Charging the wrong way

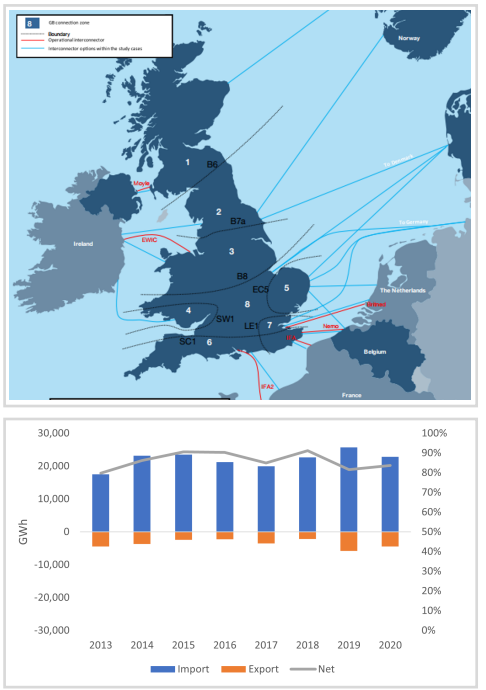
How electricity generators access the GB market

Scottish and Southern Energy Networks, the transmission owner in the north of Scotland, recently published a paper highlighting some of the issues facing the power generation sector in Scotland – the high cost and uncertainty associated with transmission network use of system charges (TNUoS) ***[1].*** The paper highlights that charges are "many, many times higher in the north of Scotland than elsewhere in GB." This issue is not new, but charges are forecast to rise further in coming years, amplifying the locational signal against generation in the north.

Another recent publication is National Grid ESO's Network Options Assessment ***[2]***, which is their annual evaluation of how the transmission system in GB should be developed between now and 2050. This year's publication is the first one that fully reflects Net Zero and a notable outcome is the forecast level of interconnection with Europe, which is set to triple over the next six years. Currently we have 4.8GW of operational interconnector capacity ***[3].***

Looking slightly farther into the future, BEIS have set at target of 18GW of interconnector capacity by 2030 ***[4]*** and National Grid ESO are projecting up to 27.7GW of capacity by 2040. The unregulated part of National Grid (National Grid Ventures) has the largest market share and is currently responsible for 16GW of interconnector capacity in operation, construction and development between Britain and Europe.

National Grid ESO forecast that by the end of this decade, between 30-36% of all electricity consumed by GB homes and businesses will be traded over interconnectors ***[5]***. As illustrated by the figure on the right, GB has for a long time had a significant electricity trade deficit with Europe. The annual net balance of flows since 2013 has ranged between approximately 80/20 to 90/10 in favour of imports.



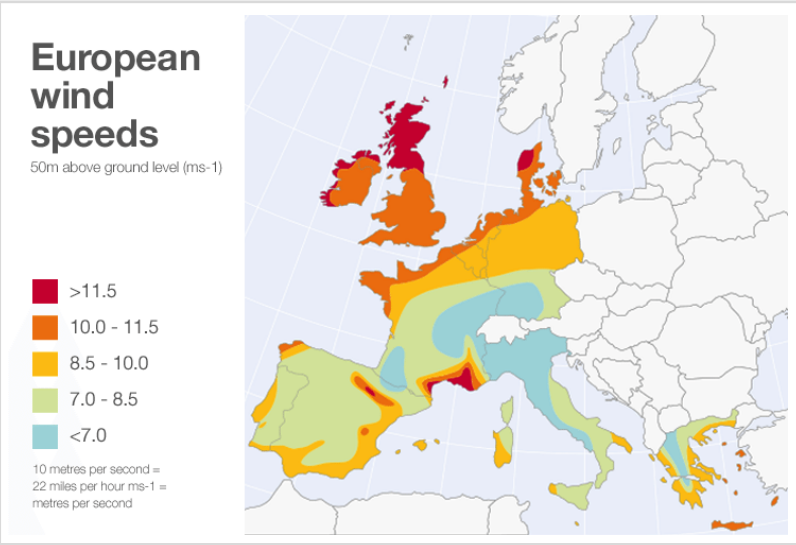
The top figure illustrates the planned suite of interconnectors to the GB system (source: National Grid ESO). All but one of the new links to continental Europe will connect to the system in England and Wales. The figure on the bottom shows the balance of electricity trade – GB imports heavily from the continent due to higher wholesale electricity prices compared to the continent.

1. *https://www.ssen-transmission.co.uk/media/5261/ssen-transmission-tnuos-paper-february-2021.pdf*
2. *https://www.nationalgrideso.com/document/162356/download*
3. *NGESO, interconnector register, 19/02/2021*
4. *https://www.gov.uk/government/publications/energy-white-paper-powering-our-net-zero-future*
5. *https://www.nationalgrideso.com/future-energy/future-energy-scenarios/fes-2020-documents*

Network charges for GB power stations

These two facts – high network charges in Scotland and more interconnection – are relevant because ***power stations located in the northern half of GB pay 16 times more for using the transmission system compared to the European average***, according to our analysis.

This puts Scottish generators at a significant disadvantage compared to sites in France, Netherlands, Belgium, Germany, Denmark or Norway. As the renewables sector continues to evolve beyond subsidy mechanisms and rely more heavily on market forces (across Europe), this distortion will likely play a significant role in determining where renewable energy projects get built.

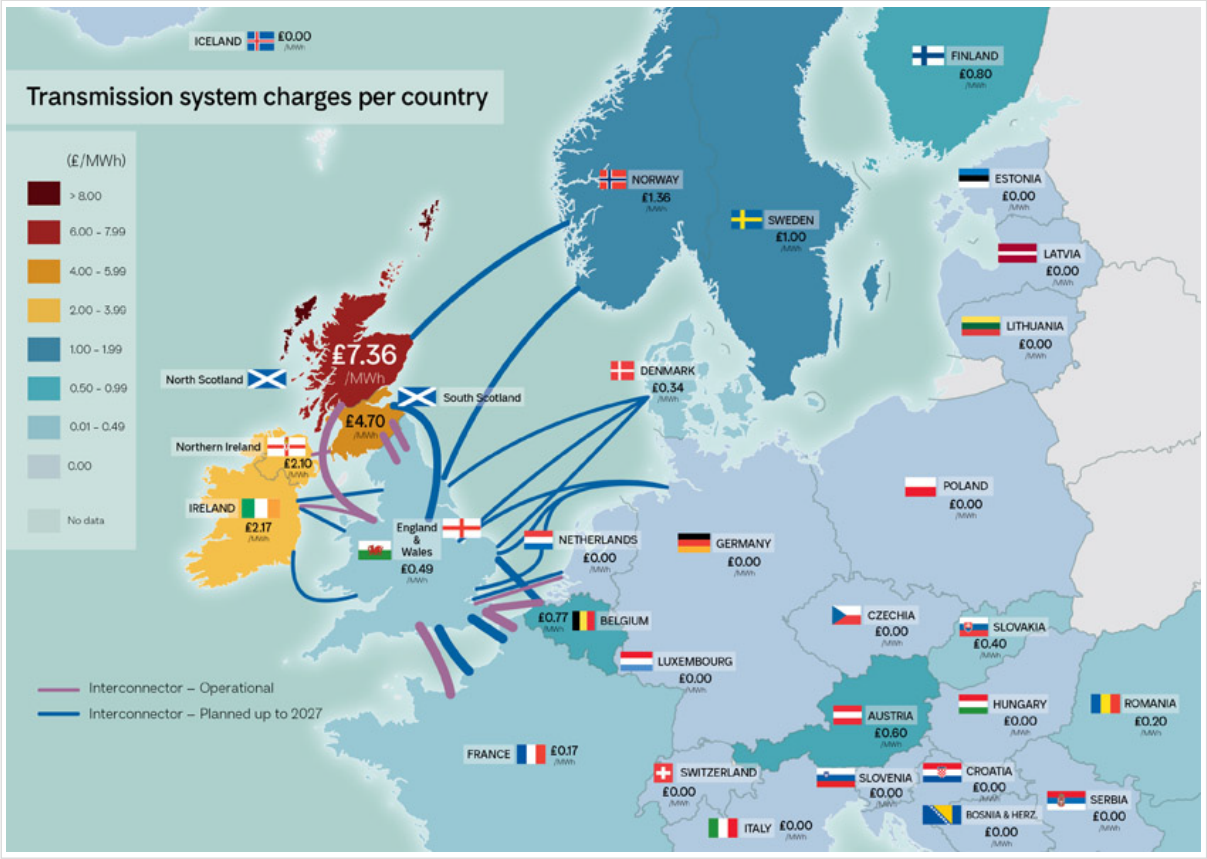


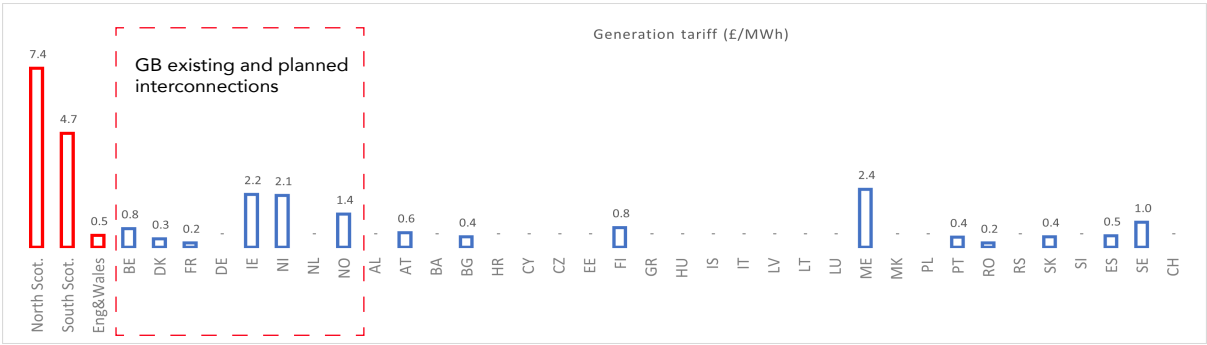
Scotland boasts 25% of Europe's wind resource and 60% of the UK's onshore wind capacity.

ENTSOE has calculated the average transmission charge for generators across Europe at £0.46/MWh per year ***[6]***. The average annual charge paid by generators in GB is now sitting at £4.37/MWh ***[7]***. However, to create a fair comparison with the ENTSOE figures we need to exclude costs for connection, which are charged differently across Europe. Removing these costs brings the average for GB generators to £2.53/MWh ***[8]***.

However, as highlighted by the SSEN paper, transmission charges are not spread evenly throughout GB – they vary depending on region. This coming year, generators in England and Wales will pay an average of £0.49/MWh. But generators in Scotland will pay an average of £6.42/MWh. This trend gets more extreme the further north you go – the average for the most northern region (covered by SSEN) is £7.36/MWh, which represents over 20% of the total levelised cost of electricity (LCOE) for new offshore wind farm sites ***[9]***.

6. ENTSO-E Overview of Transmission Tariffs in Europe: Synthesis 2019. For the purposes of comparison throughout this paper, the same EUR/GBP exchange rate has been used as the ENTSOE paper, which used a rate of 1.175.
7. 'TSO costs' as defined by ENTSOE include the cost of infrastructure, transmission system services and transmission system losses. Transmission System losses, known as TLMs, are levied in a very similar way to TNUoS. TLMs for 2020 are used.
8. The difference between the average charges including local assets is almost entirely due to the charges levied on offshore wind projects for getting the power shore.
9. https://ore.catapult.org.uk/blog/miriam-noonans-thoughts-seabed-leasing-4/





This figure shows the 'TSO costs' levied on generation across Europe, as published by ENTSOE [10]. The figures presented are called the Unit Transmisison Tariff (UTT) which is based on a generic site paying for a transmission connection that it utilises for 5000h per annum. Countries without any charge presented do not levy these costs on generators and include Germany and the Netherlands. The figures for Scotland and England & Wales have been calculated based on published tariffs from National Grid and Elexon. Note that Northern Ireland, Ireland, Sweden and Norway do charge based on location but the country-wide averages calculated by ENTSOE are shown here.

10. ENTSO-E Overview of Transmission Tariffs in Europe: Synthesis 2019

Uncertainty leads to higher consumer costs

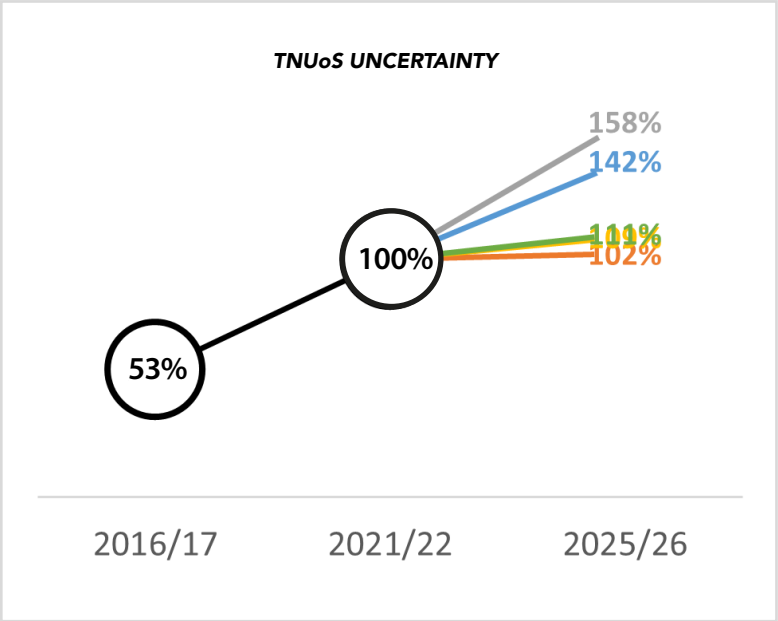
The clearing prices at the last CfD allocation round for fixed bottom offshore wind was as low as £47.20/MWh *[11]* (2021 prices) and future rounds for onshore and offshore wind are expected to be even more competitive. Scottish projects bidding into these future rounds will however be subject to significantly higher uncertainty associated with transmission charges.

By 2025, NGESO has forecast that the average transmission charge for projects in the north of Scotland will increase by between 2% and 58%. The base case forecast shows an 11% rise to £7.12/MWh, and close to £10/MWh in the far north, whilst tariffs in England and Wales are due to decrease by over 80% to 0.08£/MWh. This uncertainty has to be factored into the financing of projects, which ultimately leads to higher costs for the consumer.

Less regulation in Europe

The current network charging regime in GB is quite unusual in two ways – firstly it is locational and secondly it levies relatively high charges on generators.

Of the 36 European networks covered by ENTSOE, 20 do not charge generators at all and only five charge based on location (three of which are GB, Northern Ireland and Ireland). This means that investors looking across Europe have far less network charging risk to consider in foreign markets compared to northern sites in GB.



The change in actual tariffs for Zone 1 (north Scotland) between 2016/17 and 2021/22 alongside the five different tariff estimates published by NGESO in their 5 year forecast (corrected for inflation) published in August 2020.

11. https://www.lowcarboncontracts.uk/cfds?title=&agreement_type=All&field_cfd_current_strikeprice=All&allocation_round%5B%5D=Allocation+Round+3&sort_by=name_1

The National Electricity Transmission System – two interconnected networks

Until 2005, Scotland was a distinct electricity market when it was enveloped into the GB wide regulations under BETTA *[12]*. And the back-bone of electricity infrastructure that we use today was designed and built mid-century, with very few new overhead line projects completed in recent decades.

The transmission system north of the border is very different from that in the south. For instance, (i) it is mostly lower voltage assets - 275kV and 132kV instead of 400kV and 275kV (ii) it has low levels of interconnection, and (iii) there are only two large scale thermal generators in Scotland – Torness Nuclear Power Station and Peterhead CCGT compared to 63 currently connected to NGET's system *[13]*.

These two systems are coupled through three GB-internal interconnectors, two 400kV overhead lines and a newly commissioned HVDC subsea cable, bringing the total interconnection capacity to 5.7GW. This system border, which is known as the Cheviot Boundary, has roughly the same capacity as the installed interconnectors between England and continental Europe. ***By 2027 total capacity between Scotland and England & Wales will be roughly 7.7GW, but interconnector capacity to continental Europe will be 13.6GW*** *[14]*.

Interconnector subsidies

Whilst Scottish generators pay the highest transmission charges in Europe to move power south, interconnectors from Europe do not pay for using the GB transmission system at all *[15]*.

Further, the interconnector subsidy mechanism administered by Ofgem (known as 'Cap and Floor') appears to take little account of the movement of economic value from GB to Europe that results from further interconnection *[16]*.

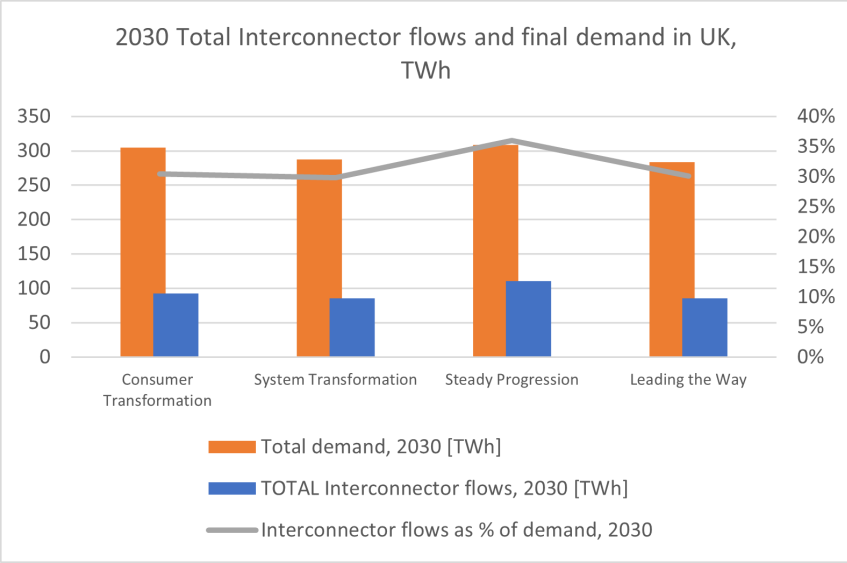
12. https://www.ofgem.gov.uk/ofgem-publications/64116/1105-factsheet070215april.pdf
13. Not including Hunterston Nuclear Power Station which recently announced its plans to close.
14. https://www.nationalgrideso.com/document/162356/download
15. The Connection and Use of System Code (CUSC) Section 14
16. https://www.ofgem.gov.uk/publications-and-updates/cap-and-floor-regime-initial-project-assessment-gridlink-neuconnect-and-northconnect-interconnectors

Rational regulation

A recent European Commission report points out that that *"Cross-border competition between generators is likely to induce regulatory competition between Member States and, as such, likely to serve as an implicit upper limit to all types of [generator] charges, preventing larger divergence of within the EU… it is likely that the [generator] charges of the largest Member States in Continental Europe become the benchmark."* ***[17]*** In other words – the commission expects rational regulators to avoid disadvantaging their own generation fleet by aligning network charging with neighbouring countries. By not doing that, regulators risk undermining the competitiveness of domestic power plants compared to imported power that can offer lower prices because it is not exposed to the same regulation.

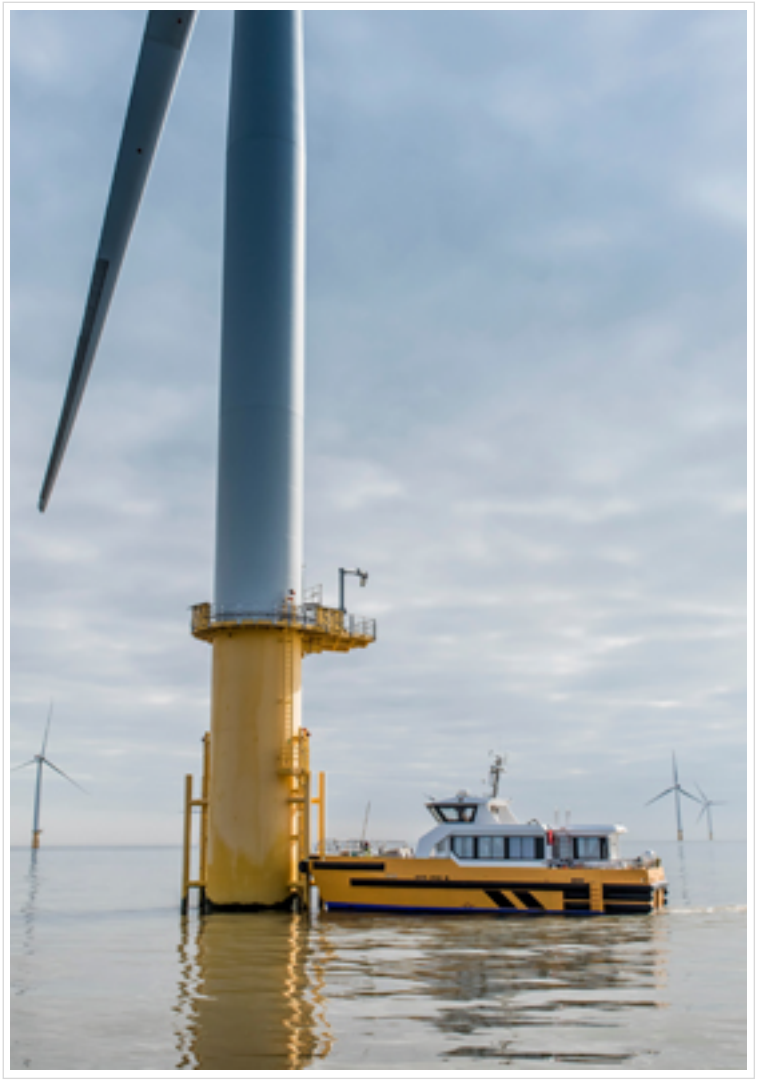
This view is underlined by analysis undertaken by Cambridge Economic Policy Associates on behalf of the Agency for Cooperation of Energy Regulatory (ACER) ***[18]***. This paper outlines that *"the application of a capacity-based generation tariff in one country, but not in the other, all things being equal, will encourage investment (especially in peak generators) in the latter country whilst discouraging investment in the former."*

The paper goes on to say that *"transmission tariffs, levied as a fixed (per MW basis) cost, can also be viewed as a tax on generator prices, which the generators may not be able to fully pass on to final customers."* TNUoS tariffs for generators are based heavily on site capacity (MWs) and through the fixed price CfD mechanism, renewable generators in Scotland will not be able to recover costs due to any unexpected increases in TNUoS. This is true for renewables across GB, but an issue which is many times more acute north of the border.



NGESO is forecasting that between 30-36% of all power consumed by GB homes and businesses will be traded over interconnectors by 2030.

17. 4.3.5. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=SWD%3A2016%3A0410%3AFIN
18. Cambridge Economic Policy Associates Ltd, SCOPING TOWARDS POTENTIAL HARMONISATION OF ELECTRICITY TRANSMISSION TARIFF STRUCTURES, Aug 2015



It is also worth noting that Northern Ireland is treated differently – although part of the UK, the Northern Ireland Electricity network is part of a regulatory framework covering the whole island of Ireland.

Therefore, from a grid charging perspective, Northern Ireland is treated as a different market. Which means that generators in Northern Ireland, which connect into GB via an interconnector to Scotland, pay a fraction of the charges compared to neighbouring projects in mainland UK.

Ofgem has recently indicated that it is considering a full review of locational charging within the scope of its Access & Forward-Looking Charging Significant Code Review (SCR).

Ofgem, though, is not currently required to regulate for the delivery of net zero and therefore has no legal basis for making changes to the charging regime to reflect this policy objective.

Complexity

Transmission charging across Europe is a complex subject. There is a patchwork of different mechanisms and comparing the details of each regime is beyond the scope of this paper. Nonetheless, what is clear from the ENTSOE work is that tariffs for generators across Europe are generally very low and there is an order of magnitude difference compared to the charges paid by generators in Scotland.

Another clear conclusion is that charges faced by generators in Germany, Netherlands and France are nil or close to it. So, those generators clearly have an advantage over Scottish projects when supplying to the GB market.

Based on the evidence reviewed, the current charging regime looks set to increasingly disadvantage the UK and Europe's best area for wind energy production and encourage investment in less efficient projects across other regions of the continent.

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Marc is an experienced grid specialist, Chartered Electrical Engineer and Vice-Chair of the RenewableUK Network and Charging Working Group. Since 2008 he has been involved in the connection of over 20GW of onshore and offshore energy projects. He leads the grid and power offtake workstreams for RIDG and is focussed on optimising power offtake arrangements including system security and affordability, key challenges for all Scottish offshore projects.

In his previous role as a director of Xero Energy (part of ITP Energised), Marc advised a wide range of organisations within the UK energy sector – focused on renewables and energy storage – and is recognised as a subject matter expert for grid (transmission/distribution) and electrical engineering.