The future of electricity in the UK

Project Discovery Seminar

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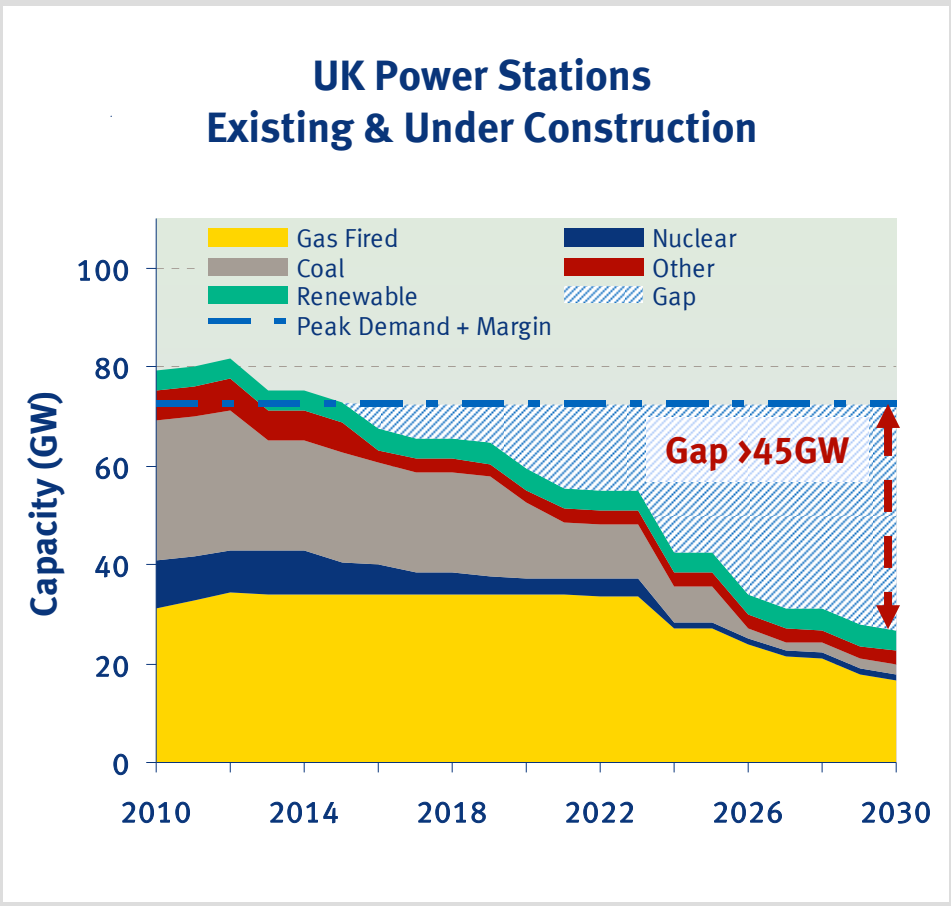
EDF ENERGY

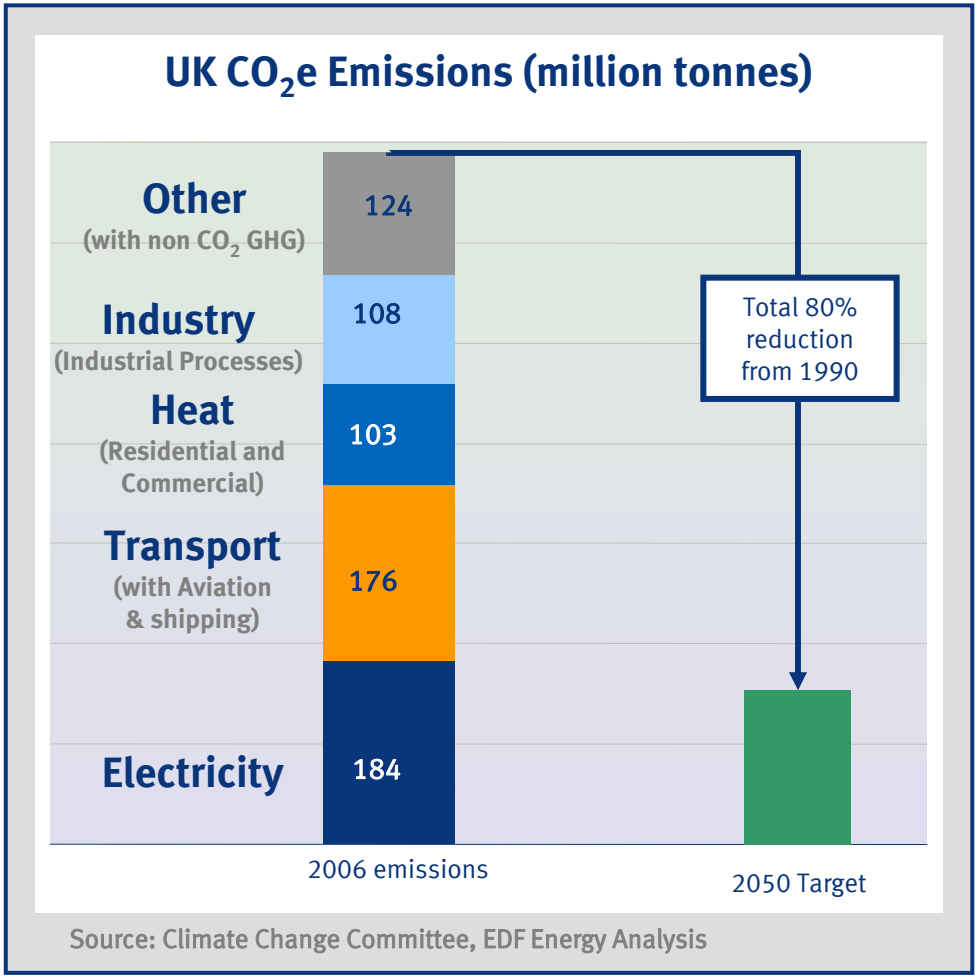
What type of generating plant should we build?



EDF Energy Analysis, shows power stations currently in operation or under construction, Renewables peak contribution is limited due to intermittency

- Many existing power stations will retire by 2030, including almost all of the UK's nuclear and coal fired stations
- This means that 45 GW of existing capacity will have to be replaced by 2030
- This could be higher if peak demand increases

The need to mitigate climate change is real



- Significant decarbonisation across all sectors is required
- The Climate Change Committee believe that early de-carbonisation of electricity is important. With significant progress (80%) by 2030
- Electricity can play a role in reducing the carbon footprint of other sectors and low CO_2 electricity can make a major contribution to decarbonising other sectors such as Transport and Heat

Translating UK Energy Policy objectives into reality

The UK needs secure, affordable, low carbon electricity to power our economy and support our way of living:

- Decarbonisation of electricity is essential if the 80% CO_2 reduction target by 2050 is to be achieved
- High levels of investment in new generation and transmission are needed, estimated at up to £200bn by 2030
- A range of technologies are available

High Level Assumptions underpinning our scenario analysis

Three scenarios that achieve the carbon ambition of 70g CO_2/kWh were developed

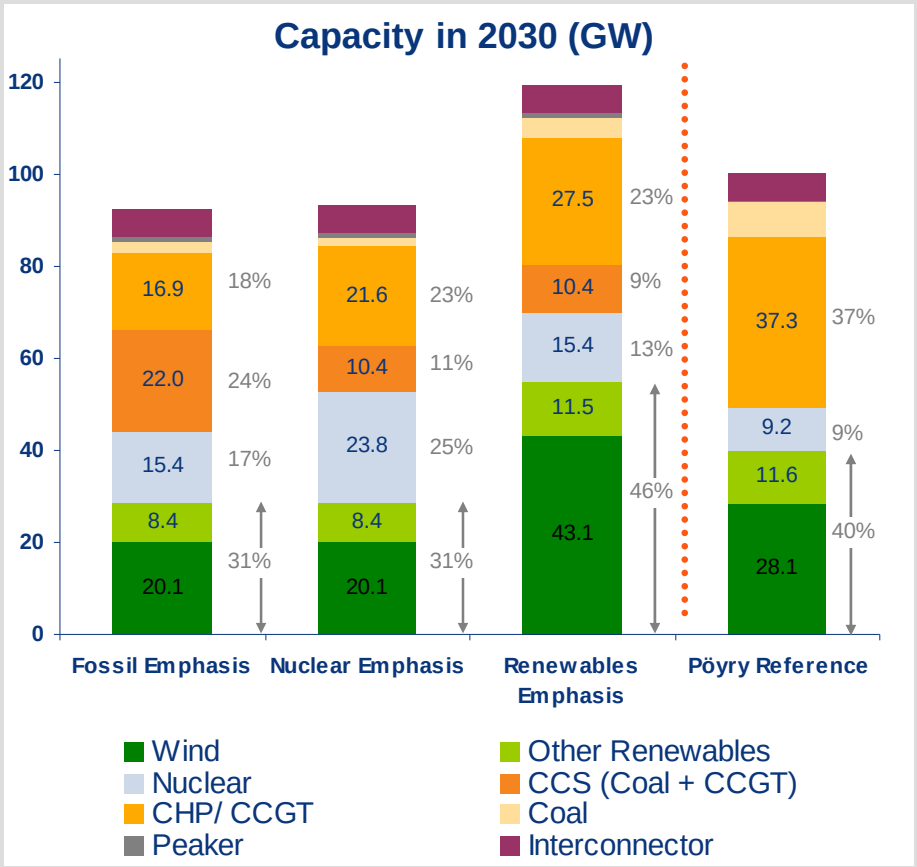
All scenarios are diverse, and include a major contribution from every low carbon technology

In each scenario, greater emphasis is placed on a particular low carbon technology (nuclear, renewables, fossil fuel with CCS)

Commodity prices, macro-economic assumptions, capital costs and demand are input assumptions and consistent across all scenarios

All assumptions are Pöyry's

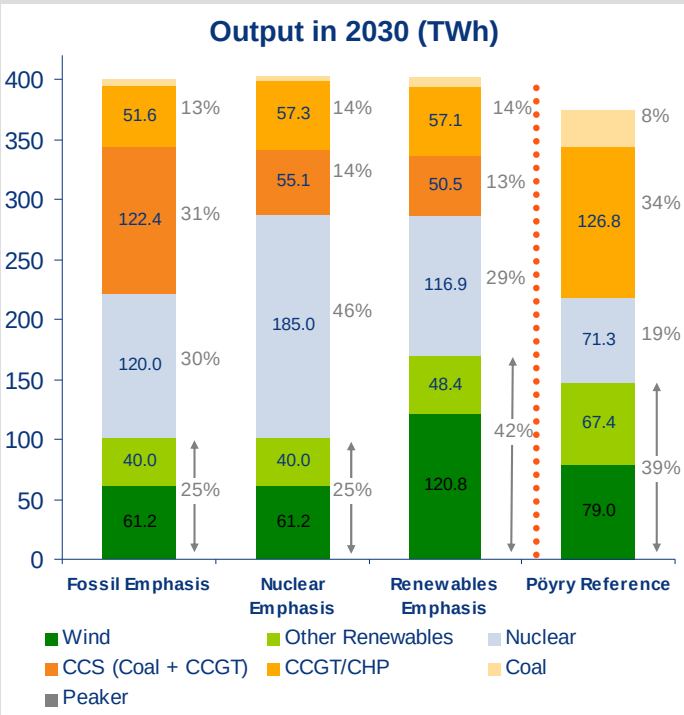
There is a range of possible scenarios



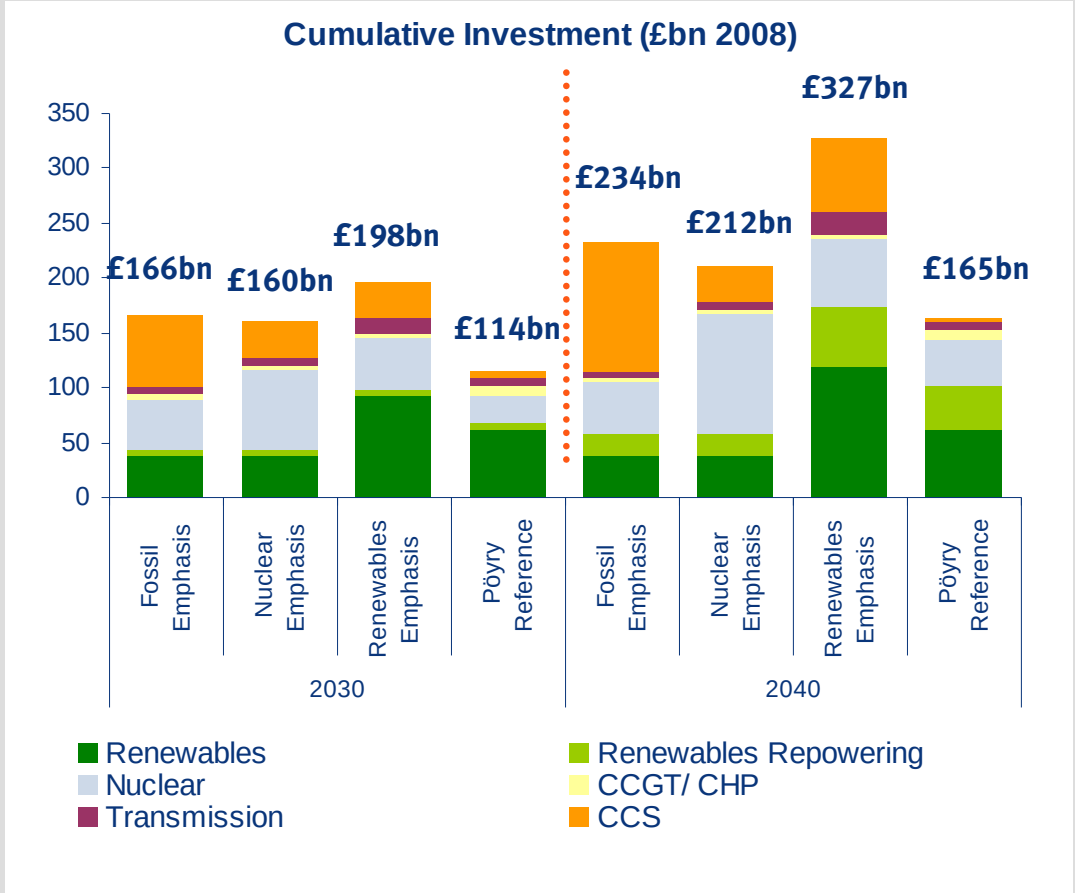
Source: Poyry Energy Consulting

The 'Pöyry Reference' scenario is a central view regularly updated by Pöyry – it does not meet the 2030 carbon target

- All scenarios require all low carbon technologies (nuclear, renewables and CCS) – no single technology can expand fast enough by 2030
- Three specific scenarios were developed that deliver a low carbon intensity by 2030 (70g CO_2/ kWh)*



Cumulative investment costs (Capital expenditure)

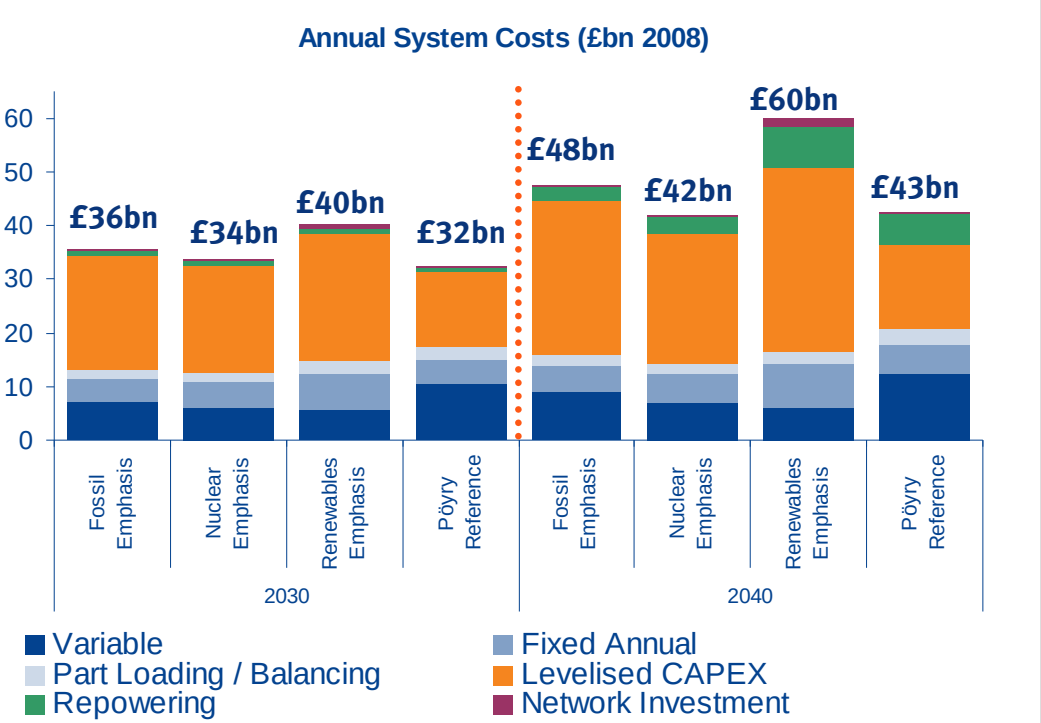


Source: Poyry Energy Consulting

Note: Capex includes interest during construction
Note: Distribution network costs are not included

- The Renewables Emphasis scenario is the most expensive
- Transmission capex is over £9bn higher as a result of the additional wind generation
- Generation and transmission capex grows proportionally faster in the Renewables Emphasis scenario
- The Pöyry reference scenario is the lowest capital cost as it assumes more CCGT build. (However, this has high operating costs and does not meet carbon targets)

Annual Total Electricity System Costs



Source: Poyry Energy Consulting

- Variable costs are fuel and net cost of imports
- Part-loading / balancing is the cost of balancing the system incurred by National Grid and the cost of actions taken by generators for commercial reasons (e.g. start up and reducing load factor which will reduce efficiency)
- Generation capital expenditure reflects the incremental levelised cost of generation commissioned after 2010, discounted over capital recovery period (40 years for nuclear, 20 for wind and CCS coal) at 12% real pre-tax.
- Network investment is the levelised cost of transmission reinforcement (40 years, 7%).
- The differences are significant

Secure & affordable electricity?

- While the recession may have reduced the extent of the capacity gap in the near and medium term, the need to deal with the carbon crunch and affordability of energy supplies remain real and urgent issues.
- All low carbon technologies (nuclear, renewables, clean gas and clean coal) have to make a contribution for the UK to successfully decarbonise its electricity supply by 2030 and then achieve its 2050 CO_2 reduction target.
- However the specific contribution from each technology to decarbonise electricity can have a significant impact on the affordability and competitiveness of UK energy supplies and it is important to debate the costs of the trade-offs in determining our future road map.
- Less emphasis on renewables significantly reduces the cost of carbon reduction
  - The nuclear emphasis scenario requires lower capex compared to the Renewables and Fossil with CCS scenarios (£38bn less capex by 2030 and £115bn less capex by 2040 than the highest cost scenario)
  - The annual system costs in the renewables emphasis scenario are c18% (›£6bn) higher in 2030 and ›40% (c£18bn) higher in 2040 than the cheapest scenario.

Is the market fit for purpose?

Some of the key changes facing the industry include:

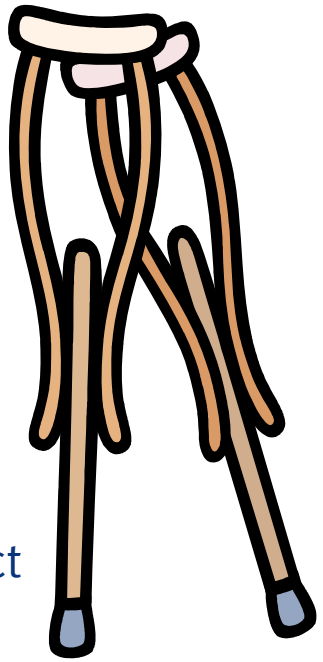
- The significant increase in the proportion of the market that will be sustained by subsidy and will distort the operation of the competitive market,
- the large increase in the proportion of high capital, low marginal cost plant on the system (such as renewables, CCS & nuclear plant),
- the significant increase in wind generation on the system, and the need to ensure that there is enough standby plant to provide back up for variations in wind output. The challenge will be to provide the appropriate investment signals to secure the investment needed in this plant without undermining the revenue streams for other plant,
- higher levels of physical interconnection and hence market convergence with other EU electricity markets, and
- the potential impact of electricity storage, demand wide management and smart technology on wholesale electricity prices.

It is difficult to predict the cumulative impact of these changes. However our main conclusion is that the sector faces considerable and increased uncertainty.

We believe a holistic review of the operation of the electricity market should be started soon to provide investors with the confidence that they can get a sufficient return on investment.

And action on carbon price is an urgent priority

- Coal to gas switching can deliver reductions in emissions but can not on its own deliver the deep cuts required to meet ambitions to mitigate climate change
- New assets have very long lives and power stations that we build today will still be around in 2040/ 50
- If we believe the electricity sector needs to be substantially decarbonised by 2030 then any asset replacement must make the shift to low carbon technologies now
- Any assets that are replaced now with carbon emitting plant increase the risk that the long term reduction targets will not be met (carbon lock in) and risk stranded investments
- If the speed at which you build low carbon plant is heavily influenced by the opportunity you have to replace ageing assets, is it then correct to rely on the ETS to effect this change and is the current ETS price providing these long term signals?



Urgent UK specific action is required to support the operation of the EU ETS in the UK -providing greater carbon price certainty for investors in all low carbon technologies