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Which weight factors can be used to evaluate wide area interconnections versus local generation?

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Economists often argue that the most obvious criterion through which to evaluate proposals for new or enhanced interconnection between two markets is whether total social welfare across the two markets is increased [1]. Given the difficulty of quantifying consumer welfare, this assessment often reduces to the impact on average wholesale prices for electricity in each of the two markets. This can cause problems as the interconnector would be expected to reduce the average in one market and increase it in the other.

Analyses carried out in 2019 and reported in [2] assessed the impact of increased interconnection between Great Britain (GB) and neighbouring countries. It showed increases and decreases in prices in the different countries. As the amount of interconnection capacity increased, so prices in neighbouring countries came closer together. From a British perspective, enhanced interconnection was good news as it generally facilitated reduction in wholesale prices compared with a reference case of simulation of how 2020 would have turned out. However, these assessments were carried out before the Sars-Cov-2 pandemic and the recent steep rises in the wholesale price of gas. This, the absolute values of electricity prices should not be taken too literally.

The electricity system needs to be decarbonised and, in Europe, significant volumes of, in particular, wind power need to be accommodated. Other metrics therefore include the impact of greater interconnection on:

1. greenhouse gas emissions in each of the interconnected markets and across the wider system; and
2. the volume of wind energy that is available but cannot be used, i.e. is 'spilled' due to lack of demand or of network transfer capacity.

(System stability limits might also cause curtailment of wind production but this was not evaluated in [2]).

Greater interconnection facilitates utilisation of low carbon energy so we would normally expect emissions to reduce. However, without a sufficiently high carbon price, interconnection might also enable cheap, high carbon generation to displace that using lower carbon fossil fuels. This is shown for some production cost scenarios in [2].

There is a need for carbon pricing to be consistent across interconnected countries. If it is not, there is the possibility of emissions reducing in the place with a high carbon price but increasing overall. This, too, can be seen in some of the scenarios reported in [2].

There is also the possibility of interconnection allowing fossil fuelled generation in particular country to expand its production. This can be seen in the 2030 scenarios in GB where gas plant appears to be running as much as in the 2020 reference case, in spite of wind meeting more of GB demand.

Note that, as well as being done before the dramatic recent rise in global gas prices, the analyses reported in [2] were carried out before new GB policies aiming to have 50 GW of offshore wind by 2030 and reduce emissions in the power sector to zero by 2035 (which will probably require not only incentives to development of low carbon generation but restrictions on the operation of fossil fuelled plant) [3].

A final metric considered here is the impact on reliability or security of electricity supply in the interconnected countries. It was reported in the Financial Times (FT) on August 8th 2022 that "Norway

is to curb electricity exports to Europe if water levels for its hydropower plants remain low in a blow to hopes that the Nordic country could help ease its neighbours' energy concerns ahead of a difficult winter" and that "Norway's centre-left government decided on Monday to prioritise refilling its reservoirs when their water levels are below seasonal averages." [4]

Greater interconnection capacity between GB and somewhere that has good hydro capacity ought to be good for reliability of supply on both sides:

- GB has a user of surplus wind and solar when it is windy and sunny, and the country with good hydro resources can leave their water in the reservoirs while still meeting domestic demand;
- when it is less windy in GB, Britain can, in effect, get to use water in the other country.

It was also noted in the FT article that "water levels in the south of Norway — where most of its export cables are based — are at their lowest since 1996".

It may be recalled that climate change will change rain and snow fall – potentially significantly reducing it, or causing it to fall in more concentrated bursts possibly giving rise to flooding – and that sufficient network capacity within a country is essential to utilisation of both interconnection and generation resources throughout the country. Gaining public support for construction of such network capacity is proving challenging in both Norway and Great Britain.

References

[1] MacIver, Callum and Bell, Keith R.W. and Adam, Grain P. and Xu, Lie, "Electrical interconnectors: market opportunities, regulatory issues, technology considerations and implications for the GB energy sector", *Energy Strategy Reviews*, vol. 38, 2021.

[2] Callum MacIver, Waqquas Bukhsh, and Keith Bell, "The impact of interconnectors on the GB electricity sector and European carbon emissions", *Energy Policy*, vol. 151, 2021.

[3] Dept. of Business, Energy and Industrial Strategy, *British energy security strategy*, 7 April 2022, https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy

[4] Richard Milne, Nathalie Thomas and David Sheppard, "Norway set to curb electricity exports in bow to European energy supplies", *Financial Times*, August 8 2022.