The role of negative emissions technologies in decarbonising the UK energy system

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What could a decarbonised UK electricity system look like?

To achieve decarbonisation without NETs, the UK would need significant expansion of intermittent renewable energy sources (iRES), energy storage and nuclear technologies in the electricity system. NETs can compensate for emissions from CO2 emitting power plants, thereby allowing for their continued utilisation.

Broader context

The Climate Change Act 2008 mandates a decarbonisation of the UK electricity system by 2050. NETs are technologies that can, directly or indirectly, remove CO2 from the atmosphere. Two are considered in this work: bioenergy with carbon capture and storage (BECCS), which involves permanently sequestering the carbon absorbed by biomass during its growth; and direct air capture and storage (DACS) which removes CO2 from the air using sorbents. We apply a power systems planning model1 to explore the potential role and value of BECCS and DACS deployment in decarbonising the UK electricity system.

What service(s) is BECCS providing to the system?

In 2030, BECCS is observed to exhibit load-following behaviour. As the emissions target becomes more stringent towards 2050, BECCS is operating at its maximum output. BECCS is therefore providing offset for CCGT emissions initially but transitions to maximum CO2 removal.

Value Transfer: a route to NETs commercialisation?

NETs allow for the increased utilisation of CO2 emitting plants, especially CCGTs. CCGT revenues were seen to increase with NETs deployment, therefore NETs accrue value to CCGTs. Allowing some of this value to accrue to NETs could potentially reduce the public burden of delivering negative emissions.

Focus for innovation

Both DACS and BECCS were made available for deployment to meet a 50 MtCO2/yr emissions target by 2050. We observe that DACS is competitive with BECCS unless DACS CAPEX falls by a factor of 10 or greater.

REFERENCES