Security of supply challenges for a weather dependent GB electricity system and the role for storage at scale

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The UK government has ambitious targets to rapidly decarbonise the electricity system through its Clean Power by 2030 targets. These aim to cut the use of fossil fuel generation to no more than 5% of total generation, parimarily via the rapid expansion of wind and solar generation and implementation of new flexibility measures in the form of storage and flexible demand.

This presentation uses historic weather data to model annual variations in the expected renewable energy output and demand in the future GB (Great Britain) electricity system, arguing that residual demand (demand after accounting for the presence of renewable energy) is the key metric important to governing system operation. Figure 1 highlights periods of both energy deficit that need to be covered by dispatchable power sources and periods of surplus energy with a clear requirement for storage to help at both ends of the curve. A multi-weather year analysis is carried out to determine the scale and annual variaition in energy requirements and so estimate the need for energy storage or alternative dispatchable energy sources at different timescales.

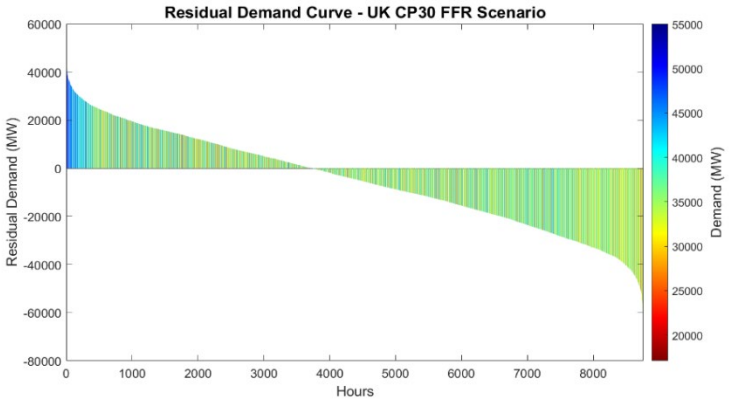

Figure 1 – Modelled residual demand duration curve for Clean Power 2030 Further Flex and Renewables scenario

This analysis is then coupled with of a 14-region disaggregated model of the GB electricity system set within a wider European electricity market model to explore some of the adequacy challenges faced by a future decarbonised GB power system. The model solves an hourly year-round unit commitment problem. Through various updates including integration of scenarios that match with Clean Power 2030 pathways and the development of realistic future demand profiles incorporating the electrification of heat and transport sectors, the model is used to assess how key metrics relating to system adequacy, operation and cost – such as energy not served, curtailment levels, carbon emissions and system prices – are impacted by the variability of weather.