

ON THE OPERATION OF CCS WITHIN A DIVERSE ENERGY SYSTEM

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That CCS will be required to operate in a flexible and load following fashion in the diverse energy landscape of the 21st century is well recognised. However, what is less well understood is how these plants will be dispatched at the unit generator scale, and what effect this will have on the performance and behaviour of the plant at the individual unit operation level.

To address this gap, we couple an investment and unit commitment energy system model with a detailed plant-level model of a super-critical coal-fired power station integrated with an amine-based post-combustion CO₂ capture process. We provide insight into the likely role of coal and gas CCS plants in the UK's energy system in the 2030s, 2040s and 2050s. We then evaluate the impact that this has on the performance of an individual coal CCS plant operating in this system, and chart its evolution throughout this period.

Owing to the increased frequency and duration of part-load operation, asset utilisation and average efficiency suffer. This leads to a substantially increased LCOE. This reflects the growing inadequacy of this metric for evaluating CCS technology within a diverse energy landscape.

Further, as a direct consequence of the dynamic operation, the interaction of the CCS plants with the downstream CO₂ transport network is characterised by highly transient behaviour, including periods during which no CO₂ is injected to the transport network, implying that the transport system must therefore be designed to incorporate this variability of supply.