Imperial College London
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Accelerated clean electricity: Impact on UK climate ambition

Independent opinion provided by:

Iain Staffell, Nathan Johnson, Luke Hatton, Olusola Bamisile
Imperial College London.

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Executive summary

The UK is legally committed to reduce its carbon emissions by 68% in 2030 and 78% in 2035, compared to 1990 levels. These targets form the UK's Nationally Determined Contribution (NDC) – the pledges that each country makes to reduce emissions under the Paris Agreement.

NDCs currently run to 2030, with NDCs for 2035 and beyond due to be submitted to the UNFCCC by spring of 2025 ahead of COP30 in Brazil, where hopes that strengthened national ambition can close the gap on 1.5ºC in response to the first global stocktake as part of the Paris Agreement. On the same timeline, the UK Climate Change Committee (CCC) is due to bring forward its proposals for the UK's Seventh Carbon Budget covering the period between the 2038-42, including the UK's 2040 target. The UK's current targets were set back at the end of 2020 and the start of 2021 during the adoption of the Sixth Carbon Budget, but since then ambition for power sector decarbonisation has increased sharply.

Following Russia's invasion of Ukraine in 2022, the then Conservative Government published the British Energy Security Strategy (BESS)[1], which strengthened targets for deploying clean energy technologies – notably increasing the UK's 2030 offshore wind target to 50GW. Going beyond this, the new Labour Government have set out even stronger commitments for boosting deployment of low-carbon technologies[2], making a Clean Energy Mission (CEM) one of their five missions as part of the UK election campaign where they were elected in July 2024. Importantly, neither of these ambitions were included in the CCC's Sixth Carbon Budget analysis back in 2020, and while progress in other sectors has been slow, with all else being equal and other sectors delivering their expected emissions savings, this could present an opportunity for the UK to increase its climate ambition in their NDC in the run-up to COP30 in 2025. The first global stocktake showed that the world is far from on track to meet the goals set out in the Paris Agreement[3], and using the accelerated ambition in the Clean Energy Mission to increase UK ambition could present an opportunity to show global leadership and encourage other countries to follow suit.

To measure this impact on accelerated clean electricity on the UK's climate ambition we modelled the impact of the BESS and CEM against the CB6[1]. We show that if the UK delivers on its potential ambitions for accelerated clean electricity while simultaneously delivering on its commitment in other sectors, **it could increase its NDC for 2030 by 1–2 percentage points, which would represent an additional saving of 8–17 million tonnes CO_2 per year in 2030.**

Figure 1 – Installed clean energy capacities today, and commitments for 2030.
6CB: The Climate Change Committee's Sixth Carbon Budget report[4].
BESS: the British Energy Security Strategy, CEM: the Labour Party's Clean Energy Mission.

Potential of additional low carbon electricity

Installing more low carbon capacity will have a mix of impacts, depending on future demand for electricity and the flexibility of the grid. It could:

1. **Reduce electricity emissions in the UK**, by reducing the amount of electricity generated by other power plants domestically;
2. **Reduce other sector's emissions in the UK**, by powering new demands for clean energy in transportation, buildings or industry;
3. **Reduce electricity emissions outside of the UK**, by increasing exports to neighbouring countries;
4. **Not be utilised**, due to curtailment caused by grid congestion and/or lack of flexible electricity demand.

Which types of electricity generation are displaced will be determined by market signals driven by the available electricity generation, network capacity and demand flexibility, or it can be exported via interconnectors. Exporting renewable electricity contributes to reducing global CO_2, but not the UK's Nationally Determined Contribution (NDC) as the electricity is consumed abroad displacing fossil-fuel generation elsewhere.

Curtailment could be limited by building a more flexible energy system (e.g. with more storage and smart demand-side response) and by utilising more electricity domestically (e.g. with faster adoption of electric vehicles and heat pumps, or producing more hydrogen from electricity). The former would reduce electricity emissions in the UK, and the latter would help ensure emissions are reduced in other sectors – which have been making slower progress than electricity.

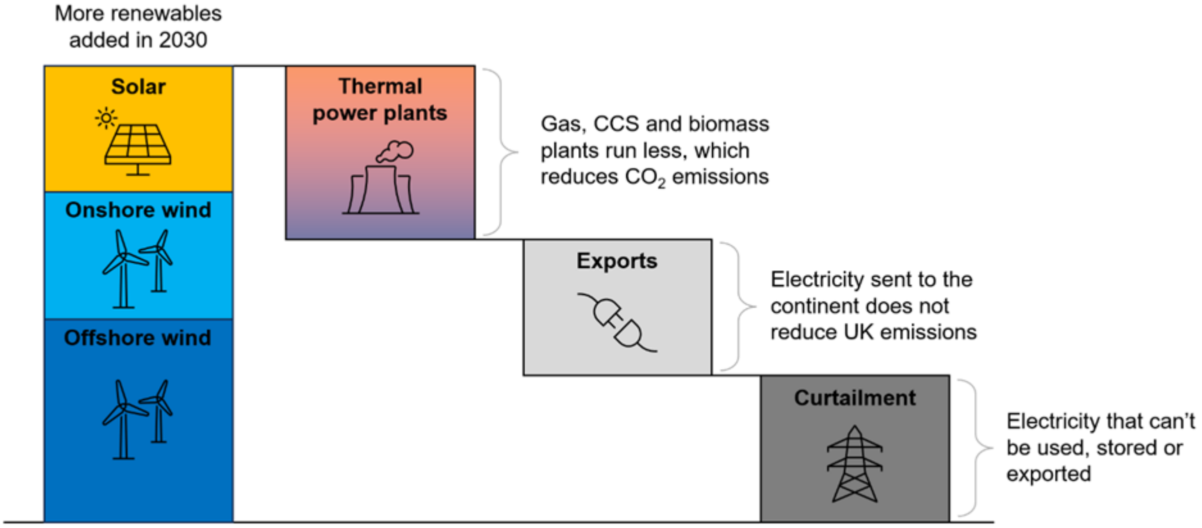

Figure 2 – Schematic showing the fate of clean electricity in 2030.
The size of the bars is only exemplary and does not correspond to modelled outcomes.

Impacts on the Carbon Budgets

To consider the impact of accelerated clean electricity ambition we model the Great Britain's power system in 2030 and 2035 under the plans outlined in Figure 1, to estimate how the CO_2 would be saved across the power system due to additional renewable generation. Future emissions from Northern Ireland's power system were calculated separately according to the European Network of Transmission System Operators Ten Year Network Development Plan[5].

Our modelling found that if targets from the British Energy Security Strategy (BESS) are met, the UK could upgrade its 2030 NDC by **0.9 percentage points** to a 68.9% reduction on 1990 levels. In 2030, the additional 10 GW of offshore wind and 19 GW of solar would produce 48 TWh of clean electricity. Two-fifths of this would displace around half of the remaining unabated gas generation. Another two-fifths would be exported to the continent, and the rest would be curtailed – but available for used if more flexible demand was deployed. Together, this would save around 8 million tonnes of CO_2 per year.

The more ambitious targets included in the Clean Energy Mission (CEM) could upgrade the 2030 NDC by **2 percentage points** to 70%. The additional wind and solar power installed are sufficient to displace much of the remaining unabated gas generation, saving around 17 million tonnes of CO_2 per year. Around one-third of the extra production is exported, and one-sixth curtailed.

The impacts on the 2035 NDC are much smaller, because the Sixth Carbon Budget already set out plans to decarbonise electricity generation by 2035. The BESS could upgrade the 2035 NDC by 0.4 percentage points, and Labour's plans by 0.8 percentage points from savings within the power sector, as there are only low-carbon generators left to displace and much of the additional electricity is curtailed or exported. For example, BESS yields an extra 39 TWh of electricity in 2035, but this only yields a saving of 3 million tonnes of CO_2. Note that using more of this electricity to displace fossil fuel use in end use sectors would enable further emissions reductions domestically, and exports of clean electricity to the continent enable emissions reduction abroad.

International comparison of clean electricity

In a companion report, we showed that between 2010 and 2022, the UK jumped from sixth in the G7 to third in terms of clean electricity share. Under the current 2030 NDC, the UK would retain its position in third with the rest of the G7 making similar progress. More detail can be found in: *A Clean Electricity Scorecard for the G7*[6].

Taking the increased clean electricity ambition in the BESS would increase the UK's position to second above Canada, with a clean share of 93%, while the ambition in the CEM would take the UK to top of the G7, above France with a clean share of 97%.

Discussion and conclusions

Wind and solar power are a central component of the UK's energy transition, and commitments to increase capacity allow the UK to decarbonise more rapidly. Building more renewables is only one piece of the puzzle though. The abundance of clean electricity could be matched with measures that increase electricity demand (such as producing clean hydrogen or accelerated electrification) and improve energy system flexibility to allow more renewable electricity to be utilised and emissions to be reduced further across all sectors.

In its Progress Report to the UK Parliament in 2023, the CCC noted that the UK's rate of emissions reductions would need to accelerate quickly to meet its 2030 NDC[7]. Excluding the power sector, emissions have fallen by an average of 1.2% per year since 2015. To achieve the UK's NDC, this pace will need to more than triple to 4.4% per year across all sectors to 2030. The estimates from this work rely on recent commitments being additional to the required increase in emissions reductions, they cannot be an excuse to ease off in other sectors.

At the same time, there are other commitments in the BESS which go beyond the Sixth Carbon Budget. The BESS commits to capturing an additional 10–20 Mt of CO_2 by 2030, enough to upgrade the NDC by a further **1.1–2.3 percentage points**. Both the BESS and the CEM also commit to deploying an additional 5 GW of clean hydrogen production capacity by 2030, which would allow emissions to be reduced further.

The commitments set out in the BESS could offer an opportunity to enhance the UK's ambition on climate change whilst improving domestic energy security, with the CEM setting out even more ambitious clean electricity targets for 2030. **If these accelerated clean electricity ambitions are realised, and other sectors meet their expected trajectories, the UK could upgrade its NDC for 2030 under the Paris Agreement by 0.9 and 2 percentage points**. At the very least, it could make up for slower progress in harder to abate sectors.

With the upcoming updates to NDC's and consideration of the UK's Seventh Carbon Budget ahead of COP30, the UK's clean electricity ambition could be translated into increased climate ambition helping to close the ambition gap in the Paris Agreement towards 1.5ºC, and spur other nations to do the same.

Appendix – Methodology

Determining the additional renewable capacity that the BESS and Labour's CEM deliver requires a counterfactual – that is, how much renewable capacity would be delivered in the absence of these enhanced commitments. The Balanced Net-Zero Pathway from the CCC's Sixth Carbon Budget report[4] is used for this purpose. Published in 2020, this pathway includes the Conservative Government's targets prior to the announcement of BESS. It is the basis of recent policy formulation, and is a balanced indicator of what should be done over the coming years to meet the UK's legal commitment to reduce emissions to net zero by 2050.

The impact of adding more solar and wind capacity depends not only on how much capacity is added but also how much of its additional generation can be utilised (as opposed to being curtailed or exported). This depends on how demand for electricity in end-use sectors changes (e.g., rate of deployment of electric vehicles and heat pumps), how much interconnection capacity there is, and how flexible the grid is (i.e., how widely energy storage and demand side response are deployed).

Neither the Conservative Government nor Labour's plans extend to accelerating electrification of end-uses, increasing interconnection capacity, or deploying more energy storage (with the exception of increasing clean hydrogen production capacity). We therefore assume that the only changes across the energy system are increases in wind and solar capacity. We do not account for additional clean hydrogen production capacity as it is unclear how much of this will be powered using clean electricity (via electrolysis) and what the end use of the hydrogen (and thus its impact on emissions) will be.

We used an open-source model of Europe's electricity markets, EuroMod,[8] to calculate the generation dispatch, storage, and electricity trade between countries. The model was run for both 2030 and 2035, at hourly resolution, calibrated to the ENTSO-E Ten Year Network Development Plan (for EU countries), the 6th Carbon Budget Balanced Pathway (for the GB counterfactual) and the additional targets of the BESS and the CEM. The installed capacities in the 2030 scenarios used in EuroMod are listed in Table 1. From these scenarios, we estimated the additional emissions reductions that can be achieved by comparing the total emissions under the 6CB Balanced Pathway's generation mix in 2030 and 2035 to the emissions of a power system with the additional low-carbon generation set out in updated targets.

Northern Ireland was considered separately from Great Britain, as it is part of a different power system (covering the island of Ireland). We modelled all additional capacity in the BESS and the CEM as being installed in Great Britain, with no change in Northern Ireland. This was because we could have greater certainty over the mix of generation that would be displaced in Great Britain than would be across the combined market of Northern Ireland and Republic of Ireland. The impact of this assumption on results should be negligible, as effects of less renewables capacity installed in England, Wales and Scotland, but more were installed in Northern Ireland, will counteract one another.

Table 1 – Generation and storage technologies included in EuroMod, giving the capacities installed in Great Britain and operating parameters. In addition to these, lignite, coal and oil were included as generating technologies, dam hydro and open-loop pumped hydro as storage technologies, but these only featured in other European markets, and were modelled according to ENTSO-E base assumptions.[5]
* carbon intensity for storage depends on grid mix when it charges

	Installed capacity in 2030 (GW)			Electricity carbon intensity (g/kWh)
Technology	**6CB**	**BESS**	**CEM**	
Nuclear	7.8	7.8	7.8	0
Biomass	3.7	3.7	3.7	121
BECCS	0.6	0.6	0.6	-833
Gas	10.7	10.7	10.7	394
Gas CCS	14.1	14.1	14.1	47
Hydro	1.5	1.5	1.5	0
Pumped Storage	2.7	2.7	2.7	*
Lithium-ion Storage	3.8	3.8	3.8	*
Wind Offshore	40	50	55	0
Wind Onshore	16.2	16.2	35	0
Solar PV	23.1	42.2	50	0

References

[1] HM Government, 'British Energy Security Strategy', 2022.

[2] Labour Party, 'Making Britain a Clean Energy Superpower', 2023.

[3] UNFCCC, 'Global Stocktake Synthesis Report', 2023.

[4] Climate change Committee, 'Sixth Carbon Budget', 2020.

[5] ENTSOG, ENTSOE, 'TYNDP 2020 Scenarios Report', 2021.

[6] Staffell, I., Johnson, N., Hatton, L. and Bamisile, O., 'A Clean Electricity Scorecard for the G7', 2024.

[7] Climate Change Committee, '2023 Progress Report to Parliament', 2023.

[8] Mendes, C., Staffell, I. and Green, R., 'EuroMod: Modelling European power markets with improved price granularity', 2023.

Imperial College London

Consultants

Imperial Consultants

Email: consultant-support@imperial.ac.uk

Web: www.imperial-consultants.co.uk

X: @ConsultImperial

LinkedIn: /IC-CONSULTANTS-LTD