NOA for Interconnectors

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The Year 1 Network Options Assessment (NOA) for Interconnectors defines the GB consumer welfare derived from two levels of interconnection, across four Future Energy Scenarios. It provides a comparison between a future where the only additional interconnectors are those that have been approved for Cap & Floor regulation, and a future where all currently planned interconnectors come to fruition.

We recognise that this analysis is driven by interconnector developers seeking to identify an opportunity in the markets and apply for a connection. We are looking to enhance our capability in assessing interconnectors such that in next year's NOA we will be able to perform an enhanced assessment which will provide a view from the System Operator as to the optimum amount, timing and locations of future interconnectors.

Key Statistics

For Gone Green and Slow Progression scenarios, the connection of all planned interconnectors improves the GB consumer welfare, against a "Cap and Floor only" level of interconnection. This occurs through reduction in energy prices, triggered by greater access to lower prices in European markets. Savings have been evaluated from the present until 2035/36.

- **Savings available under Gone Green: £8.9bn**
- **Savings available under Slow Progression: £4.3bn**

GB Consumer Welfare

For this analysis, GB consumer welfare is defined as *the reduction in total spend on wholesale energy in GB, as precipitated by greater interconnection with lower priced markets*. Savings arise as the increased ability to buy cheaper power in a connected market means the most expensive plant running in GB is displaced from the merit order, and this reduces the GB System Marginal Price.

The agreed approach to the assessment is to compare two levels of interconnection: (i) a minimum level, likely to materialise, for a baseline, and (ii) a plausible high level, that includes all planned interconnectors known to National Grid. Projects with a regulatory regime in place are included in the baseline, as achieving this agreement requires a certain level of project maturity.

The effect of interconnection on the future electricity market depends heavily on the state of that market in future years. The possible states are outlined in the annual Future Energy Scenarios (FES), The FES generation backgrounds used in this report are those published by National Grid for 2015 and include forecasts of levels of demand, the generation mix and plant running costs. The four scenarios (Gone Green, Slow Progression, Consumer Power and No Progression), each predict levels of interconnection in future years by setting out possible connection years and capacities for specific interconnector projects.

In two of the scenarios, Consumer Power and No Progression, no additional interconnections above the Cap and Floor levels are forecast. Thus for these scenarios, there is no change to the level of interconnection between the baseline case and study case, and hence there is no change in consumer welfare to forecast. For scenarios Gone Green and Slow Progression, a higher level of interconnection above

the Cap and Floor projects is forecast. A comparison between these scenarios with the two levels of interconnection is therefore meaningful.

Consumer welfare comparison

There are several interconnector projects currently known to National Grid that are yet to secure a regulatory regime. If all of these projects were to connect, modelling of the GB and European markets shows a clear benefit. Up to and including 2035/36, the change in GB prices would save consumers £4.3 billion if the energy sector develops as in Slow Progression (a reduction ≈ 1% from the base case). In a Gone Green future, this would rise to up to £8.9 billion (down ≈ 2%). In future scenarios where interconnection is predicted to be at a lower level, it is unlikely any projects that currently have no regulatory regime will be realised; thus there is only one forecast cost of electricity in GB. The cost for these scenarios is included in the results below to show the range of expected expenditure, between £306 billion and £402 billion.

Figure 1- Unconstrained consumer cost

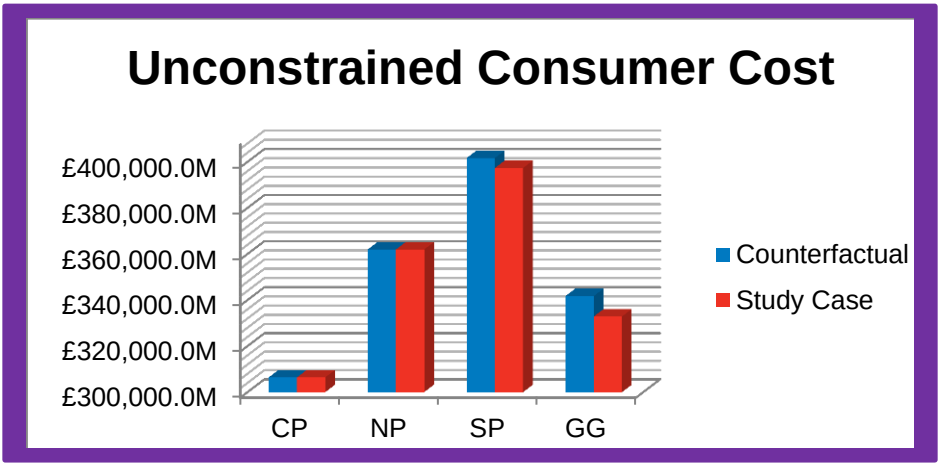
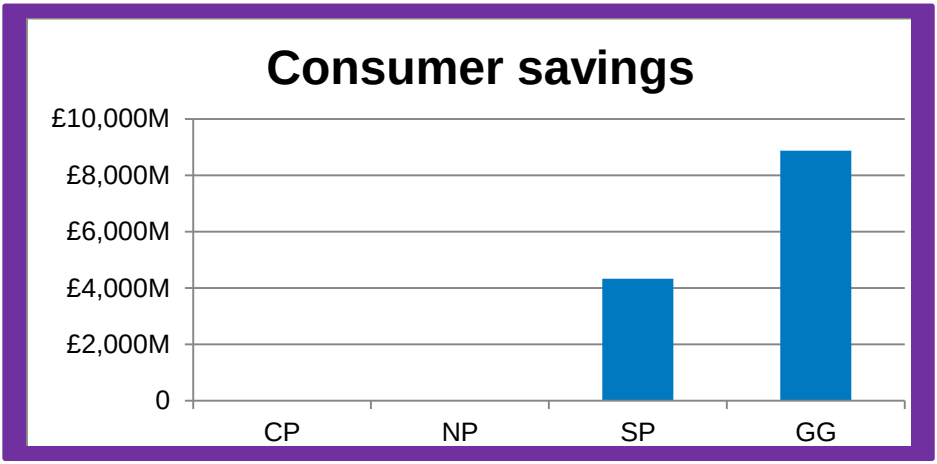


Figure 2- Savings per scenario



Methodology

The results were obtained using the approach published in the NOA for IC Methodology report released by National Grid in September 2015.

The market modelling tool currently used by National Grid is called ELSI; it is used to forecast the constraint costs for different network states and scenarios. It is an open source Excel based tool, developed in-house and made available to stakeholders to conduct their own constraint forecasting. Version ELSI3, which simulates European market prices, was used to assess interconnector flows.

ELSI3 files were configured to simulate the two levels of interconnection, study case and counterfactual, for each of the four Future Energy Scenarios 2015. These files

were modified such that the yearly total unconstrained GB spend was provided as an output. ELSI3 evaluates system marginal price for 1460 variable length periods per year. The total cost is therefore:

$$UCC = \sum_{n=0}^{n=1459} USMP_n \times length\ of\ period_n \times GB\ unconstrained flows_n$$

Where

$$UCC = Unconstrained\ consumer\ cost$$

$$USMP = Unconstrained\ System\ Marginal\ Price$$

For the purpose of this analysis, the definition of GB consumer surplus, is the change in this spend when the level of interconnection is adjusted. This is therefore found by the following equation:

$$Consumer\ surplus = UCC_{counterfactual} - UCC_{study\ case}$$

A simplified example for year 1 is presented below:

$$Annual\ demand\ weighted\ averaged\ SMP\ for\ counterfactual\ in\ year\ 1\ =\ £46/MWh$$

$$Annual\ demand\ weighted\ averaged\ SMP\ for\ study\ case\ in\ year\ 1\ =\ £44/MWh$$

$$Annual\ demand\ in\ year\ 1\ =\ 270TWh$$

$$Welfare\ Benefit\ in\ year\ 1\ =\ (£46/MWh - £44/MWh) \times\ 270TWh\ =\ £540m$$

The procedure is applied for all years and scenarios.

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Future Methodology

The NOA for Interconnectors year 1 methodology has acknowledged deficiencies, measuring as it does only GB consumer welfare. Social Economic Welfare is the preferred indicator of benefits, as this considers the impact on more stakeholders. It includes consumer and producer surplus for GB and the connected markets, and the surplus available to interconnector owners. By measuring this overall welfare for various interconnection levels, a maximum aggregated welfare increase for all connected markets can be found. The output will therefore be a socially optimal set of interconnection capacities.

In year 2, the NOA for interconnectors will take these factors into account to determine the optimal level of interconnection with European markets (where increase in interconnection capacity is deemed plausible).

Have your say

As the NOA for Interconnector process develops, stakeholder input is vitally important to creating a process and report that the industry values. We are seeking views on how NG should assess GB's interconnection capacity needs going forward, and what the scope of this assessment should be. An important consideration is what, in your opinion, are the important factors for NG to review when evaluating potential interconnectors- for example GB consumer welfare, global welfare, the welfare/capital cost ratio, and system security.

You can have your say on the NOA for Interconnectors report or ongoing development of the methodology for next year via the following channels:

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