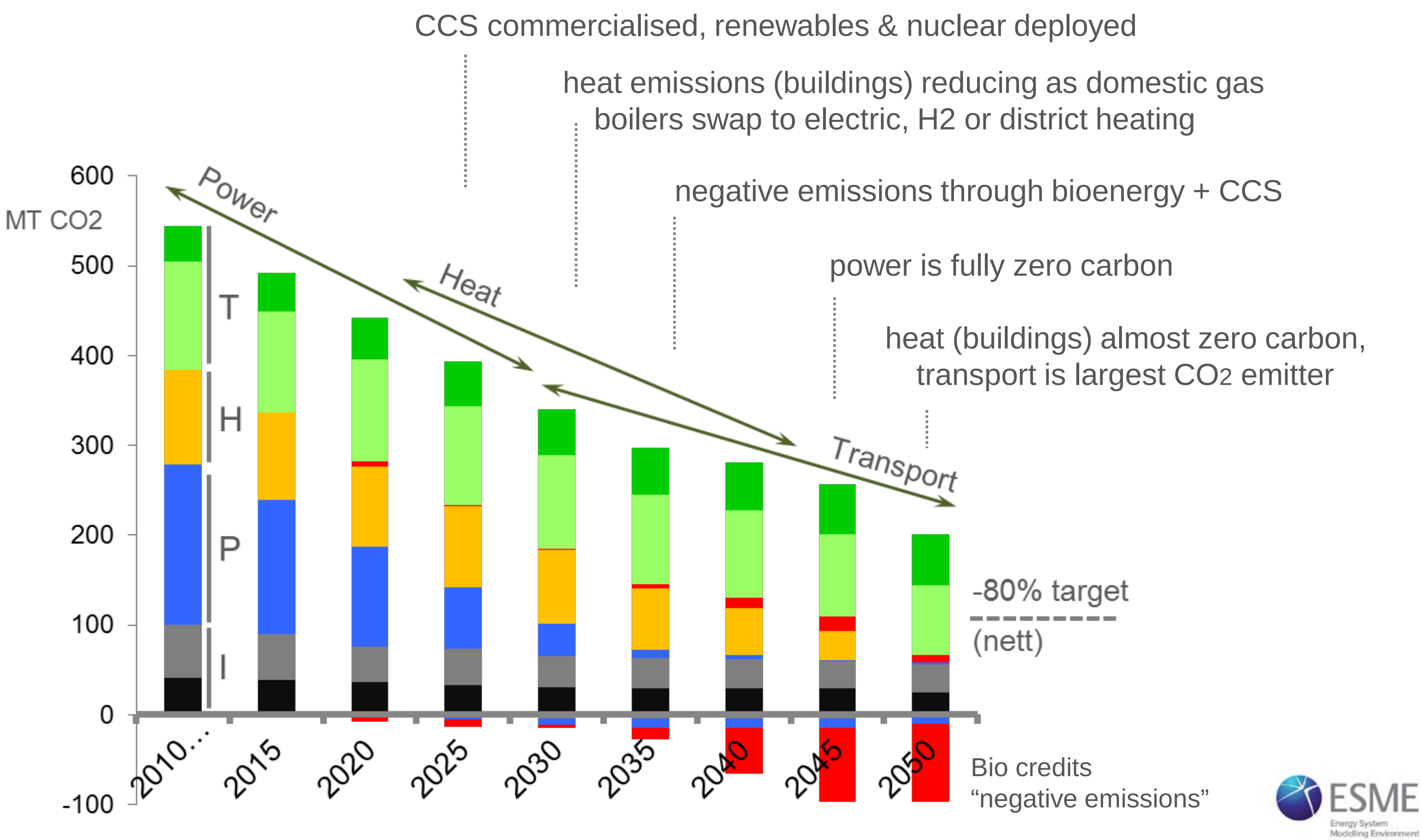
An emissions reduction plan

Power now, heat next, transport gradual – cost optimal



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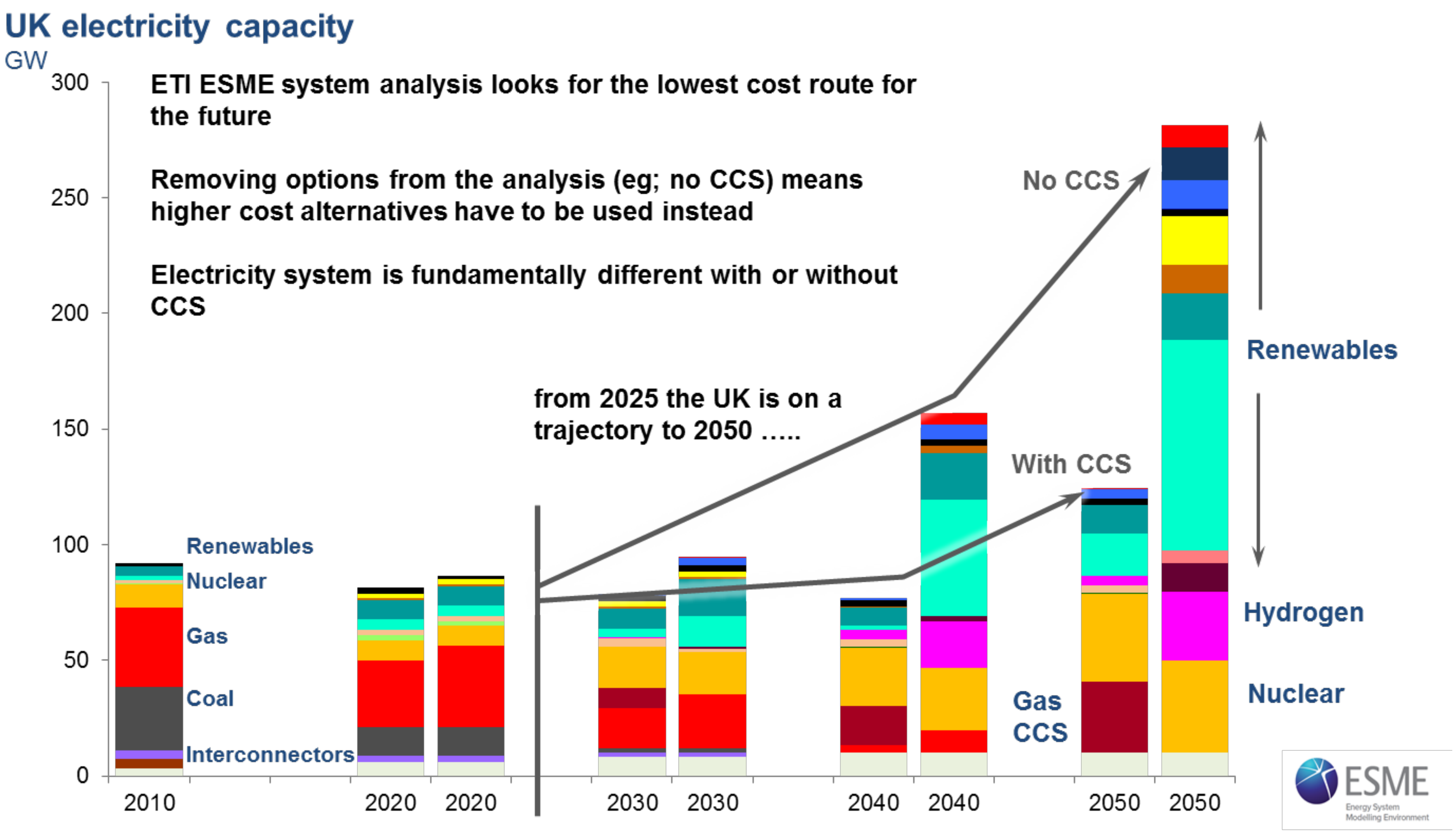
There are major options and drivers in how we develop the UK energy system …..



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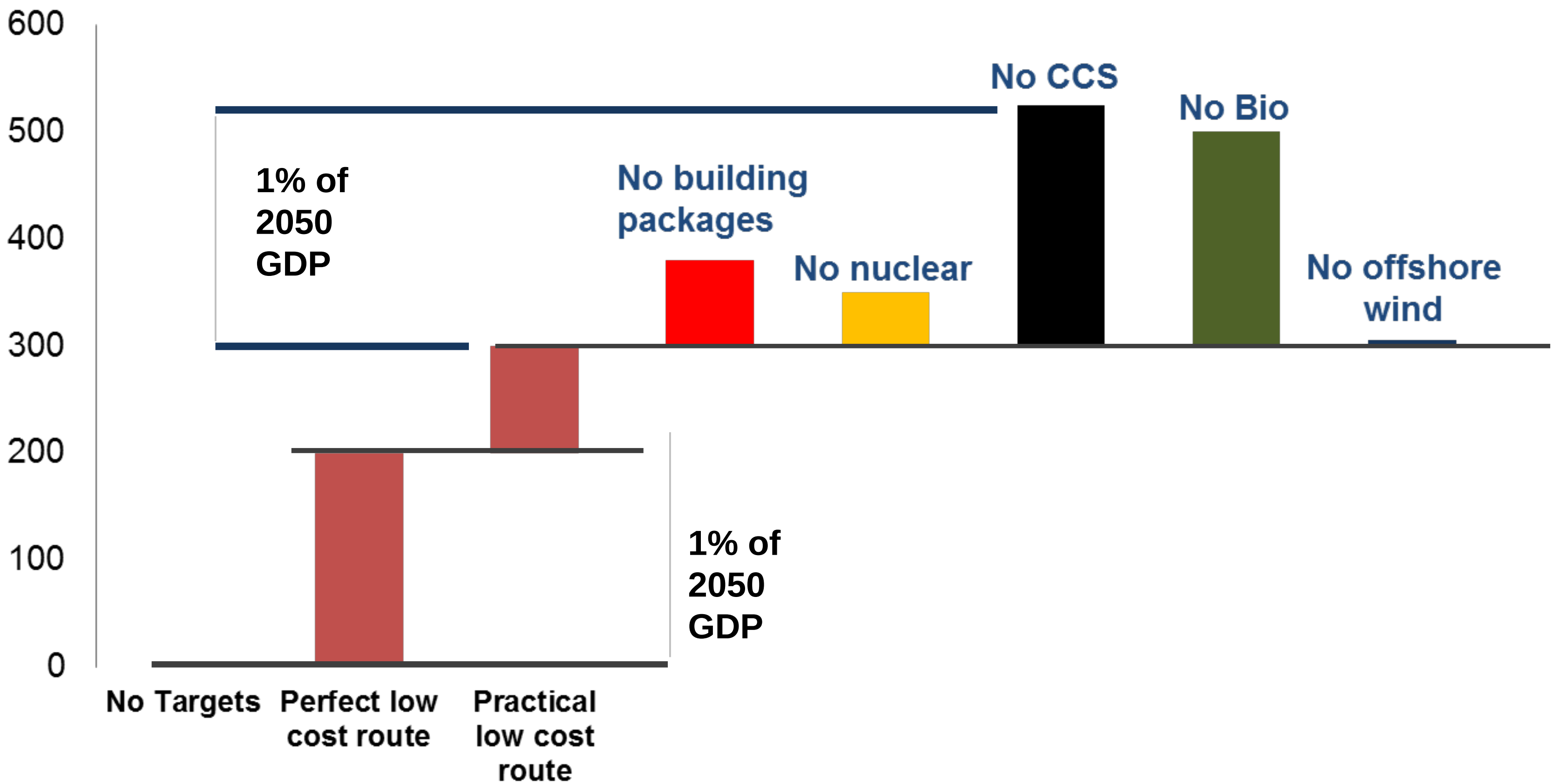
The UK can achieve an affordable transition (1-2% of GDP) but system optimisation is key

Additional cost of delivering 2050 -80% CO2 energy system
NPV £ bn 2010-2050



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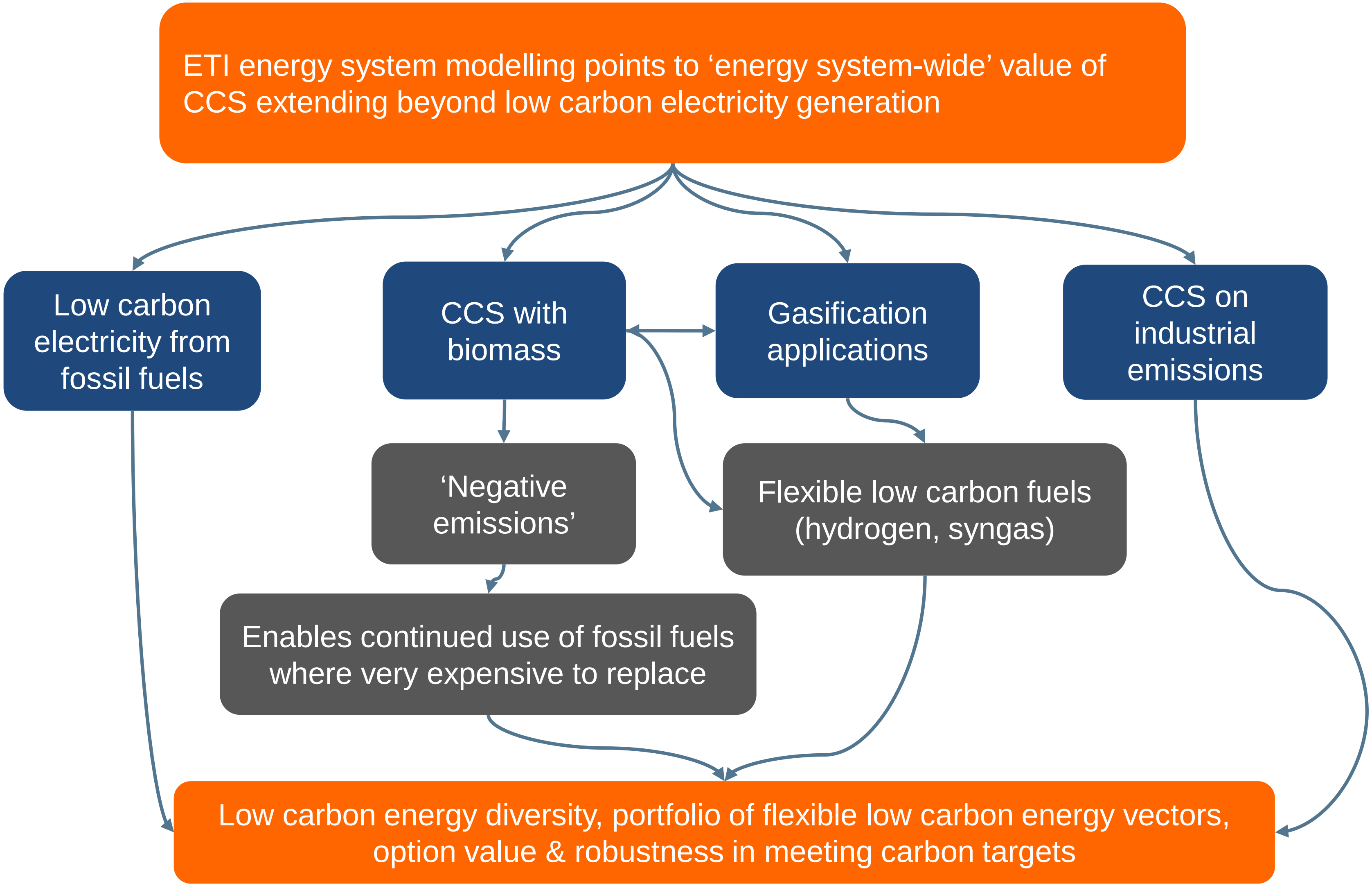
The Value of CCS is in its many roles



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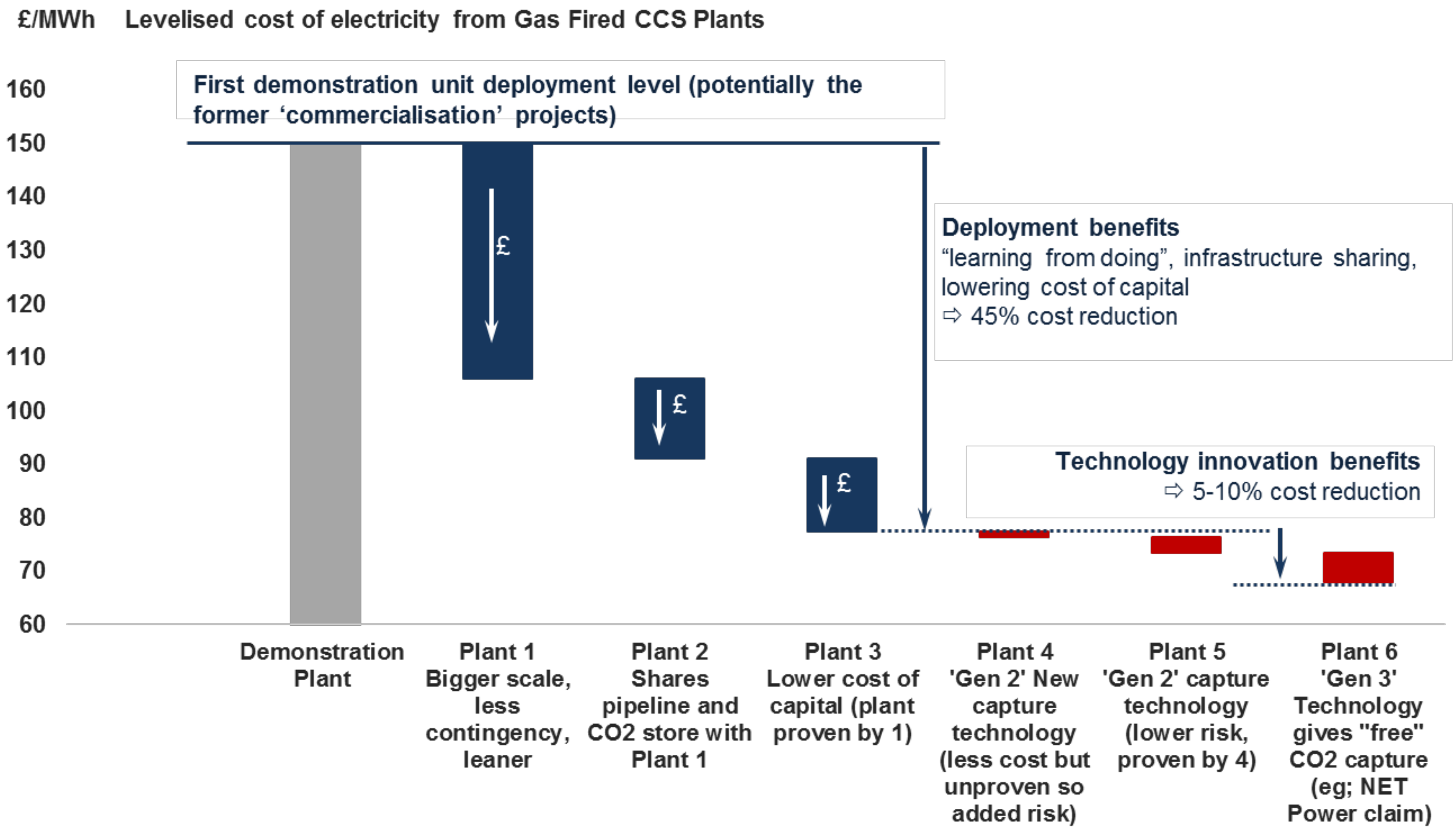
CCS cost reduction potential

primarily driven by increasing scale and sharing infrastructure



*Levelised costs are in UK£ 2013, capital costs are +/- 40%(EPC *1.4), discount rates are adjusted for risk (range 9-16%). Gas £24/ MWht and CO_2 emission £31/te. All plants other than first demonstration plant are 860MW net output.*

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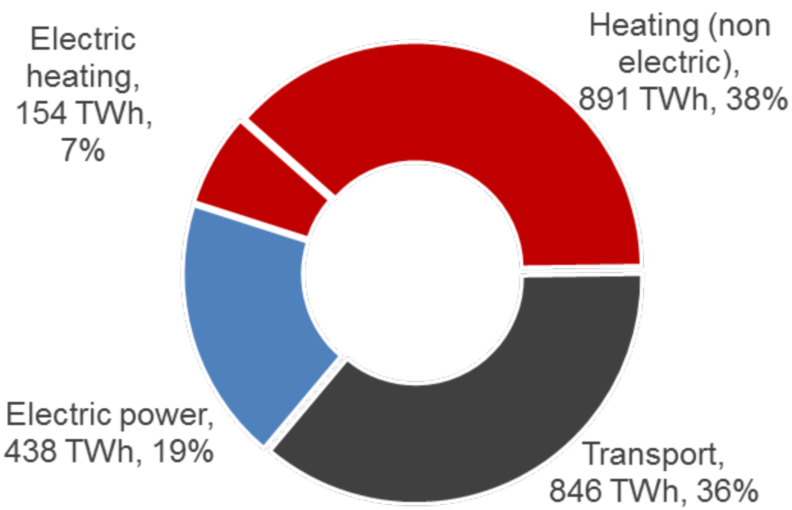
Storage

it's not going to be simple if we want it to make a big difference

What do we use energy for…



DUKES (2014 data)

What do we want storage for ?

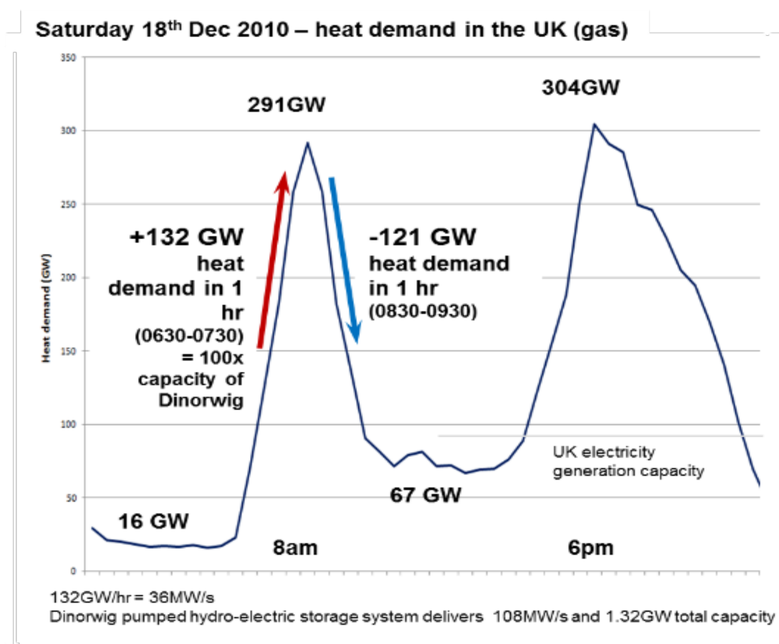
- Mobility (road vehicles)
- Responsiveness / flexibility
- Reserve / back-up
- Load levelling

All different, all changing markets...

Effective large scale energy storage needs to support multiple integrated demands – across the system…

...and the system may need considerable adaptation to incorporate it…

Gas is an easy example…



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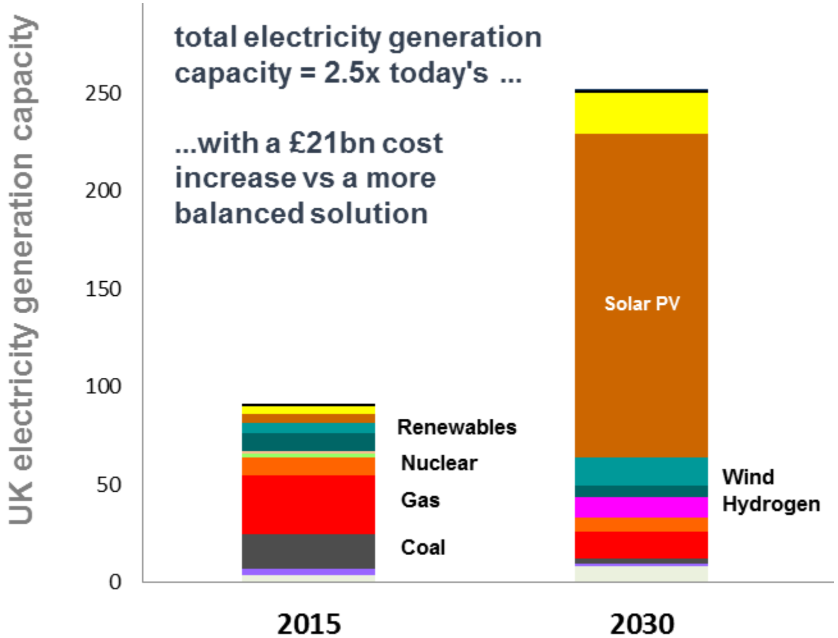
Reset :
could we meet 2030 emissions reduction targets on solar ?

- Current outlook suggests by 2030 there could be no CCS, very limited bio, up to 10GW additional offshore wind, maybe no new nuclear
- How far can solar PV, storage and gas take us?



- 188GW of solar PV delivering just over half of current total annual demand (~163KWh)
- Less than half (47%) could be used at the time of production
- 20-50GW of storage needed to shift supply to meet evening demand

- Land required equivalent to 4 national parks in south of England

- Winter demand met by gas – annual CO_2 intensity >100g/kWh
- To remove gas use requires further 80GW of solar and 60TWhs of storage (equating to a 40ft shipping container battery pack for every person in the UK)
- **Not a basis for the electrification of cars and home heating which will increase winter demand and overall system flexibility required**

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ETI scenarios – Clockwork, Patchwork

central control vs locally based decisions

25% increase in abatement cost to 2030 (+£33bn)

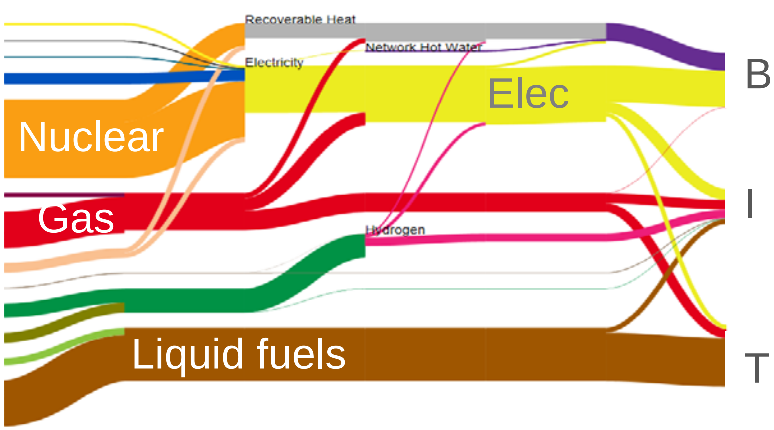
→

100% increase in system capex cost to 2030 (+£450bn)

Clockwork

Well coordinated, long-term investments
National planning

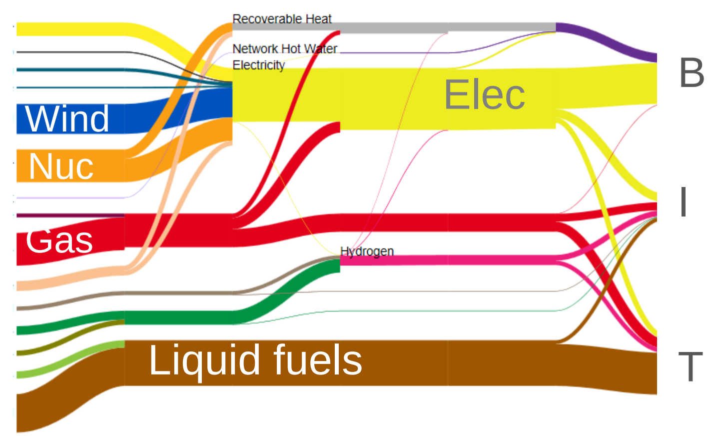
2050



Patchwork

Regional and community decisions
Larger number of (generally) smaller capital projects

2050



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Less coordination increases costs
– but may be faster in today's UK ?

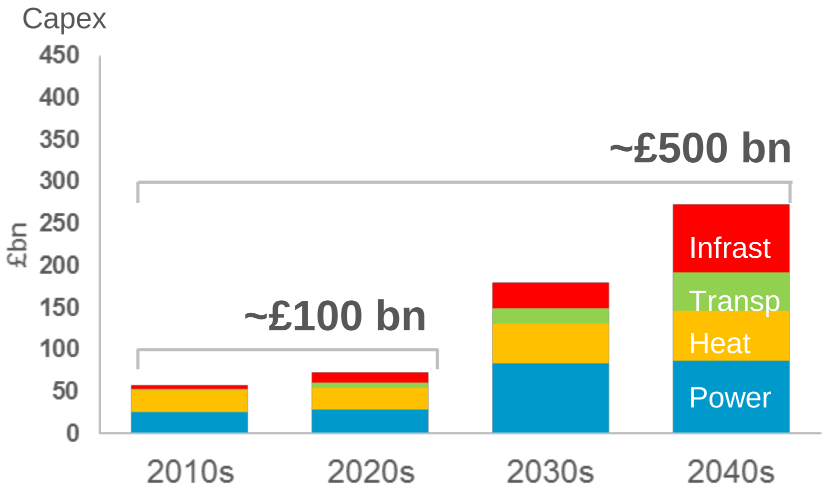
Reality - somewhere in the middle?

£150bn capex to 2030

+£2-3bn p.a.vs 'do nothing' on carbon reduction

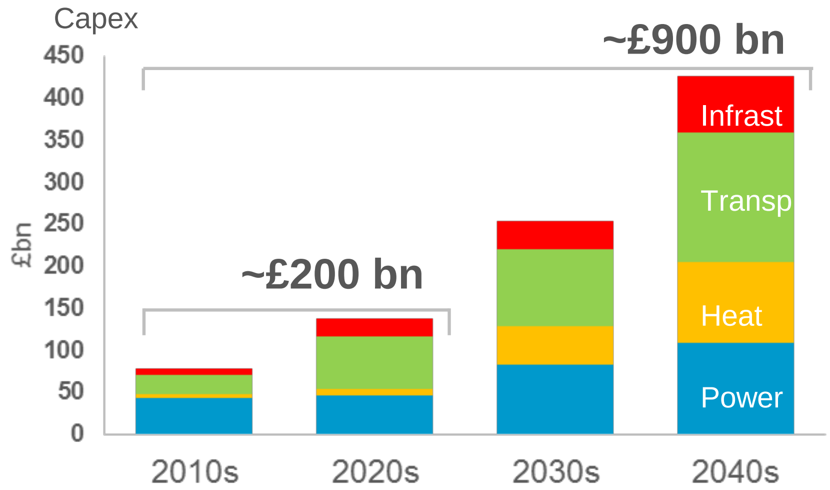
Clockwork – steady progress

lowest cost
greatest economic benefits …



Patchwork – fast decisions at regional level, diverse solutions

Adaptability for shocks and diversions?



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Way forward is clear - implement ‘no regrets’ solutions, test new options

Seek to understand scale of uncertainties and evaluate potential impacts

- The logical, economic, route forward is clear …..
  - Decarbonise **electricity** by 2030 – gas, CCS, nuclear, renewables (wind), bioenergy
  - Then accelerate decarbonisation of **heat** (electricity, non-fossil gases, CHP, efficiency) and **transport** (efficiency, biofuels, electricity, hydrogen)
  - Retain centralised grids but ‘smarter’
- The details of all these need to be tested …..
  - Drive forward new capacity in the main low carbon electricity generating technologies — nuclear, carbon capture and storage (CCS, on gas powerplants) and offshore wind
  - Press ahead with local and regional whole-system, large-scale pilot projects to establish real-world examples of how the future system will work
  - Move beyond current ‘single technology’ demonstrations and incorporate all aspects of the energy system along with consumer behaviour and financial mechanisms
  - Develop policies to accelerate demand reduction, especially in the domestic heat sector, and the introduction of ‘smarter’ demand management.
  - Clarify and stabilise market mechanisms and incentives in order to give industry the confidence to invest.

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