Trident Economics

Briefing Note

CMP 423 – Generation or demand weighted reference node ?

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Key Points

The characteristics of the GB transmission system expansion suggest that a generation weighted reference node is more appropriate than a demand weighted reference node for the ICRP calculation of incremental MWkms on which to base TNUoS tariffs .

- The use of a demand weighted reference node is consistent with an implicit assumption that the transmission required to cover generation at other nodes cannot be reduced if generation is increased at a specific node.

- This would be true with a static transmission system. Transmission can't be unbuilt in response to new generation elsewhere.

- However, the GB transmission system is expanding rapidly across key transmission boundaries. In planning how much to expand transmission, the National Energy System Operator will be able to explicitly take into account the impact of new generation on the operating patterns of existing generation.

- Given that, in response to incremental generation at one point, the planned transmission system build can be reduced elsewhere, a demand weighted reference node would seem to over-estimate the actual incremental MWkms required.

- CMP 423 offers a straightforward approach to correcting this by replacing the demand weighted reference node with a generation weighted reference node (actually replacing demand scaling with generation scaling against a constant level of demand).

Introduction

Currently, the ICRP methodology determines Transmission use of System (TNUoS) tariffs through the following steps:

1) Develop two 'Backgrounds' to assess the required transmission system, one reflecting peak demand conditions (Peak) and the other the range of operating conditions (Year-round). Set the required level of transmission across each transmission boundary on the system at the higher of the transmission 'MWkms' required under the Peak or Year-round backgrounds.

2) Add 1 MW of generation from an unspecified technology at each node in turn, matched by 1 MW of demand distributed across the system nodes in proportion to the underlying nodal demand.

3) Calculate the incremental MWkms over the transmission network arising from the incremental generation and demand.

4) Translate the MWkms from Peak and Year-round boundaries into tariffs for users of the transmission system using a number of formulae intended to reflect the role of different types of generation in the power system.

SSE has submitted CMP 423 which proposes that rather than adding demand at each node to match the incremental generation, the initial generation at each node should be reduced in proportion to nodal generation. This would still lead to equal generation and demand levels in the incremental analysis but would have a consistent demand level across the base and incremental cases.

This note considers whether demand scaling (often referred to as a demand weighted reference node) or generation scaling (referred to as a generation weighted reference node) seems most appropriate to reflect the characteristics of the evolving GB electricity system.

Demand Scaling

The key issue for the demand scaling approach is that incremental generation does not cause additional demand. Why, therefore, should the approach to estimating incremental MWkms pair increased demand with new generation ?

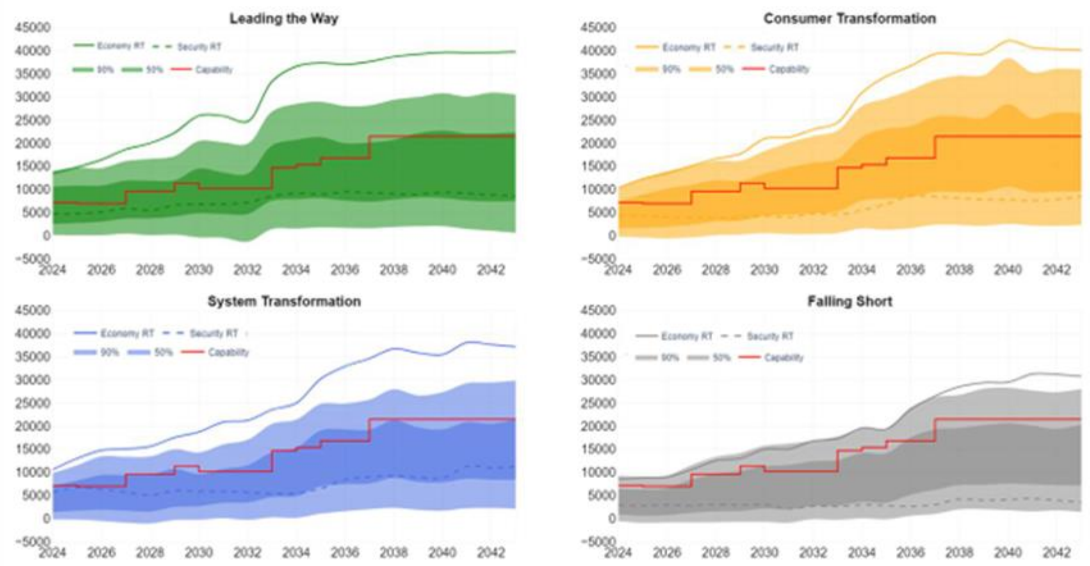
Using this methodology, the calculated incremental MWkms will partially reflect the spatial pattern of generation, which the methodology is supposed to do, and partially reflects that a higher level of demand is being met.

In the Transport and Tariff model the total MWkms required to meet the peak and year-round backgrounds is approximately 317 MWkm per MW of demand. With no change to the spatial distribution of generation, just the approach of adding a MW of demand across the system can therefore be expected to increase the general level of measured incremental MWkms by 317 for each nodal calculation.

In practice, there is a fixed level of demand which the generation portfolio is dispatched to meet. In the Transport and Tariff model this portfolio dispatch is mimicked by the scaling of generation according to set parameters in the construction of each background. In the backgrounds therefore, an increment of generation would be offset by a reduction in generation at other nodes. The incremental generation would create a need for MWkms of transmission to cater for the output from the node in question but this would be offset by reductions in MWkms required for transmission from other nodes. There is no barrier to this offsetting effect across the generation portfolio in the setting of each background because the Transport and Tariff (T&T) model creates a solution specific to the input generation assumptions in each run.

However, under the methodology for calculating incremental MWkms in the Transport & Tariff model, this offsetting of transmission requirements does not happen because the demand level is increased rather than generation at other nodes being reduced. An implicit assumption with demand scaling therefore seems to be that it is not possible to respond to incremental generation at one node by reducing the transmission provided to connect generation at other nodes. The incremental generation solution includes both the initial transmission requirement and the transmission required to deal specifically with the incremental generation.

In a static transmission system, it would seem to be possible to make a case for this, you cannot undo built transmission in response to new generation. However, the GB transmission system is expanding rapidly with step changes in expected transmission capability across key transmission boundaries. The National Energy System Operator will, in determining the optimal development of additional transmission boundary capability, be able to factor in the impact of new generation on the required operational pattern of existing generation within the fixed demand profiles. This is exactly the analysis carried out regarding optimal transmission expansion in the Network Options Assessment and this will continue to be the case in the Strategic Spatial Energy Plan and the linked Centralised Strategic Network Plan. The following shows the transmission expansion path for the B6 transmission boundary (Scotland to England) compared to the frequency distribution of expected power flows across the boundary. The expansion path for boundary capability is shown by the red line running through the middle of the frequency distribution of power flows and growing substantially over time.



The capability line (in red) is based on the recommendations from the Beyond 2030 report which uses the 2023 FES and ETYS data as inputs. The 50%, 90%, Economy RT and Security RT lines are based on FES 2023. The ETYS and NOA methodologies for this boundary are different and can result in different transfer capabilities.

The boundary capability is limited to 6.3GW due to a thermal constraint on the Harker – Moffat 400kV circuit

That the B6 boundary situation, i.e. significant expansion over time, is common across the system can be seen from the maps illustrating intended transmission network build up to 2030 under the Holistic Network Design and after 2030 in the Beyond 2030 plan. These maps are shown below.

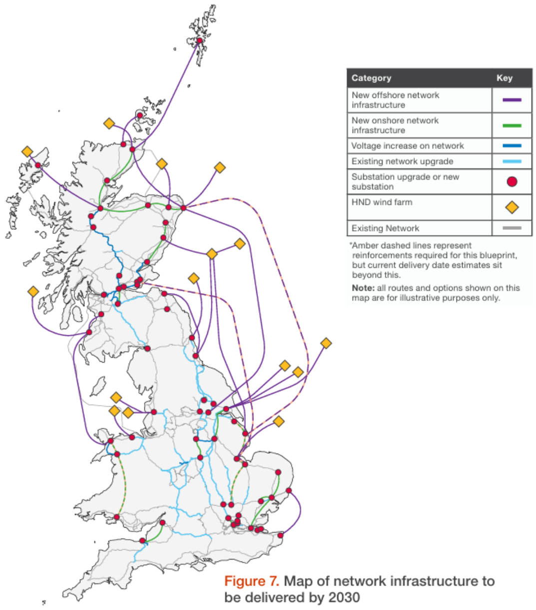


Figure 7. Map of network infrastructure to be delivered by 2030

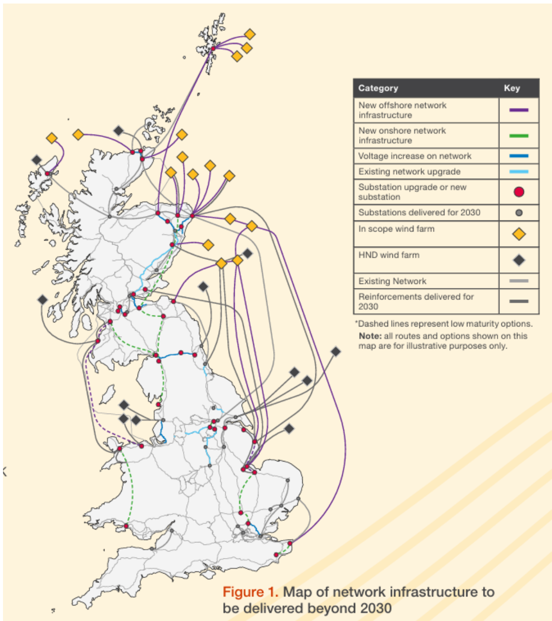


Figure 1. Map of network infrastructure to be delivered beyond 2030

The cost benefit analysis used to determine the optimal transmission expansion path across each boundary will take into account the basket of generation contributing to the potential power flows. Within this analysis the varying mix of generation used to meet demand on an hourly basis will be explicitly factored in.

Using demand scaling in the ICRP calculation would therefore seem to overestimate the actual MWkms arising from incremental generation at a node to the extent that reductions in the future required MWkms from other generation is not taken into account. If charges are higher than is cost reflective, this will distort the pattern of generation development away from the lowest cost future generation mix.

Generation scaling

CMP 423 proposes that for the calculation of incremental MWs the addition of 1 MW of generation (of an unspecified technology) is balanced by a reduction in generation at other nodes proportional to the initial generation at each node.

This recognises that generation from one source displaces generation from another, avoiding the key weakness of demand scaling. The proposal also has the advantage of simplicity and not requiring adjustments to other parts of the ICRP tariff calculation. It would result in an effective reference node that differs between the peak and year-round backgrounds because these have different assumed generation mixes, this has been raised as an issue with generation scaling but it is not clear why two different hypothetical reference points is an issue.

Conclusion

Given the significant expansion of the GB transmission system that is happening, a charging methodology that implicitly assumes that the future transmission system development cannot make trade-offs between generation at different nodes does not seem appropriate. This suggests that demand scaling is not an appropriate approach to apply when calculating the incremental MWkms for setting tariffs. Generation scaling avoids the potential overestimation of incremental MWkms arising from increasing the demand level as part of the estimation of incremental MWkms.