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# Dynamic Long-Term Modelling of Generation Capacity Investment and Capacity Margins: a GB Market Case Study

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The UK Government is developing policies whose combined goals are 1) to promote the level of investment in renewable generation required to meet emissions reduction and renewable electricity targets; 2) maintain the level of security of supply risk that society has come to expect; and 3) reduce customer costs. The view of Government is that these goals will not all be met by the current market design, and consequently a reform of current arrangements has been proposed.

This paper presents a dynamic simulation model of the aggregated Great Britain (GB) generation investment market and seeks to inform the debate about market reform, in particular the response and profitability of thermal investments to policies promoting investment in variable output renewable generation such as wind. An computationally fast, accurate and robust method of calculating the expected output, cost and revenue of thermal generation subject to varying load and thermal plant reliability expectations in a power system with high penetrations of wind is presented.

Simulated results for the GB market case study show a pattern of increased relative security of supply risk during the 2020s with very tight supply conditions experienced during a small number of peak hours. In addition, fixed cost recovery for many new investments only occurs during years in which more frequent supply shortages push wholesale energy prices higher. Factors that affect the timing and level of generation investment are explored by discussing the relative change in simulated outputs for a sensitivity analyses on a number of key model assumptions.

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These model results provide insights into the increased revenue risk facing thermal generating units, particularly peaking units that rely on a small number of high price periods in order to recover fixed costs and receive adequate returns on investment.

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