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Non-technical summary

Cost trajectories of low carbon electricity generation technologies in the UK: A study of cost uncertainty

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This paper investigates the cost uncertainty around published future electricity generation costs, as revealed in recent publications from the UK Department of Energy and Climate Change (DECC). Such analysis is important because these published cost estimates are an important input into policy making and to company forecasting.

The first component of our paper composes *contextual cost landscapes* which present the UK's Department of Energy and Climate Change (DECC) Levelised Cost of Electricity (LCOE) estimates as estimate trajectories, in the context of historic and future estimates, and actual (*out-turn*) costs. The second component is a numerical analysis of the estimate trajectories, which embodies a new approach to measuring and communicating uncertainty. It is intended that this new measure capture the degree of consistency (or variability) of the DECC LCOE estimates over time, alongside variations in cost magnitude. This is premised on the notion that the temporal consistency of an estimate's magnitude is one indication of the overall levels of certainty embodied in it; something that is often overlooked with conventional uncertainty measures.

Three technology groups – nuclear, offshore wind and CCS (carbon capture and storage) – have been selected, which together constitute a spectrum of cost uncertainty and deployment progress in the UK. Contemporary nuclear generation – principally represented by Pressurised Water Reactors (PWRs) – is a well-established technology, with several years of operational experience accrued to date across several countries (despite well publicised problems at the two plants currently under construction in the EU). Though in its infancy, offshore wind generation is a technology that is gaining momentum, with the UK now the world leader in terms of installed capacity. Finally, Carbon Capture and Storage (CCS) is truly a First-of-a-Kind (FOAK) technology in the UK, with initial commercial-scale installations planned for the mid-2020s.

The results show nuclear to be forecast not only as the cheapest sub-group, but also the one least laden with uncertainty. It is hard to resist the conclusion that, economically, nuclear seems to the best option of the three, based on these results.

What is immediately apparent from our analysis of offshore wind is that both Round 2 (R2) and Round 3 (R3) installations demand significant cost premiums over most other sub-group estimates, and over projected wholesale costs. Current installed costs are increasing. We suggest that the benefits of delaying the roll out of offshore wind currently look significant, while the benefits of accelerated roll out – in terms of future cost falls - are uncertain.

The contextual cost landscape for CCS shows the LCOE estimates for the technology reaching parity with wholesale cost from 2025 onwards, depending on the sensitivity viewed. The key finding of the uncertainty results for CCS is that they resonate with the fact that it is

a technology in the conceptual stages of its development. The disparate results in the temporal uncertainty analysis – for both CCS sub-groups – confirm the unknown nature of the costs. The broad impression is an *unknown-unknown* characterization of likely future costs and their evolution.

We demonstrate a number of ways in which to analyse and present cost uncertainty. DECC's methodology – and the modified approach – leads to nuclear being presented favourably compared to other technologies, yielding figures with relatively narrow cost uncertainty. If technologies with narrow uncertainty bounds are prioritised when investing, their cost uncertainty range is likely to shrink further. This seems to be what has happened with nuclear in the UK. Conversely, technologies that exhibit broader cost uncertainty are likely to attract less investment, and remain cost-uncertain – for example, CCS in the UK. To compound this effect, there are obvious political incentives to validate previous estimates and maintain a constant policy thrust, thereby simplifying future investment decisions. This underlines the importance of independent analysis - such as ours - of the internal consistency through time of government cost estimates.

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Publication January 2015