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28th May 2014

Dear Kersti,

Scottish Hydro Electric Transmission: Proposed transmission project between Caithness and Moray in northern Scotland

National Grid Electricity Transmission (NGET) welcomes the opportunity to respond to the consultation on Scottish Hydro Electric Transmission's (SHE Transmission or SHETL) proposed transmission project in northern Scotland. This response is on behalf of NGET and is not confidential. The consultation seeks views on a project involving a subsea High Voltage Direct Current (HDVC) cable link between Caithness and Moray to be built by 2018/19 and estimated to cost £1.3 billion. This represents a significant investment and as such we welcome the fact that Ofgem are actively seeking out views that will protect the interests of existing and future consumers. Our responses to the issues identified in the consultation document are summarised below.

Our analysis has demonstrated that there is insufficient transmission capacity in northern Scotland, B0 and B1 boundaries in particular. This shortfall is clearly demonstrated in the 2013 EYTS and analysis represented in our response. The shortfall in transmission capacity in this area is manifesting itself by:

- Increasing generation constraint cost, for the period 11/12 to 13/14 some £65M have been observed. With increasing generation capacity in this area, constraint volumes will increase. This will be further compounded by the potential requirements for additional transmission outages required to facilitate future transmission reinforcements.
- Even allowing for additional generation which can be accommodated through Connect & Manage (C&M), there are presently 13 projects totalling 1.8 GW of proposed installed capacity that is conditional to delivery of the proposed transmission. Furthermore, deliverability of some of these generation projects will be affected by the implementation of the Shetland link, which is envisaged to directly connect into the proposed HVDC link.

We would concur with your view that the existing transmission capacity is highly likely to be exceeded. We believe that the principal area of focus should be to understand the appropriateness of the proposed offshore option and how it compares with the onshore AC alternative.

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We recognise the need for each of the reinforcement options to be costed appropriately to inform the cost-benefit assessment and subsequent decision making to maximise the benefits for GB consumers. We acknowledge the level of analysis that has already been undertaken by SHETL, Ofgem and its consultants. However, in the absence of any detailed breakdown of costs and assumptions used, we have no further comments to make on options' costs.

We have undertaken some analysis against the 2013 Gone Green scenario to facilitate comparison with both SKM's and POYRY's CBA analysis. We support SHETL's conclusion that the HVDC offshore option meets the objective of facilitating new connection at the minimum cost to the end consumer and that it should be delivered as soon as possible.

Delaying the implementation of the required reinforcements can result in significant delays generation connections in the area. This can have considerable negative impact on perceived market confidence, particularly regarding investment in renewables in Scotland and wider UK markets.

1. Appropriateness for consumers at this stage

There is a need to reinforce the transmission network in northern Scotland, this is clearly demonstrated in National Grid's 2013 Electricity Ten Year Statement (2013 EYTS) highlights that the network in north of Scotland is relatively sparse in places. It also demonstrates that the power transfer through northern Scottish boundaries B0 (north of Beauly comprising north Highland, Caithness, Sutherland and Orkney) and B1 (inclusive of Moray, north Highland, Caithness, Sutherland, Skye and Orkney) has increased in the recent past due to the substantial growth of renewable generation in the area.

Limited capabilities of the current transmission network in northern Scotland have resulted in high generation constraints, particularly across boundaries B0 and B1 (some £65M over period 11/12 to 13/14). There will be an increasing trend for constraints in this area, driven by increasing volumes of new renewable generation.

Furthermore, it is worth noting is that over 1.8 GW of renewable generation in the area have conditional contracted dates, which range between 2018 and 2021, subject to implementation of the proposed reinforcement.

SHE Transmission's preferred option of a standalone subsea cable can ensure deliverability of the boundary capabilities by 2018. This will provide additional transmission capacity to support the increased power flows from north Scotland to the rest of GB and relieve existing and future constraints and facilitate future connections of renewable generation. In contrast, the onshore options appear to have optimistic delivery dates based on assumptions regarding timely planning approvals and considerable construction outages that would need to take place on the network. Any slippage in these assumptions will impact the deliverability of the onshore options. Furthermore, as the analysis demonstrates that the HVDC link is the optimum economic solution, any attempts to obtain planning consents are likely to be unsuccessful or affected by notable delays and significant increase in constraint costs.

Therefore, we believe that the standalone subsea cable will deliver timely investment to ensure least worst regrets for the GB consumers, by enabling the network to minimise the constraints witnessed today as well as in the future across a range of generation scenarios.

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2. Timing and scale

As highlighted in response to Question 1, our view is that SHETL Transmission's proposed option in terms timing and scale presents an optimised least worst regret solution for the GB consumers. Any onshore AC alternatives which result in deferring the reinforcement of the network by 2024/26 at the soonest, would expose consumers to considerable risks of continued and increasing constraint costs and delay the development of considerable volumes of renewable generation which is required to support meeting of GB renewable targets.

We note your statement with respect to a 'wait and see' approach that could result in a positive value. This approach is appropriate for the 'BB400' (onshore reinforcement south of Beauly) element. However, it should be noted that given the volume of renewable generation which is dependent on the next major reinforcement, such an approach for the HVDC link, in our view, would lead to significant uncertainty on timing of future connections. This could result in many projects being delayed and or cancelled. As stated earlier in this response, this ongoing uncertainty would have considerable negative impact on perceived market confidence, particularly regarding investment in renewables in Scotland and wider UK markets. Hence, the offshore HVDC solution should be progressed in timely manner.

3. Future costs of generation constraints

We have undertaken some in-depth constraint analysis against our 2013 Gone Green scenario to allow us to undertake a high level comparison of options. Furthermore, this analysis facilitates some comparison against SKM's analysis (undertaken on behalf of SHETL whilst preparing the Need Case) and POYRY's analysis (undertaken on behalf of Ofgem whilst reviewing Need Case submission).

In our view, whilst the Counterfactual studies provide a firm basis for comparing range of proposed reinforcements, they should not be considered as indicative of future constraint costs if no network reinforcements were taken forward. This is particularly because the level of renewable generation considered across the range of scenarios would not be connected without appropriate additional transmission capacity. In particular, some 1.8 GW of new renewable generation capacity has conditional consent to be delivered between 2018 and 2021, subject to timely implementation of Caithness Moray reinforcements by 2018.

Whilst we do not believe the counterfactual case represents a plausible future state, it does provide a benchmark of our analysis with the SKM's and POYRY's analysis. Our analysis demonstrates a Net Present Value of £3.12 billion and £3.09 billion for the preferred HVDC offshore option and the onshore AC alternative respectively. The analysis demonstrates that for the 2013 Gone Green Scenario the HVDC offshore option's NPV is marginally better than the onshore AC alternative.

On a related note, although our analysis is based on Gone Green scenario, it must be noted that this has been undertaken to facilitate a comparison with SKM's and POYRY's analysis. We fully understand that the Need Case of reinforcement must appraise the options across a range of scenarios to determine the least worst regret option for the GB consumers.

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4. Wider benefits

Our view is that strategic transmission infrastructure projects such as the SHETL Transmission's proposed subsea link can result in significant direct and indirect wider benefits, which are not readily quantifiable. The key wider benefits of the proposals include:

- Contributions to UK Government's energy policies
- Contributions to 2020 renewable targets
- Contributions to local network (strategic and operational) priorities
- Market externalities such as increased private sector confidence and investment in renewable energy industry
- Environmental externalities such as reduction in carbon emissions, deterioration of areas of environmental significance and visual amenity impact
- Stakeholder buy-in.

In addition to making contributions to some key prevailing network priorities, the HVDC link also presents a more economically efficient solution for connection of future reinforcements in northern Scotland, namely the Shetland link, compared to the onshore AC alternative. Furthermore, the suggested HVDC link for the subsea link will provide a greater control on power flow than AC options due to less impedance. A HVDC link would also be our suggested and preferred option as it allows the ability to black start a system (if permanent fault on an AC system). In particular, it can provide damping power oscillations to improve system stability as well as provide both dynamic voltage support and static at a wider range.

5. Your and your consultants' views on the need case

We appreciate the rigorous analysis undertaken by you and your consultants to review the Need Case assessment for SHE Transmission's proposal. We agree with your (and your consultants') conclusions that there is a need for reinforcing the transmission network in northern Scotland. Our analysis provides consistent results to that undertaken by SKM, and whilst we agree with many of the observation made by POYRY, we are of the view that the material impacts of limitations of SKM's analysis are overstated by POYRY. This, along with some further areas regarding modelling assumptions and approaches where our views may differ, is discussed further in the attached appendix.

However, in contrast to your conclusions, which suggest that the case for the offshore option is finely balanced, we are of the view that the offshore option presents a solution which be delivered to required timescales, facilitates the earlier connection of significant volume of renewables and provides the more economically efficient solution for the GB consumer. We have major reservation regarding the ability to obtain planning permission for an onshore AC alternative solution, given that a viable and economically efficient solution is feasible. This could result in high residual delivery based risks for the onshore AC alternative, which could further result in delays and cost escalations. This could considerably weaken the economic case for the onshore option and widen the gap between the preferred offshore solution and the onshore AC alternative.

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We are happy to discuss our views contained within this letter further with Ofgem and other interested parties should that be helpful. For further details, please contact myself on Andrew.Hiorns@nationalgrid.com or my colleague Karan Monga on Karan.Monga@nationalgrid.com.

Yours sincerely

[By email]

Andrew Hiorns

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Appendix

Questions raised within the Consultation on Scottish Hydro Electric Transmission's proposed transmission project between Caithness and Moray in northern Scotland and National Grid's response.

Note: Please note that our response is predominantly based on review of consultation documents published by Ofgem earlier in the year, which has been supplemented by some additional quantitative analysis that we have undertaken. Also note that our response is informed by National Grid's vast industry knowledge, best practice and intelligence about the GB network gained through the System Operator function.

1. Do you consider SHE Transmission's proposed standalone subsea cable project to reinforce the transmission system in northern Scotland is an appropriate option for consumers at this stage? Please explain your reasons.

National Grid's response:

National Grid is of the view that there is already a need for reinforcement of the transmission network in North of Scotland. In particular, National Grid's 2013 Electricity Ten Year Statement (ETYS 2013), an annual publication which outlines our proposals for planning and operating the GB transmission system, highlights the network in north Scotland is relatively sparse in places. The ETYS 2013 states that power transfer through northern Scottish B0 and B1 has increased in the recent past due to the substantial growth of renewable generation in the area.

Limited capabilities of the transmission network in northern Scotland have been resulting in considerable constraints particularly on boundaries B0 and B1 (estimated to be some £65 million over the last three years). A continuation of such trends for constraints and subsequent costs for the consumers already presents a strong economic case for investments to reinforce the transmission network in northern Scotland.

Furthermore, generation in the north of Scotland is envisaged to increase over time due to deployment of high volume of new renewable generation seeking connection in the SHE Transmission's area over the next few years (by 2021) across a range of scenarios, including Gone Green, Slow Progression and Contracted scenarios. However, the ability to connect significant proportion of these renewables is dependent on the timely completion of additional transmission capacity in this area.

As highlighted above, the current capabilities of northern Scottish boundaries are insufficient to satisfy current boundary transfer requirements throughout the year. New generation connections will increase the required transfer capability in northern Scotland. Lack of investment to facilitate these additional power flows will result in further constraints and subsequent costs to the consumer in the foreseeable future, over and above of those witnessed on the network in the recent past. This further justifies the urgent need for reinforcements in northern Scotland.

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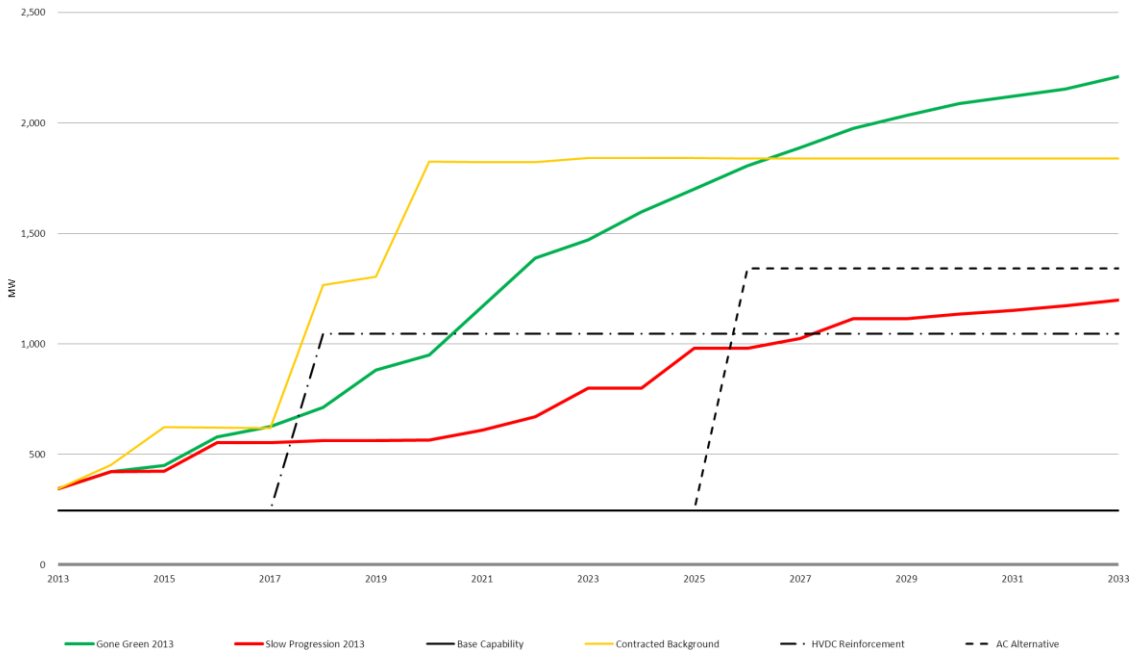
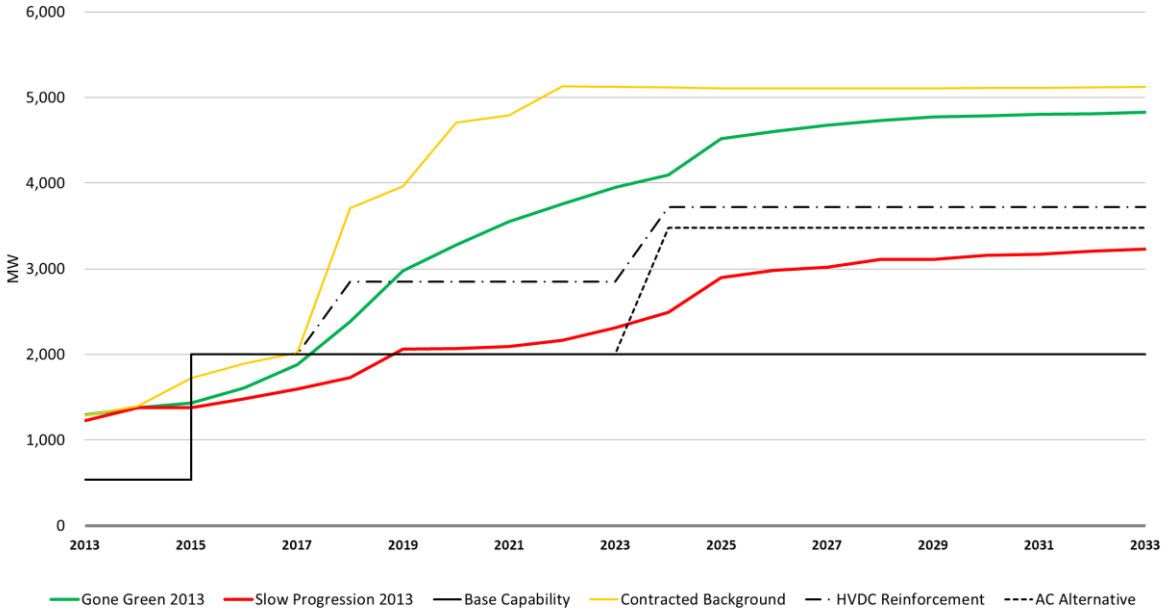
Figure 1: Required transfer, base capability and reinforced capability of boundary B0



Source: ETYS 2013 and Ofgem

Figure 2: Required transfer, base capability and reinforced capability of boundary B1



Source: ETYS 2013 and Ofgem

SHETL's preferred option of standalone subsea cable can ensure deliverability of the boundary capabilities by 2018 to support the power flows from north Scotland to the rest of GB and relieve existing and future constraints. In contrast, the alternative onshore option has an earliest delivery date of 2026. This will result in significant constraint costs on the network across a range of studied scenarios, which will be borne by the GB consumer. Furthermore, National Grid is of the view that 2026 as the delivery date of the onshore AC alternative is highly optimistic, as its implementation will be inhibited due to the following key factors:

- Requirements to obtain the necessary planning approvals for works in areas of considerable environmental significance, which will be a very lengthy process. One of the key pre-requisites is to consult and ensure buy-in from various stakeholders. This could result in further delays. Furthermore, inclusion of economic opportunity costs as well as any actual disbursements (not currently included) associated with any negative environmental impacts could result in considerable cost escalations. It is also worth noting that, as the analysis demonstrates that the HVDC link is the optimum economic solution, any attempts to obtain planning consents are likely to be unsuccessful or affected by notable delays.

- Requirements to take considerable construction outages on the network, which is sparse in places (e.g. north of Beauly) and has low boundary capabilities. This already limits the network's ability to take or plan outages easily (and economically efficient) and remain SQSS compliant north of Beauly.

If at all feasible, the above drivers are likely to cause considerable delays in deliverability of the onshore AC alternative(s) and likely to lead to a significant increase in cost. This could result in considerable ongoing and potentially increasing constraints in northern Scotland up to 2030 and beyond, which will subsequently deplete the key positive economic impact measured in terms of constraint savings for the GB consumer. A reduction in economic impacts coupled with cost escalations (actual disbursements and opportunity costs associated with environmental impacts) will considerably worsen the economic case for the onshore AC alternative across a range of scenarios, as portrayed by your consultants. Furthermore, pursuing the onshore AC alternative(s) in the above context could result in very high regrets for the GB consumers across a range of scenarios, including Gone Green and Contracted position.

Hence, National Grid strongly supports SHETL's proposed standalone subsea cable to reinforce the transmission network in northern Scotland as it will deliver timely investment to ensure least worst regrets for the GB consumers, by enabling the network to minimise the constraints witnessed today as well as in the future across a range of generation scenarios.

2. What are your views on the timing and scale of SHE Transmission's proposed subsea link to reinforce the transmission system in the Caithness Moray area?

National Grid's response:

As highlighted in response to Question 1, National Grid is of the view that SHE Transmission's proposed option in terms timing and scale presents an optimised least worst regret solution for the GB consumers. Any delays in delivery or reduction in scale of the scheme proposals would expose consumers to risks of continued and increasing constraint costs.

3. What are your views on the future costs of generation constraints in northern Scotland?

National Grid's response:

National Grid is of the view that constraint costs or costs of generation constraints originating from the northern Scotland have been a very high proportion of GB total. As mentioned earlier in response to Question 1, this is because of deployment of high levels of renewable generation capacity that leads to power flow requirements in excess of boundary capabilities.

Going forward, if no additional reinforcements are delivered in the north of Scotland, constraints on northern Scottish boundaries B0 and B1 are forecasted to be approximately £10 million to £40 million per annum just between 2014 and 2018 (for Gone Green scenario). This will continue to increase as new generation is installed in the area beyond 2018.

In particular, following the high upward projections of generation forecasts and power flows across a range of scenarios (please see figures 1 and 2), the prevailing network limitations could result in higher annual constraint costs from 2018 and beyond. This appears to be consistent with SHE Transmission's forecast for constraint costs for the counterfactual case over the appraisal period.

4. What are your views on the potential wider benefits of SHE Transmission's proposed subsea link? How should the wider benefits be measured and evaluated in the Needs Case assessment for a proposed Transmission project?

National Grid's response:

National Grid is of the view that strategic transmission infrastructure projects such as the SHETL proposed subsea link can result in significant direct and indirect wider benefits, which are not readily quantifiable. The key wider benefits of the proposals include:

- Contributions to UK Government's energy policies
- Contributions to 2020 renewable targets
- Contributions to local network (strategic and operational) priorities
- Market externalities such as increased private sector confidence and investment in renewable energy industry
- Environmental externalities such as reduction in carbon emissions, deterioration of areas of environmental significance and visual amenity impact
- Stakeholder buy-in.

HM Treasury's Green Book, National Guidance on Undertaking Economic Appraisals, states that value for money decision of an investment should be based on a comparative assessment of options in terms of both cost efficiency and effectiveness of the proposals. The former is typically driven by quantified assessment of monetised economic impacts and costs, which result in estimating net present values of the options.

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On the other hand assessment of effectiveness of the proposals is based on comparative assessment of options' ability to deliver a range of direct and indirect wider benefits like those outlined above. Wider benefits assessment for the options, as highlighted in the HM Treasury's Green Book, should be appraised through a weighted Multi Criteria Assessment (MCA). Such an approach will avoid any double counting of quantifiable impacts in the cost efficiency assessment, as well as capture benefits which are difficult to quantify by form part of the investment's strategic case.

5. Do you consider we (and our consultants) have identified the relevant issues to the Needs Case assessment for SHE Transmission's proposal? Are there any other factors you think we should examine in order to inform our views on the proposed reinforcement?

National Grid's response:

We appreciate the rigorous analysis undertaken by you and your consultants' to review the Need Case assessment for SHE Transmission's proposal. We agree with your (and your consultants') conclusions that there is a need for reinforcing the transmission network in northern Scotland. However, in contrast to your conclusions that the case for the offshore option is finely balanced, we are of the view that the offshore option presents a more economically efficient solution for the GB consumer.

Table 1: Economic Impact and NPV of core options (in £s millions)

Option	Present Value of Constraint Savings: Gone Green	NPV: Gone Green
Preferred Option	£4,863	£3,120
Onshore AC alternative	£4,462	£3,095

Note: Capital cost assumptions adopted for these calculations have been drawn from the consultation draft. Also note we have undertaken some in-depth constraint analysis against our 2013 Gone Green scenario to allow us to undertake a high level comparison of options. Furthermore, this analysis facilitates some comparison against SKM's analysis (undertaken on behalf of SHETL whilst preparing the Need Case) and POYRY's analysis (undertaken on behalf of Ofgem whilst reviewing Need Case submission).

Furthermore, if risks such as uncertainty over timely deliverability (even to the planned dates of 2024 / 26) and costs escalations (resulting from likely planning conditions) materialise for the onshore options, this would widen the gap between the preferred offshore option and the onshore AC alternative/s in terms of the economic case.

As part of the detailed review of the Need Case, your consultants have outlined some issues, which we are not in full agreement with.

One such issue is your consultant's view that hydro (with storage) and pumped storage should be optimised to load flow wind generation. We agree that there is significant potential benefit if pumped storage and hydro with storage is operated to address wind as well as demand variations. In so far as the operation of these plants will be optimised by their

owners in response to the market prices to which they are subject, they will currently only be expected to respond to wind fluctuations if this affects the system wide market price.

Although they might receive additional signals concerning local constraints from the system operator, we do not believe these currently provide the correct incentives for them to respond efficiently. For example, if they seek to generate within an export limited area where the constraint is active due to local wind then they may benefit from system operator compensation (acceptance of bid) for reducing production. This leaves their stores charged and ready to repeat this behaviour at the next wind constrained event. The efficient behaviour would arise if both their generating and pumping activities are optimised to reflect the local marginal price (inside the export constraint).

As part of constraint modelling, storage devices should be scheduled to minimise total system production costs over typical days to act as if responding efficiently to the local marginal price of energy. This will ensure economically efficient, market driven operation of such generators, such that when the local marginal price is sufficiently high (e.g. inactive local constraints) such plants will generate energy that has been stored at linked timesteps, and when the marginal prices are low (e.g. an export constraint is active due to wind). If price differences are not sufficient given the specified cycle efficiency the plant will be inactive (i.e. a 'float' state).

By representing wind variations and demand cycles in sample days of linked timesteps, our modelling used to estimate the constraint costs and savings in this consultation response, represents the efficient response of storage as well as other stations to the impact of wind as well as demand on network constraints.

On another matter, we agree with your consultants that an approach that adopts a single assumption of high constraint price such as the central case assumption of £130 / MWh adopted by SHE Transmission in their need case, will overestimate the economic impact of the options appraised. However, we disagree that generation constraints in northern Scotland could be as much as 50% lower on average than the £130 / MWh assumption.

Our constraint model, which builds upon forward looking economic assumptions such as fuel prices, carbon prices and subsidies for renewable generation, does somewhat align with POYRY's conclusions that average constraint prices for the GB network are considerably lower than the £130 / MWh. However, our forecasts for volume weighted constraint prices using the same forward looking model for northern Scottish boundaries suggest a range from £100 / MWh to £125 / MWh (please see Figure 3 for further details). These forecasts are closer to SKM's assumption rather than POYRY's forecasted profile.

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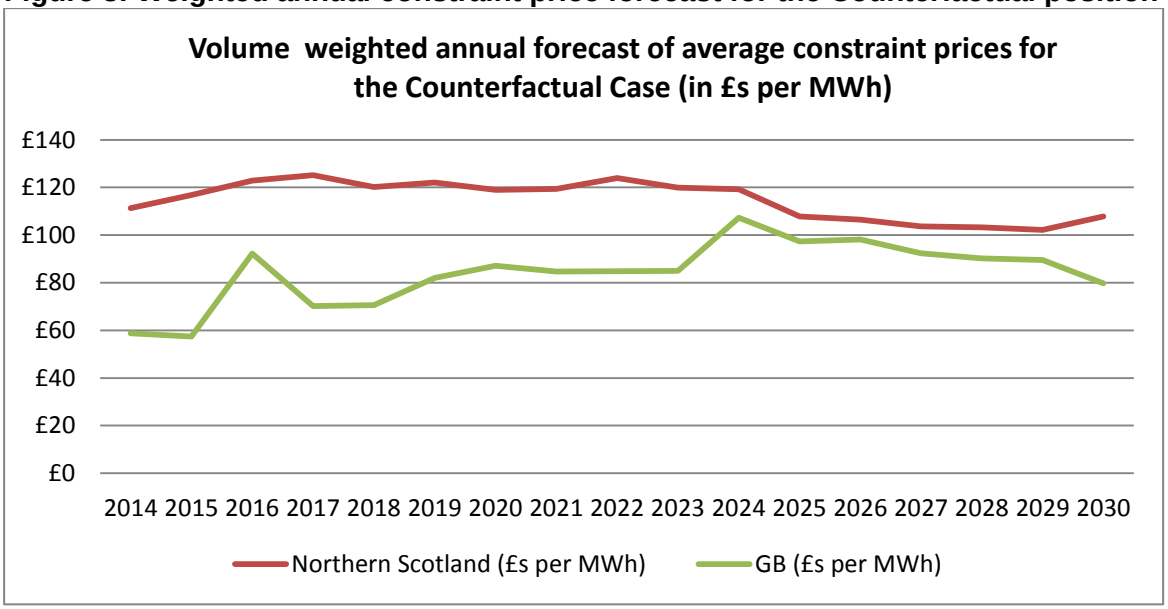
Figure 3: Weighted annual constraint price forecast for the Counterfactual position



Source: National Grid

6. Do you have any other comments on our initial views set out in this letter?

National Grid's response:

No. However, we would like to reemphasise that SHE Transmission's proposed offshore option presents an optimised least worst regret solution for the GB consumers.