

WP1.1 Update

Whole System Modelling

Murray Thomson and John Barton

CREST

Centre for Renewable Energy Systems Technology
Loughborough University

Journal Publication

Time-Step Analysis of the DECC 2050 Calculator Pathways

- John Barton, Eoghan McKenna, Murray Thomson
- Proceedings of the Institution of Mechanical Engineers
Part A: Journal of Power and Energy
- Accepted for publication

Conclusions

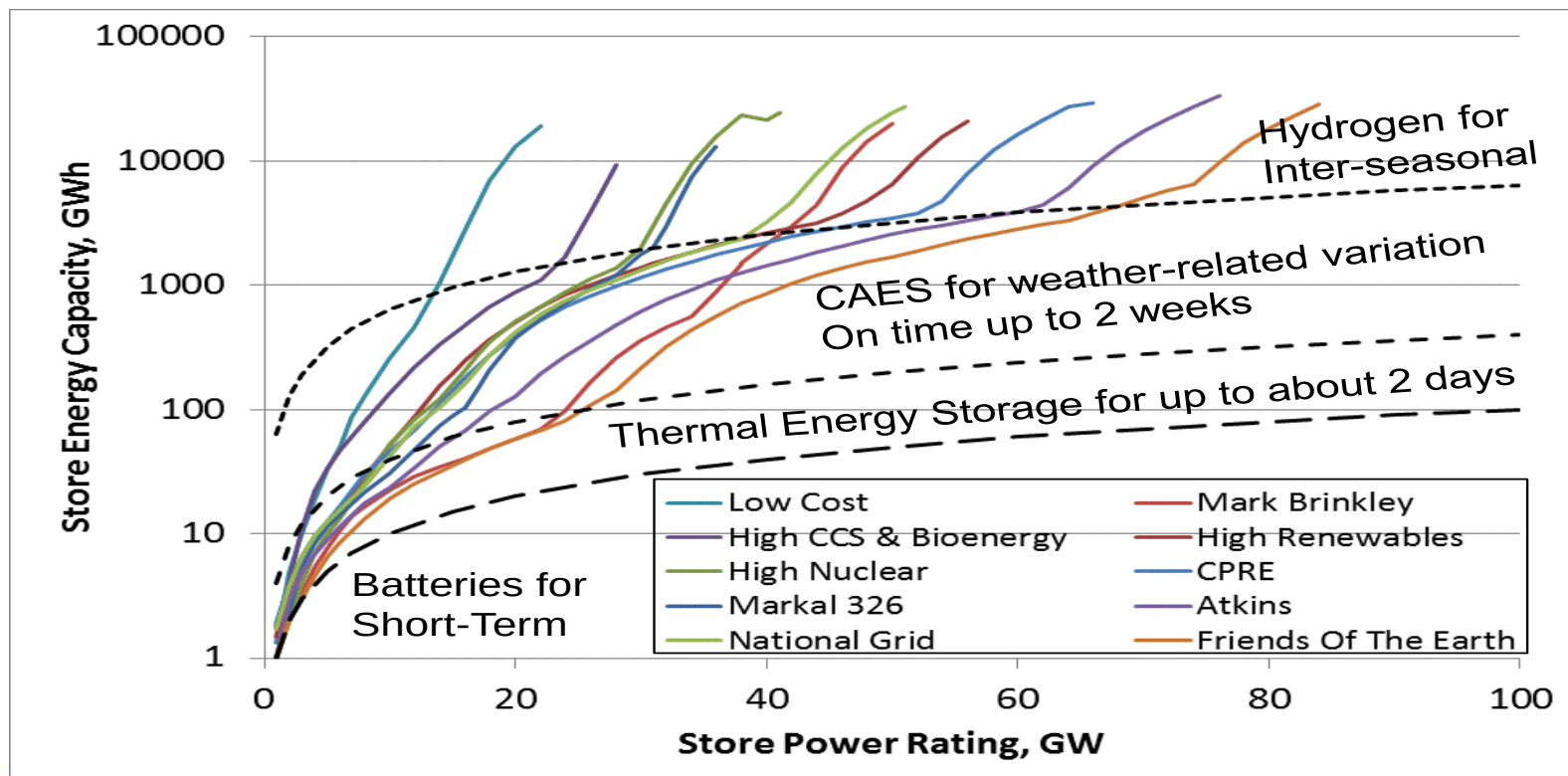
- The grid balancing **challenge is much greater** than is suggested by the DECC 2050 Calculator.
- Most of the example pathways **fail to meet the peaks** of net electricity demand, even with smart grid technologies, flexible demand and flexible imports.
- In most cases, the **unmet demand is a modest** shortfall of power, up to 16 GW peak, and a very small shortfall in annual energy, not more than 1 TWh/year and persisting for only a few hours.

- The DECC 2050 Calculator's assumptions of large installed generating capacities, together with high capacity factors for despatchable generators, result in **very large surpluses of electricity** not required in the UK.
- Both DECC 2050 Calculator and FESA predict that in most of the pathways, the UK will be a large **net importer of fuels**, or a large **net exporter of electricity**, or both by year 2050.
- FESA calculates that a large amount of energy is curtailed, with up to **75 GW peak and 160 TWh/year completely lost**.

- These **surpluses can persist for many days** and indicate the **importance of developing long-term energy storage** technologies (days and weeks, not just hours) including power-to-gas or other fuel-producing technologies.
- Short-term time-shifting forms of demand response have very limited benefit to grid balancing but **fuel-switching technologies show promise** in helping to address many of the above problems, by flexibly using electricity instead of a fuel. Fuel switching technologies currently omitted from the models include flexible heating systems, flexible operation of plug-in hybrid vehicles and power-to-gas.

Next paper – working title

- The Role of Energy Storage in Low Carbon Electricity Systems, the Value of its Services and Suitability of Different Storage Technologies



Next step within IMAGES

**Develop a low-carbon energy scenario for the UK in 2050
with the specific aim of
minimising the need for long-term energy storage.**

- Strategy
 - Use solar to improve summer renewable energy supply, balanced by wind and wave in winter.
 - Use CHP balanced with heat pumps to minimise temperature effects on net demand.
 - Use flexibly fuelled heating as a balancing mechanism.
 - Consider electrification of heating balanced against decarbonisation of the gas grid.