

**National Electricity Transmission System
Security and Quality of Supply Standard**

**Largest Power Infeed Loss
Amendment to GSR007
proposals**

**Prepared by the SQSS Review Group for submission to the
Authority**

Amendment Reference	GSR007-1
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Executive Summary

In 2007 the SQSS Review Group undertook a review of the merits of increasing the limits on generation losses permitted by the criteria of the NETS SQSS. This review considered the issues, and developed proposals through an industry working group. The proposals were consulted on in February 2009 (consultation GSR007) and a report, recommending NETS SQSS changes, was submitted to the Authority in September 2009. Ofgem has recently undertaken an Impact Assessment of the proposal, and is currently considering whether to approve it.

Since submission of the report, the Review Group has become aware that the proposals, and in particular the uncertainty and delay in implementing them if approved, are potentially providing a barrier to the connection of new generators. The issue specifically applies to the connection of generation to existing transmission spurs, and is most likely to affect relatively small, renewable generation. In addition, due to the progression of offshore connection applications, together with advances in cable and converter technologies, there may be benefits for the connection of offshore wind generation in advancing the GSR007 proposals.

As a result of this, analysis has been undertaken of the benefits, both qualitative and quantitative, of amending the GSR007 proposals such that their implementation is fixed to a date in 2014, the first date that new generation is expected to want to connect to transmission spurs. The view of the Review Group is that this advancement and fixing of the date is warranted.

A consultation (henceforth referred to as the GSR007-1 consultation) on this amendment was undertaken in September 2010, via an open letter, to ascertain wider industry views on the proposal. Six responses were received. Five were fully supportive of the proposals, the other was partially supportive.

On this basis, the SQSS Review Group recommends an amendment to the proposals previously submitted in respect of the NETS SQSS infeed loss limits. This amendment will advance the implementation date to April 1st 2014. The reasons for this recommendation, and the NETS SQSS changes that are required, are described in this report.

The GSR007-1 consultation document (open letter) is available at:

<http://www.nationalgrid.com/uk/Electricity/Codes/gbsqsscode/fundamental/April+2010+Consultation/>

and is included in Annex 1.

The industry feedback and the Review Group's replies are included in Annex 2.

A revised version of the relevant NETS SQSS text, indicating the recommended changes, is included in Annex 3.

1. Background

The National Electricity Transmission System (NETS) Security and Quality of Supply Standard (SQSS) Review Group is responsible for ensuring that the NETS SQSS is kept up to date and relevant as the energy industry develops and technology advances.

In view of the anticipated future connection of generating units of greater capacity than that currently in use, the SQSS review group has reviewed the appropriateness of the requirements of the NETS SQSS in respect of infeed loss criteria. This review took place during 2007/8 and resulted in a proposal to increase both the normal and infrequent infeed loss limits from the date of connection of the first large new unit, which was assumed to be around 2018. The proposal was subject to industry consultation in February 2009 (consultation GSR007), and a recommendation to implement it was subsequently submitted to the Authority in September 2009. Ofgem undertook an Impact Assessment of the proposal in November 2010, and is currently considering whether to approve it.

Several of the responses to consultation GSR007 suggested that the changes could be implemented sooner to remove the barrier to connecting new generation to transmission spurs with existing generation. In these cases reinforcement of the transmission spur connection assets is needed under the current SQSS, if the new generation takes the total capacity over 1320 MW. At the time, the Review Group reported to Ofgem that it did not see benefit in advancing the proposals, as there had been few such connection applications. The group undertook to keep the issue under review.

2. Developments since the GSR007 consultation

Since the GSR007 consultation of February 2009, a number of factors have emerged that led to the SQSS Review Group making the GSR007-1 amendment proposal. These are described more fully in the GSR007-1 consultation, and are summarised as:

- The TOs have received a number of applications for connection to existing spurs
- Prior to implementation of the GSR007 proposals, the connection of these generators will require new transmission assets, most likely an overhead line or a cable, where the new generation takes the capacity on the spur over 1320 MW

- It is unlikely that consent would be given for new lines or cables, as the GSR007 proposal will remove their need (if approved, and provided the new infeed loss is lower than 1800MW)
- This results in five options being available :
 - The Generator is not allowed to connect until the SQSS criteria change – the SQSS Review Group believes that this is discriminatory, and introduces a barrier to the connection of new generation
 - The Generator requests a ‘Customer Choice’ connection and is responsible for the cost of additional response holding as a consequence of the choice of connection – the SQSS Review Group believes this to be discriminatory (it is anticipated that the costs of extra response will be socialised if the GSR007 proposals are implemented), and introduces a barrier to the connection of new generation
 - The TO is derogated from the NETS SQSS criterion that requires the extra transmission capability, and the cost of additional response is then recovered via the generator which requested the connection – the SQSS Review Group believes that this is discriminatory, and introduces a barrier to the connection of new generation
 - The TO is derogated from the NETS SQSS criterion that requires the extra transmission capability, and the cost of additional response holding is socialised – this effectively brings forward the implementation date of the GSR007 proposal
 - The GSR007 proposal is brought forward – no derogation is needed and the response holding costs are socialised.

In addition to this, in the intervening period, the progression of offshore connection applications, together with advances in cable and converter technologies, has led the SQSS Review Group to consider whether there is benefit in advancing the implementation of the GSR007 proposed change to better facilitate the connection of offshore low carbon generation.

3. Consideration of way forward

In respect of the qualitative arguments above, the SQSS Review Group concluded that the only option to remove the potential discrimination and barrier to entry that the GSR007 proposals have (unintentionally) introduced, is to advance the implementation date of the GSR007 proposals to April 1st 2014, the likely earliest date that new generation will connect to an existing spur.

In addition to this, the Review Group undertook Cost Benefit Analysis (CBA) of advancing the date, both for onshore and offshore generation. The detailed CBA is included in the GSR007-1 consultation document. The CBA was developed for a range of possible carbon prices and intensities. The width of the resulting benefits

range covered the projected costs, meaning a definite conclusion cannot be drawn from the CBA: the analysis neither showed that the proposal would be beneficial nor costly.

Increasing the infeed loss criteria will have impacts on the levels and characteristics of response required from generation following the largest credible loss. The issues were described in the GSR007 consultation, which concluded that new Grid Code requirements and Commercial mechanisms will be needed to ensure that the system can be securely operated without significant constraints, particularly at low levels of demand. The proposal of GSR007-1 does not affect the need for new levels of response provision, but it does advance the date by which they are needed. The GSR007-1 consultation noted that work is progressing within the industry on this, and that the Review Group anticipates the issues will be successfully resolved.

4. Industry feedback on the proposal

Six consultation responses were received by the Review Group. Of these, five supported the proposal and the sixth gave partial support. One of the responses was marked confidential, and has been submitted to the Authority separately to this report, along with the Review Group's reply. The other five responses, and the Review Group's replies, are included in Annex 2. None of the responses suggested changes to the proposed NETS SQSS wording.

The five responses included in this report were received from E.ON, RWE, EDF energy, RenewableUK, and Scottish Power.

Scottish Power Response

Scottish Power supports the proposal, commenting that it will avoid investment in unnecessary transmission lines, and will lead to the most economic and efficient connection of new generation.

EON Response

E.ON noted the benefits of connecting low carbon generation and avoiding transmission investment, and supports the proposal. They raise a number of issues:

- That a clear process and timetable should be established to resolve the issue of synthetic inertia (part of the likely new response provision requirements), prior to implementation of the proposal
- That the NETSO should only hold response sufficient for the maximum loss at any particular time, and should not unduly benefit from the proposal
- That the market should be periodically informed of the actual maximum potential system risk, as generation connections may not reach 1800 MW at any site for some time

- That the reason for not adopting the derogation option was unclear, as the cost allocation method is a separate question.

In its response, the Review Group referred to the current work being undertaken by the existing joint BSSG / Grid code Frequency Response working group; the emphasis placed on this work by the paper submitted to the September GCRP, and the new technical working group established by the GCRP to progress the issue. The Review Group anticipates that, with appropriate industry focus and commitment, suitable new arrangements will be developed ahead of the need.

The reply describes how the NETSO currently varies the level of response holding in line with need, and that this practise will continue. We expect that associated incentive schemes will be adjusted in line with the proposal to ensure there is no undue benefit (or cost) to the SO.

The Seven Year Statement currently contains data on generation capacities and connection arrangements. This data identifies the potential largest loss, and will continue to do so. We do not believe that further mechanisms are required.

We do not agree that the derogation option is separate from the question of cost allocation. As discussed in the consultation report, we believe that there are two ways of apportioning the extra response holding costs associated with derogation: the generator takes it all, which we believe to be discriminatory, or the cost is socialised, which is effectively an informal advancement of the GSR007 proposal. Consequently, we do not see merit in the derogation route.

RWE Response

RWE is generally supportive. Whilst it does not find the CBA entirely convincing, it believes there is benefit in the increased certainty of the proposal. RWE questions whether it is necessary to raise the limit to 1800MW immediately. The Review Group believe that raising the limit part way will not resolve the uncertainty issues that arise from knowing the limit will reach 1800MW at some point in the future, at best it may defer them. As there will be no additional response costs incurred by having a limit higher than that needed, because the NETSO only holds appropriate response, the maximum benefit will be gained from raising the limit to 1800MW in one step.

EDF Response

EDF are supportive of the proposal, commenting that the qualitative arguments outweigh the uncertainty of the CBA. They note that a number of other factors could be included in the CBA that would increase its uncertainty.

In EDF's view, the issues around managing frequency transients should be considered separately from the decision on changing the infeed loss criteria. As discussed above, through the GCRP and the BSSG, the industry is working to resolve the issues in a timely manner. Should the issues not be resolved, it will be

necessary to constrain generation under certain demand conditions, as described in the GSR007 consultation report.

RenewableUK Response

RenewableUK support the proposal in respect of wind generation, believing there to be a cost benefit case. They comment that the case for conventional generation should be revisited. They make a number of suggestions for adjusting the factors used in the CBA. Whilst the Review Group accepts that there will be varying benefits for different generation types, it would be discriminatory to introduce NETS SQSS criteria that favour the connection of specific generation types. Consequently we have carried out the CBA against our forecast mix of generation types. As discussed, this has not been conclusive, and the case for the proposal is substantially based on the qualitative arguments. We do not believe that the CBA changes suggested will materially affect the outcome and lead to a firm conclusion.

RenewableUK recommend the development of new commercial frequency response services in preference to new Grid Code requirements. In our reply, we referred to the work of the joint BSSG / Grid Code working group, which is aiming to find the right blend of commercial and Grid Code requirements.

Several of RenewableUK's comments and suggestions are, in our view, outside the scope of this proposal. For example, they raise the possibility of including weather risks in determining potential credible generation losses. The Review Group will address such issues in future work, beginning with discussions with customers to understand their preferred balance of risk and cost (this work will form part of the customer engagement of the Transmission Price Control Review).

NETS SQSS text

None of the responses suggested changes to the proposed NETS SQSS wording. The text included in Annex 3 of this report is the same as that consulted on.

5. Conclusions

The Review Group's proposal to bring forward the implementation date of the GSR007 proposal is based on:

- Resolving an issue of potential discrimination brought about GSR007
- Removing a potential entry barrier to the connection of new generation
- Facilitating the connection of new, renewable generation to existing spurs
- Cost benefit analysis which is inconclusive on the merits of the proposal

The proposals are generally supported by industry. An issue has been raised that there may not be benefit in applying the change to all types of generation, but the

Review Group believe that it would be discriminatory to introduce the proposal for specific generation types.

Further work is required to determine appropriate arrangements for the provision of frequency response for larger losses. This work is currently being progressed by a joint BSSG / Grid Code working group. Industry focus will be required to introduce new arrangements – failure to do so will impact on constraint costs, as there will be a need to desynchronise some less responsive units and synchronise some that are more responsive.

6. Recommendations

The SQSS Review group recommends that the criteria of the NETS SQSS are modified, in line with the GSR007-1 consultation proposal, such that:

- The infrequent infeed loss limit is increased to 1800 MW from April 1st 2014
- The normal infeed loss limit is increased to 1320 MW from April 1st 2014

Proposed NETS SQSS text is included in Annex 3.

7. Impact on other Industry Codes

It will not be necessary to amend any other codes or standards to implement the changes. However, the proposed change is a factor in the need to develop new Grid Code and Commercial frequency response provisions. These are being developed presently.

Annex 1 – GSR007-1 consultation document (open letter)



20th September 2010

Largest Power Infeed Loss – Amendment to GSR007 proposals

I am writing to you as the Chair of the SQSS review group to inform you that the group intends to, subject to feedback to this consultation, recommend to Ofgem that the proposals to modify the NETS SQSS infeed loss limits, consulted on in GSR007, are amended to bring forward their implementation to 1st April 2014. This letter sets out that the rationale for this change, which we believe will be beneficial to the whole of the industry.

I would welcome feedback on this proposal by Friday 8th October.

Background

In view of the anticipated future connection of generating units of greater capacity than that currently in use, the SQSS review group has reviewed the appropriateness of the requirements of the NETS SQSS in respect of infeed loss criteria. This review took place during 2007/8 and resulted in a proposal to increase both the normal and infrequent infeed loss limits from the date of connection of the first large new unit, which was assumed to be around 2018¹. The proposal was subject to industry consultation in February 2009 (consultation GSR007²) and a recommendation to implement it was subsequently submitted to Ofgem. The proposal facilitates the connection of new low carbon generating technology, and the justification is supported by cost benefit analysis which considered savings in carbon against the cost of providing increased response & reserve. There has also been an associated charging consultation to consider the way in which the costs of response holding are recovered. The conclusion of this consultation was that no change is required and such costs will continue to be recovered on a socialised basis as a component of Balancing Services Use of System Charges (BSUoS).

Several of the responses to GSR007 suggested that the changes could be implemented sooner to remove the barrier to connecting new generation to transmission spurs with existing generation. In these cases reinforcement of the transmission spur connection assets is needed if the new generation takes the total capacity over 1320 MW. At the time the review group reported to Ofgem that it did not see benefit in advancing the proposals as there had been few such connection applications. The group undertook to keep the issue under review.

¹ The proposal is to increase the Infrequent Infeed loss from 1320 MW to 1800 MW and the Normal Infeed loss from 1000 MW to 1320 MW when a single generating unit greater than 1320 MW connects

² The consultation document is available at: http://www.nationalgrid.com/NR/rdonlyres/EEEE8EDB-6AA5-4D44-BFDC-763ECE251E73/31739/SQSS1320Reportfinalv10_040209_.pdf

Reasons for change

A number of applications have been received from Generators to connect to the transmission system at sites where existing generation is connected by a spur. At present we have six such applications to connect by 2017, and three of these applications are for connection dates in 2014. Furthermore, the progression of offshore connection applications in the intervening period, together with advances in cable and converter technologies, has led us to consider whether there is benefit in advancing the implementation of the proposed change to better facilitate the connection of low carbon generation (both onshore & offshore).

In some cases the connection of new generation to a spur will result in the total capacity at the site exceeding the existing infeed loss limit, triggering the need for additional transmission capacity at the connection point before the Generator can connect. In such cases the TO will need consent to build the new assets, which would typically be an overhead line as the most economic solution. Granting of consent will depend on the overall benefit of the line across its lifetime. If the proposals of GSR007 are implemented the line will be redundant from the time the limit is increased. The timescales for consenting and construction of a line, together with the expected date of connection of the first unit greater than 1320MW, will mean that the line will be of benefit for only a small number of years (2 – 3). It is highly unlikely that consent would be granted for an overhead line of such limited benefit, and it is the view of the TOs that applying for consent and undertaking the ensuing process will not be efficient for the industry. Under these circumstances there are three options:

- The Generator delays its connection until the limit is changed. This will both delay the connection and introduce uncertainty as the Generator will be dependent on the connection of another party.
- The TOs seek derogation from the NETS SQSS requirement. Under this condition either the Generator will take on the costs of the extra response holding, or they are socialised. In the first instance this is likely to severely impact on the viability of the new generation.
- Seek to bring forward the date proposed for the change to the NETS SQSS, which would then facilitate earlier connection of additional generation.

It is our view that the current proposal is creating a barrier to the connection of generation to certain parts of the onshore transmission system. This directly conflicts with the intention of the GSR007 proposal, which is to facilitate the connection of low carbon generation, in line with Government targets, and with the Connect and Manage regime aimed at facilitating the early connection of new generation. It is also potentially discriminatory across all parts of the country served by transmission spurs – the Generator is either incurring costs or delaying its connection whilst waiting for changes dependent on a third party competitor over which it has no influence.

The current NETS SQSS criteria mean that it is necessary to connect offshore generation by more than one cable where the capacity is greater than 1320MW. It is expected that interconnected offshore networks will be developed as the capacity of offshore generation increases. Advances in technology mean that cables are capable of carrying more than 1320 MW, and the use of high capacity cables as part of offshore networks, and in their connection to the onshore system, is likely to be economic. In the interim, prior to the full development of networks with multiple connections to the onshore system, generation will continue to be radially connected.

The Review Group believe that raising the infeed loss limit to permit the use of higher capacity cables will help in the development of offshore networks and hence the earlier connection of wind generation. This is a key component of the government's climate change targets, and has been emphasised in a letter of September 9th from the Parliamentary Climate Change committee to the Secretary of State. The letter supports the current carbon reduction targets and encourages a focus on the delivery of them, stating that a step change in the connection of renewable generation is needed.

Based on the above discussions, advancing the date at which the infeed loss limit is raised will bring a number of benefits:

- Generation will be able to connect to existing transmission spurs, up to a total capacity of 1800MW, without the need for new connection assets. As a result they will be able to connect as soon as they can be built.
- The cost of connecting offshore wind generation will be reduced as fewer cables will be required, encouraging earlier connection and facilitating the development of offshore networks
- The connection of new generation will introduce further competition in the generation market
- The majority of new generation that will connect to spurs will be low carbon and will contribute to meeting government targets
- Climate change objectives will result in the closure of a number of older, high emission generators. The connection of new generation will help maintain sufficiently high margins to ensure security of supply
- The potential discrimination introduced by the implementation aspect of the GSR007 proposal, that generators on transmission spurs cannot reasonably progress their connection until an arbitrary date in the future when a third party connects, will be avoided

The outcome of the cost benefit analysis of the proposal is dependent on the values used for the price of carbon and for carbon intensity. The analysis suggests that the cost of response holding may increase by £120m per year for a carbon benefit in the range £51m to £254m per year. The benefit figures will be increased by any further connection applications, and by any avoided cable cost from large offshore projects. The Cost Benefit Analysis does not include the avoided costs of the new lines that would be needed at spurs if the infeed loss criteria are not changed. Typically this reinforcement will cost £10m per site, giving a total capital cost of around £60m for the six projects that have applied for connection to a spur.

It is likely that some Generators have been deterred from applying for connection by the likelihood that this will not be possible until the largest loss infeed limits change. If the implementation date is brought forward the Review Group believes removal of this barrier will further competition and more connection applications may well be received, strengthening the cost benefit case.

For all these reasons the review group believes that bringing forward the change to the infeed loss limits is warranted. The connection agreements signed so far, together with the minimum time that will be required for the connection of new applicants, suggest that an implementation date in early 2014 is appropriate.

There are various challenges to overcome in managing the frequency transient that results from the higher largest loss. These issues need to be resolved and analysed

further e.g. the effects we expect to see at times of low demands as system inertia reduces. However with the support of the Industry, the Review Group anticipates that they can be resolved by 2014.

Proposal

The SQSS Review Group believe that bringing forward the date at which the largest infeed loss limits are increased will be of significant benefit and propose that in the NETS SQSS:

- The infrequent infeed loss limit is increased to 1800 MW from April 1st 2014
- The normal infeed loss limit is increased to 1320 MW from April 1st 2014

Proposed NETS SQSS text is included in appendix A. The text proposed in GSR007 is included in Appendix B for reference.

Feedback

The Group will welcome feedback on this proposal. Please respond to Mark Perry at either:

.Box.ENI.SQSS

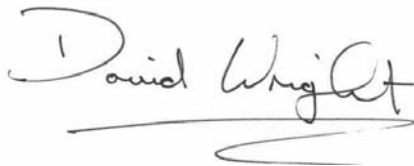
Or

National Grid House
Gallows Hill
Warwick CV34 6DA

Please supply comments by Friday 8th October 2010

The Review Group is committed to the review programme that I outlined in my open letter in March of this year. We believe that the proposal in this letter is consistent with our desire to ensure that the NETS SQSS remains appropriate through the period of rapid change affecting our industry.

Yours Sincerely

A handwritten signature in black ink that reads "David Wright". The signature is written in a cursive style with a long horizontal flourish underneath the name.

David Wright

SQSS Review Group Chairman

Appendix A – Proposed NETS SQSS wording

Existing NETS SQSS text is in black font. Additions are shown in red font. Deletions are in red font with a strike through.

7. Generation Connection Criteria Applicable to an Offshore Transmission System

7.1 This section presents the planning criteria applicable to the connection of one or more offshore power stations to an offshore transmission system. The criteria in this section apply from the offshore grid entry point/s (GEP) at which each offshore power station connects to an offshore transmission system, through the remainder of the offshore transmission system to the point of connection at the first onshore substation, which is the interface point (IP) in the case of a direct connection to the onshore transmission system or the user system interface point (USIP) in the case of a connection to an onshore user system.

7.2 The generation connection criteria, applicable to an *offshore transmission system*, presented in this section, are based on a series of cost benefit analyses. The scope of those analyses was bounded by certain pragmatic assumptions, which recognised the technology available at the time the analyses were carried out. Accordingly, the generation connection criteria presented in this section should only be applied up to those limits. **The criteria have been updated since the initial analysis to account for developments in cable and HVDC technology.** The limits are:

- 7.2.1 the capacity for *offshore power park modules* was limited to a maximum of 1500MW. **Following review of the values of *normal infeed loss risk* and *infrequent infeed loss risk*, this capacity limit will equal the *infrequent infeed loss risk* from April 1st 2014.**
- 7.2.2 the type of intermittent power source powering the offshore *Power Park Module* was limited to wind.
- 7.2.3 the capacity of offshore gas turbines was limited to a maximum of 200MW per platform;
- 7.2.4 the distance from an offshore *grid entry point* on an *offshore platform* to the *interface point* or *user system interface point* (as the case may be) at the *first onshore substation* was limited to a maximum of 100km;
- 7.2.5 the length of any overhead line section of an *offshore transmission system* was limited to a maximum of 50km; and
- 7.2.6 Radial offshore network configurations only have been considered. Until reviewed, section 4 shall apply in respect of interconnected offshore networks.

The above limits will be subject to periodic review in the light of technological developments and experience. The limits should not be exceeded without justification provided by further review.

Terms and Definitions

Normal infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency by more than 0.5Hz. Until **reviewed 31st March 2014**, this is 1000MW. **From April 1st 2014, this is 1320MW.**

Infrequent infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency outside the range 49.5Hz to 50.5Hz for more than 60 seconds. Until **reviewed 31st March 2014**, this is 1320MW. **From April 1st 2014, this is 1800MW.**

Loss of Power Infeed

The output of a *generating unit* or a group of *generating units* or the import from *external systems* disconnected from the system by a *secured event*, less the demand disconnected from the system by the same *secured event*. For the avoidance of doubt if, following such a *secured event*, demand associated with the normal operation of the affected *generating unit* or *generating units* is automatically transferred to a supply point which is not disconnected from the system, e.g. the station board, then this shall not be deducted from the total *loss of power infeed* to the system. For the purpose of the operational criteria, the *loss of power infeed* includes the output of a single *generating unit*, CCGT Module, boiler, nuclear reactor or DC Link bi-pole lost as a result of an event. **In the case of an offshore generating unit or group of offshore generating units, the loss of power infeed is measured at the interface point, or user system interface point, as appropriate.**

Appendix B – NETS SQSS wording proposed in GSR007

Existing NETS SQSS text is in black font. Additions are shown in red font. Deletions are in red font with a strike through.

Terms and Definitions

Normal infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency by more than 0.5Hz. Until ~~reviewed the~~ *Infeed Change Date*, this is 1000MW. *After the Infeed Change Date, this is 1320MW.*

Infrequent infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency outside the range 49.5Hz to 50.5Hz for more than 60 seconds. Until ~~reviewed the~~ *Infeed Change Date*, this is 1320MW. *After the Infeed Change Date, this is 1800MW.*

Infeed change Date

The date on which a single generating unit, CCGT module, boiler or nuclear reactor of registered capacity greater than 1320MW connects and commissions to the national electricity transmission system.

Appendix C – Cost Benefit Analysis

List of Projects, currently behind 1320–1800MW transmission spurs

Projects with signed connection agreements that would benefit:

- Intergen South Holland 900MW CCGT at Spalding, Lincs – proposed 2014 connection is subject to infrequent infeed loss limit derogation;
- Westernmost Rough 180MW Offshore Wind at Hedon, Humberside – proposed 2014 connection is subject to loss limit derogation;
- RWE Stallingborough, 65MW of embedded Biomass at Grimsby West, Lincs – requires increase to 1365MW in 2014;
- DONG Humberside Biomass, 300MW at Hedon, Humberside – requires increase to 1620MW in 2016;

Generation projects considered likely that could potentially benefit:

- Proposal to connect 1800MW of offshore wind on a new spur in 2017;
- Proposal to connect 1GW of wind into an existing spur in 2016.

Cost-Benefit

Assume:

- All six projects above go ahead by a notional year of 2016.
- The two Spalding / South Holland CCGTs will only both be running for some 70% of the year. The remaining risks will only contribute fully for another 10% of the year. So we carry the full extra Response for 80% of the year.
- Cost of extra Response on a full-year basis = +480MW all-year = +£150m pa, as per GSR007.³

Then:

- Cost of extra Response here = 80% × 150 (full-year) = +£120m pa.
- GSR007 used a carbon intensity figure of 0.43T_CO2/MWh – based on the period 2020 to 2030. If the GSR007 implementation date is advanced, the figure for the relevant period 2014 to, say 2018, could be up to 0.8T_CO2/MWh. In addition there are two different prices of Carbon currently in use: the traded price of £14.1/tCO2 and the non-traded price of £52/tCO2. The benefits for the four combinations of these prices are as follows:
- For carbon intensity = 0.43T_CO2/MWh and price = £14.1/tCO2
 - Benefit = 900MW CCGT × 85% load factor⁴ × 8760hr × 0.1 T_CO2/MWh (slightly generous assumption, that modern CCGT is 0.1 less Carbon intensive than the Coal / older CCGT mix it replaces) + 365MW biomass × 50% load factor × 8760hr × 0.43 T_CO2/MWh + 1.14GW wind (only 2x +480MW + 180MW of capacity is claimed) × 35% load factor (offshore) × 8760hr × 0.43 T_CO2/MWh = 6.8 × 0.1 + 1.6 × 0.43 + 3.4 × 0.43 = 0.7 + 0.7 + 1.5 = 2.9 MT_CO2
 - Benefit 2.9 MT_CO2 × 14.1 £/MT_CO2 = £41m pa
- For carbon intensity = 0.43T_CO2/MWh and price = £52/tCO2

³ The headline oncost in GSR007 was +£160m £10m referred to costs of downward reserve at low demands, which is not relevant and is omitted here.

⁴ If each individual South Holland CCGT has 85% availability, then both run for 70% of the time, as per above. (Note that we are generously crediting the full +900MW of the second CCGT, not just the output above 1320MW.)

- Benefit = 900MW CCGT x 85% load factor⁵ x 8760hr x 0.1 T_CO2/MWh (slightly generous assumption, that modern CCGT is 0.1 less Carbon intensive than the Coal / older CCGT mix it replaces) + 365MW biomass x 50% load factor x 8760hr x 0.43 T_CO2/MWh + 1.14GW wind (only 2x +480MW + 180MW of capacity is claimed) x 35% load factor (offshore) x 8760hr x 0.43 T_CO2/MWh = 6.8 x 0.1 + 1.6 x 0.43 + 3.4 x 0.43 = 0.7 + 0.7 + 1.5 = 2.9 MT_CO2
- Benefit 2.9 MT_CO2 x 52 £/MT_CO2 = £151m pa
- For carbon intensity = 0.8T_CO2/MWh and price = £14.1/tCO2
 - Benefit = 900MW CCGT x 85% load factor x 8760hr x 0.1 T_CO2/MWh (slightly generous assumption, that modern CCGT is 0.1 less Carbon intensive than the Coal / older CCGT mix it replaces) + 365MW biomass x 50% load factor x 8760hr x 0.8 T_CO2/MWh + 1.14GW wind (only 2x +480MW + 180MW of capacity is claimed) x 35% load factor (offshore) x 8760hr x 0.8 T_CO2/MWh = 6.8 x 0.1 + 1.6 x 0.8 + 3.4 x 0.8 = 0.7 + 1.3 + 2.7 = 4.7 MT_CO2
 - Benefit 4.7 MT_CO2 x 14.1 £/MT_CO2 = £66m pa
- For carbon intensity = 0.8T_CO2/MWh and price = £52/tCO2
 - Benefit = 900MW CCGT x 85% load factor x 8760hr x 0.1 T_CO2/MWh (slightly generous assumption, that modern CCGT is 0.1 less Carbon intensive than the Coal / older CCGT mix it replaces) + 365MW biomass x 50% load factor x 8760hr x 0.8 T_CO2/MWh + 1.14GW wind (only 2x +480MW + 180MW of capacity is claimed) x 35% load factor (offshore) x 8760hr x 0.8 T_CO2/MWh = 6.8 x 0.1 + 1.6 x 0.8 + 3.4 x 0.8 = 0.7 + 1.3 + 2.7 = 4.7 MT_CO2
 - Benefit 4.7 MT_CO2 x 52 £/MT_CO2 = £244m pa
- GSR007 quoted a benefit, estimated at £10m pa, of being able to hold extra volumes of generation on inter-trip to resolve Constraints. Across 2014-2020, we would expect to gain this benefit against Cheviot constraints only. Depending on both volume and prices of commercial inter-trips, we might struggle to attain quite as large a benefit as this, but for simplicity we quote this full benefit.
- Thus this assessment of the costs and benefits of fixing the implementation date of GSR007 to 1/April/2014 amounts to £120m of cost vs benefit ranging between 41+10 = £51m and 244+10 = £254m, by year 2016.
- As ever, there are a large variety of alternative presentations of this cost-benefit. For simplicity we felt it not worthwhile to detail them all here.

Benefit for offshore generation

- Consider an offshore windfarm of 1.8GW. At present, it will require 2x900MW DC cables and converters. If GSR007 is endorsed in time, it will require 1x1800MW DC cables. (Note: these numbers may appear to bias the argument, by moving from 900MW to 1800MW. However, it is the case that currently discussed DC cable and converter sizes are of order 1000MW at 300kV and of order 2000MW at 500kV. No-one is discussing or costing an intermediate size of 1320MW, and so it would be unrealistic to construct an argument using numbers closer to the pre- GSR007 limit of 1320MW.)

⁵ If each individual South Holland CCGT has 85% availability, then both run for 70% of the time, as per above. (Note that we are generously crediting the full +900MW of the second CCGT, not just the output above 1320MW.)

- Typical cable cost for 900MW, (approx 1600mm² at 300kV DC) = £1100k /km cable. x100 km length = £110m per cable. Plus £100m for 900MW converters + £65m for offshore platform = £275m total.
- Typical cable cost for 1800MW (approx 2200mm² at 500kV DC) = £1300k /km cable. x100 km length = £130m per cable. Plus £130m for 1800MW converters + £130m for offshore platform = £390m total.
- Thus the saving in using 1x1800MW rather than 2x900MW cables = 2x275 - 1x390 = £160m. Annuitising at 6.25% tdr over 20 years (a transmission rate-of-return, over an OFTO lifetime), = $160 \div 10.9 = £14.5\text{m pa}$.
- We believe it reasonable to assume that two instances of this design saving could be present on the GB system by 2016, eg one in the Irish Sea and one in either the Hornsea or the Norfolk offshore zones. Hence the contribution to the cost-benefit for advancing GSR007 is £29m.

Annex 2 – Consultation feedback and Review Group responses

Scottish Power:

Response

Tom,

ScottishPower supports the proposal in the Open Letter to modify the NETS SQSS infeed loss limits from 1st April 2014.

This would avoid unnecessary investment in transmission lines which would otherwise become redundant when the new limits were introduced and allows the most economic and efficient method of connecting large onshore and offshore generators to the NETS to be adopted, including those on transmission spurs.

Regards,

James

James Anderson
Commercial & Regulation Manager
ScottishPower Energy Wholesale
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Review Group reply

James,

Thanks for your response. We are currently preparing our recommendations report for Ofgem, and will include your support in it.

Regards

Mark

Mark Perry
Electricity Network Investment
01926 655468

E.ON
Response



Mark Perry
National Grid House
Gallows Hill
Warwick
CV34 6DA

Friday 8 October 2010

Re: Largest Power Infeed Loss - Amendment to GSR007 proposals

Dear Mark,

Thank you for the opportunity to respond to the SQSS Review Group's proposal to implement increases to the infeed loss risk from April 2014. We note that there are a number of benefits for the connection of low carbon generation and avoided cost of transmission investment. We therefore support the revised implementation date, but have further observations below that should be addressed in any recommendation to the Authority.

We note National Grid's paper to the September 2010 Grid Code Review Panel with respect to synthetic inertia and the NETSO's ability to secure the system under certain conditions in the event that the Infrequent Infeed Loss Risk is increased to 1800MW. In order to be able to implement the increase to the infeed loss risk, a clear process and timetable should be set out to resolve the synthetic inertia issue prior to the implementation of the increase to the infeed loss risk limits.

As is highlighted, the increase to the infeed loss risk may result in the cost of response holding increasing by £120m per year. As total annual balancing costs may increase as a result of this change it is important that the NETSO does not unduly benefit from its incentive arrangements as a result of managing a larger cost base. It is important that NETSO is only permitted to hold sufficient reserve, should it be necessary, for up to 1320 & 1800MW losses and continues to only contract for sufficient response and reserve as needed according to the prevailing conditions on the network.

Given the uncertainty of what generation will connect from 2014 onwards that may result in exceeding the existing loss risk, without either increasing the loss risk limits or transmission investment, the market will have limited visibility over the largest single loss until the first new EPR nuclear unit connects. The market must be informed of when the largest loss increases and what the new single largest loss will be in a year, even if the SQSS planning standard allows for up to 1320MW and 1800MW losses. This figure could

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perhaps be published in the Seven Year Statement. This will allow for an incremental implementation to the level of reserve and response required, as opposed to a single step change, as new generation connects and will aid in minimising the anticipated increase in the cost of response holding.

It is not entirely clear from the letter why the derogation route has been discounted, as the cost allocation method is a separate matter. This may benefit from further explanation to support the preferred option.

We hope that you find our response of help. Should you wish to discuss any aspect of our response further please do not hesitate to contact me.

Yours sincerely

Guy Phillips
Grid Interface Executive

Review Group reply

Mr Guy Phillips
E.ON UK plc
Westwood Way
Westwood Business Park
Coventry CV4 8LG

Ref: EON-GSR007

16th November 2010

Dear Guy,

NETS SQSS – Largest Power Infeed Loss, Amendment to GSR007 proposals

Thank you for your response to the above consultation.

We note E.ON's support for the revision to the implementation date of the GSR007 proposals and the concerns that you raise.

The issues raised in National Grid's GCRP paper in respect of both rate of change of frequency and response holding have been the subject of a joint Grid Code / BSSG working group since 2008. The intention of the paper was to both provide an update on the work to date and to emphasise the need for the industry to make timely progress in developing Grid Code requirements that meet the needs of the UK system with large volumes of new generation technologies. In response to this paper a separate technical group will be working over the next few months to define the system needs, the basis of which will assist in providing focus in developing the appropriate Grid Code requirements to the required timescale.

One of National Grid's roles as system operator is to ensure economic system operation, which includes minimising annual balancing costs. As part of this we only contract for the level of response and reserve required to ensure system security under the prevailing conditions, taking account of the largest credible loss that may occur at any time. This policy will continue if the infeed loss limits change. We expect that appropriate adjustments will be made in our incentive arrangements to reflect any operational changes that are needed.

Information on generation capacity and connection arrangements is already included in the Seven Year Statement. This data will continue to describe the largest potential generation loss. It is possible that the largest potential loss will increase to 1800 MW from the date of the criteria change, this will depend on the connection of new generation. As described in our open letter, adoption of our proposal may mean that we receive more connection applications for the period from 2014. This will increase

the likelihood of the largest potential loss becoming 1800MW soon after the change implementation date.

We have considered the derogation route as an alternative to the proposals. As you comment, under this option consideration has to be given to the allocation of additional response holding costs. If the costs were allocated across the industry the effect would be the same as the proposals we are making, but the mechanism would be less clear and visible. Alternatively, the costs could be allocated to the specific generator. We believe this to be unfair and potentially discriminatory – the reason that derogation will be required is the generator cannot get a more robust connection because the extra assets will become redundant if the infeed loss limits are raised. Raising the limits would be dependent on other parties, and outside the control of the affected generator.

Once again, thank you for your comments. We will be submitting our recommendations to Ofgem later this month. Please contact me (mark.perry@uk.ngrid.com – 01926 655468) should you wish to discuss any issues further. I look forward to working with you on the next phase of the review.

Yours sincerely

Mark Perry

RWE

Response

RWE Supply & Trading



Mr Mark Perry
Electricity Network Investment
National Grid Electricity Transmission plc
National Grid House
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Name John Norbury
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mark.perry@uk.ngrid.com

8th October 2010

Dear Mark

Largest Power Infeed Loss – Amendment to GSR007 proposals

Thank you for the invitation via an open letter dated 20th September 2010 to provide comments on the proposal to bring forward the implementation date of SQSS Consultation GSR007. The following response is provided on behalf of the RWE group of companies, including RWE Npower plc, RWE Supply & Trading GmbH and RWE Npower Renewables Limited, a wholly owned subsidiary of RWE Innogy GmbH.

RWE is generally supportive of the proposal to implement the proposed change to the infeed loss limits with effect from 1st April 2014. However, a marginal increase above 1320MW, and not necessarily 1800MW, may be sufficient to enable the connection of low carbon based generation at this time. Whilst we are not entirely convinced by the cost benefit analysis of this proposed change, we welcome the increased certainty which it creates.

If you wish to discuss any matters further please do not hesitate to contact me.

Yours sincerely

John Norbury
Network Connections Manager

RWE Supply & Trading GmbH
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Dr. Peter Kreuzberg
Richard Lewis
Alan Robinson

Review Group reply

Mr John Norbury
RWE Supply and Trading GmbH
Windmill Hill Business Park
Whitehill Way
Swindon SN5 6PB

Ref: RWE-GSR007

16th November 2010

Dear John,

NETS SQSS – Largest Power Infeed Loss, Amendment to GSR007 proposals

Thank you for your response to the above consultation.

We note your general support for the proposal.

We agree that from 2014 it may not be necessary to have an infeed loss limit of 1800MW to enable the connection of new generation. However, if we move to a value less than 1800 MW as an interim measure, the present issues associated with having a limit of 1320 MW will arise at any site where generation wishes to connect and make the total on the spur higher than the limit, whatever it is. In operating the system we will only hold response on the basis of the generation connected at any time. Consequently, additional costs will not be incurred if the infeed loss limit is higher than needed at the time. On this basis, we believe that it is appropriate to raise the limits to their long term level from the outset.

Once again, thank you for your comments. We will be submitting our recommendations to Ofgem later this month. Please contact me (mark.perry@uk.ngrid.com – 01926 655468) should you wish to discuss any issues further. I look forward to working with you on the next phase of the review.

Yours sincerely

Mark Perry



Mark Perry
National Grid
National Grid House
Gallows Hill
Warwick
CV34 6DA

8 October 2010

Dear Mark,

Largest Power Infeed Loss – Amendment to GSR007 proposals

EDF Energy is one of the UK's largest energy companies with activities throughout the energy chain. We provide 50% of the UK's low carbon generation. Our interests include nuclear, coal and gas-fired electricity generation, renewables, combined heat and power plants, and energy supply to end users. We have over 5 million electricity and gas customer accounts in the UK, including both residential and business users.

EDF Energy welcomes the opportunity to provide feedback on this proposal. The key points of our response are as follows:

- We believe that the change to infeed loss limits and the bringing forward of the implementation date is a sensible, evidence based and timely proposal which will allow progress towards Government targets for a low carbon generation mix.
- Implementation of this proposal in 2014 has substantial benefits for investor certainty and removes a barrier for new generation projects.
- It is our view that earlier implementation of the infeed loss change will provide cost savings to consumers as it will avoid unnecessary investment in transmission network.
- We note the reference in the open letter to a potential requirement for further analysis regarding management of frequency transients. We strongly believe this issue exists in its own right, should be investigated thoroughly but must be dealt with independently from this decision on SQSS infeed loss.
- Any cost-benefit analysis is difficult as a number of assumptions must be made which might not address all potential outcomes. However, the assumptions made in developing the cost-benefit analysis seem proportionate and therefore we support the direction they provide.
- Any uncertainty over this analysis is almost certainly outweighed by the clear and sensible qualitative arguments.

Rationale for the change

EDF Energy welcomes and fully supports the views of the SQSS Review Group to implement the amendment to infeed loss limits on 1 April 2014. Since the original proposal was assessed by a working group and has been the subject of industry consultation there has been greater clarity over Government policy objectives regarding electricity transmission access arrangements and grid connection.



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There are clear and sensible arguments as to why the amendment should be brought forward to 2014. In particular, this change to infeed loss limits will fully support progress towards Government targets for low carbon electricity.

The investor certainty for those parties who can benefit from the earlier implementation date should not be underestimated. The provision of investor certainty was a significant requirement for the Government's decision on implementation of a Connect and Manage regime for transmission access. This regime for access would be undermined should generators be held up by an historical and arbitrary number in a security standard or if those generators were reliant on others' access requirements for their connection date.

We note that the review group refers to a demonstrable risk of asset stranding should additional transmission lines be built to accommodate generation connecting onto a spur. An earlier amendment to the infeed loss limits, i.e. from 2014, is a sensible way forward to avoid the risk of an unnecessary cost to consumers.

Management of frequency transients

We note that the Review Group refers to the need for further analysis regarding management of frequency transients. Clearly National Grid has already made an assessment of frequency response requirements for an 1800MW loss, as this information has been used for their recent charging consultations, and previously in the Operating in 2020 work. EDF Energy does not fully agree with the analysis but there can be no doubt that National Grid has considered this issue in detail when calculating the requirements and costs. Given Poyry's analysis of these requirements and costs we would suggest that National Grid's analysis be used as an upper limit guide for volumes and costs of frequency response (we discuss this further below). However, there is ongoing industry discussion regarding Grid Code and Balancing Services requirements for frequency response. These meetings are considering detailed solutions for what are well understood issues. It is our view that these issues are important but separate and independent of the decision on infeed loss. These can continue to be addressed once the change to infeed loss limits has been approved for implementation.

Cost benefit analysis

We welcome the cost benefit analysis provided with this proposal and appreciate the difficulties in predicting a scenario on which these items can be measured. A range of carbon benefits is provided in the original GSR007 amendment report, taking account of the uncertainties on price and carbon intensity, and a number of assumptions are made. It is understood that any cost-benefit analysis is difficult, as the assumptions made might not address all potential outcomes. However, the assumptions made in developing the cost-benefit analysis seem overall to be proportionate and therefore we support the direction they provide.

Notwithstanding our view on the overall proportionality of the cost-benefit analysis we have the following comments to make regarding the costs part of this calculation. We

have previously made comments to National Grid with regard to its development of response costs due to this change. National Grid calculated additional costs by extrapolating the results from a previous year but we do not believe this can accurately represent the costs involved. As a result we commissioned Poyry to model additional frequency response costs due to the change (we provided this analysis in our response to GB ECM 19) and this analysis indicated that the costs might increase from £37m to £56.7m p.a. We believe it is a reasonable assumption that the cost of utilising reserve, i.e. response costs, will not increase due to the larger unit size; it is the cost of creating additional headroom, i.e. upward reserve costs, that is expected to change.

Furthermore, the costs of additional response were only considered by National Grid on the basis of holding dynamic response (i.e. balancing mechanism, mandatory response and commercial response costs). No consideration was given to the use of alternative mechanisms such as static response providers on low frequency relays.

We would suggest that, as a range of carbon benefits has been developed, it would also be possible to consider a range of costs for the additional response. This reinforces our view that the nature of this issue is subjective and that it is the overall proportionality of the cost-benefit analysis that is important.

Conclusions

In our view, the qualitative arguments are stronger and should not be underrated merely because of the difficulties in placing tangible financial benefits against them. The benefits of increased investor certainty, reduced costs for consumers, alignment with Government objectives for transmission access, and the removal of the risk of stranded assets, are sufficiently robust to warrant an earlier change to the SQSS infeed loss limits, i.e. from 2014.

Should you wish to discuss any of the issues raised in our response or have any queries please contact my colleague Rob Rome on 01452 653170, or myself.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'D. Linford'.

Denis Linford
Corporate Policy and Regulation Director

Review Group reply

Denis Linford
Corporate Policy and Regulation Director
EDF Energy
40 Grosvenor Place
Victoria
London SW1X 7EN

Ref: EDF-GSR007

16th November 2010

Dear Denis,

NETS SQSS – Largest Power Infeed Loss, Amendment to GSR007 proposals

Thank you for your response to the above consultation.

We note that you support the proposals. We agree that there is considerable uncertainty in the cost benefit analysis, and that the qualitative arguments are a significant factor in the merits of the proposal.

The issues associated with future frequency response requirements, including inertial and primary response, arise from a number of factors, including the potential increase in the largest generation loss. As has been discussed in the joint Grid Code / BSSG Frequency Response working group to which you refer, the response requirements of generators in the future will need to be different to those at present to ensure the continued secure and economic operation of the whole system. As noted in both the original GSR007 consultation, and our recent open letter on the proposed amendments, we are confident that, as an industry, we will identify appropriate Grid Code requirements and Commercial arrangements. As described in our paper to the September Grid Code Review Panel, advancing the date of the original proposals will require greater industry focus on the associated issues in the next couple of years.

We agree with you view that there is a range of possible additional costs that will result from any raising of the infeed loss limits. There is currently considerable uncertainty as to how reserve and response will be most economically provided in the future. Some of these issues will be clarified by the Frequency Response working group. Others, such as utilising response from energy storage, or from a greater level of demand management, are still too early in their development for us to reasonably include their impact in any assessment. As you note, the overall proportionality of the cost-benefit analysis is the important issue, and we do not anticipate that near future developments will significantly alter this.

Once again, thank you for your comments. We will be submitting our recommendations to Ofgem later this month. Please contact me (mark.perry@uk.ngrid.com – 01926 655468) should you wish to discuss any issues further. I look forward to working with you on the next phase of the review.

Yours sincerely

Mark Perry

RenewableUK

Response



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David Wright
SQSS Review Group Chairman
National Grid
By email [mark.perry@uk.ngrid.com]

Date: 20th October 2010

Dear David,

Largest Power Infeed Loss – Amendment to GSR007 proposals Renewable UK consultation response - updated

RenewableUK (formerly the British Wind Energy Association (BWEA)) is the trade and professional body for the UK wind and marine renewables industries. Formed in 1978, and with over 650 corporate members, RenewableUK is the leading renewable energy trade association in the UK, representing the large majority of the UK's wind, wave, and tidal energy companies.

Update:

In our original response to this consultation we expressed some serious concerns asking for more information and analysis before we could consider this proposal for support. Since that response was made we have had received feedback and more information which was not available in the consultation document and undertaken our own analysis which has enabled us to develop the view we originally expressed.

In future we request that such important consultations should have a fuller more detailed and accessible analysis and presentation of the options.

This letter has been turned around in short time frame to input to an SQSS review group on 20th October and so has not had the benefit of scrutiny by member companies.

Overview:

Our reworking of analysis in the consultation shows that there are clear benefits of the connecting more than 1320MW of wind to transmission spurs. The additional costs of up to £50m per annum are more than recouped in carbon savings alone.

In our analysis we have included an estimate of the cost of carbon in providing the extra reserve.

We have suggested some actions that could lead to the costs (including the costs of carbon) of providing the reserve being reduced.

We have proposed that the SQSS should differentiate between the largest loss caused by a transmission failure and the instantaneous loss of generation.

Renewable UK Comments and Questions:

1. Refined cost benefit assessment

We have carried out a refined cost benefit assessment which shows annually:

- The cost of adding the gas generation at Spalding is **£77m**
- The benefit of adding the wind generation is £30m
- The cost of adding the gas generation at Spalding after the wind is **£29m**
- If less wind is developed there is still a benefit of £13m
- If more wind is developed there is a bigger benefit of £101m

The cost benefits are shown in appendix 1 and in a spreadsheet we enclose with this letter. These costs are based on the higher cost of carbon (52£/t) and the lower carbon intensity (0.43t/MWh) to provide a mid case assessment. We have estimated the carbon costs of providing the reserve.

We have used the same data used in the consultation analysed in a different way apart from adding in an estimate for the carbon costs of the reserve, and showing two further wind options, a high and a low wind option.

2. Carbon cost of reserve.

We note that the consultation estimated carbon *benefits* of the increase to 1800MW, but not the carbon *costs* of holding the additional spinning reserve. The assessment should assume that a low carbon “merit order “ will apply so that the lowest carbon footprint service will be the first to be secured and the highest carbon footprint the last. The additional reserve required to secure the 1800MW loss will therefore have a higher marginal carbon footprint than the peak footprint already secured for a 1320MW loss.

We have assumed that the marginal cost of carbon of holding a MW of reserve for one hour is 10% of the average cost of carbon of generating a MWh. We have used the consultation’s 0.43 t_CO2/MWh figure. Therefore to hold an extra 480MW would produce an extra:

$$= 480 \times 10\% \times 0.43 = 21 \text{ t-CO}_2/\text{h}$$

We have used these figures to re-consider the carbon cost benefits summarised in section 1 above and shown in Appendix 1.

3. Transmission vs. generation infeed loss.

We recommend that the two aspects of large infeed loss i.e. of transmission failure and generation failure are separated in the SQSS. The risk of a double circuit loss (transmission failure) varies according to weather and is much lower than a large generation infeed loss.

With only wind generation connected to a spur the requirement to hold spinning reserve will only occur for a part of the year. With a mix of generation connected to a transmission spur the requirement to hold spinning reserve will not exist for the whole year due to diversity. If some of that generation mix is wind the need for reserve will occur even less. At high wind periods lower market prices will tend to drive other generation off the spur and could remove the need for any additional reserve altogether. The system operator can additionally manage the situation with constraint payments if this is lower cost than securing the spinning reserve and gives an additional option to managing costs.

In operation of the system national grid should consider the constraint option and use as an alternative to spinning reserve if it proves lower cost for any instance.

4. Wind only spurs

Our further cost benefit analysis has shown that the even a few wind projects on spurs would prove cost effective. More projects on more spurs would require reserve to be provided for a longer period. However, due to the correlation of wind across different sites, that extra duration would be modest and vary to a degree with geographic spread of such projects. In the cost benefit analysis we have shown that more wind connected on spurs would be even more cost effective, even allowing for some extra duration of reserve.

From discussions we note that the system operator expects more wind projects to come forward and make applications to spurs once it is clear that they can be connected in this way.

We expect that the transmission owners will consider system upgrades to further increase the utilisation of spurs, as a spur can only cater for 1320MW (or 1800MW), whereas an additional 400kV double circuit will bring ~6000MW of incremental connection capacity.

5. Offshore cables

The consultation suggests that this proposal will allow larger offshore cables/ links of 1800MW. We are not aware of well developed project proposals to use such cables at present. Offshore windfarms are not compensated in the event that cable failures restrict generation and therefore offshore developers will want to have their projects connected by at least two cables to provide at least some partial redundancy. There are additional array costs involved in marshalling power to a single 1800MW offshore substation compared to two 900MW offshore substations. Even if an increase beyond 1320MW is shown to be an optimum design solution for offshore connections it is not clear that 1800MW will be the preferred rating.

However, if such proposals and schemes come forward in the future and prove to be cost effective, they will add additional carbon benefits with a relatively small expected increase in costs of reserve.

6. Transmission spur vs. generation trips

We have examined the Significant Incident reports produced annually at the Grid Code review panel and cannot identify any double circuit trips in over a decade of reporting. We therefore question the need to provide additional spinning reserves for such an eventuality. In the run up to the utilisation of the large capacity (expected in 2014) we recommend that the SQSS review group consider the value of the reserve holding for spurs – and in particular whether a weather risk factor can be used to reduce the duration of the holding and therefore the cost.

7. South Holland CCGT

The consultation has claimed an economic benefit due to a new CCGT power station. Our cost benefit analysis shows that providing the reserve for this connection alone is not cost effective in carbon accounting terms. Even after the wind is connected and reserve is provided for that, adding the CCGT station is still not cost effective. The extra 40% of time the reserve must operate costs more than the value of the carbon benefits estimated from the information provided (see Section 1 above and Appendix 1)

8. Speed of change

We note that a change to the 1320 MW loss limit could be made very quickly as the system operator can contract for extra reserve (almost overnight if required). However to optimise connections and allow planning of connections and to promote consenting; developers, users, transmission owners and system operator must know in advance that such schemes are possible in order to balance decisions on planning, capital and carbon costs.

9. Contracts for reserve - STOR

We recommend that National Grid as system operator considers contracting new reserve services through their STOR contacts to provide a lower cost and low/zero carbon means of securing against a double circuit fault on a transmission spur. Such a service could be provided by demand. This would require demand to respond very quickly on frequency and very occasionally (signalled by a large and rapid dip in frequency). It would be an infrequent service and a short duration service whilst other slower reserves were implemented. We note that at present that STOR contract¹ requires 3 operations a week for a minimum of 2 hours and therefore there does not appear to be a product specification appropriate to solving this problem.

10. Inertia and Frequency Response

We note that the industry is considering the impacts of increasing the large loss on frequency response requirements and the interaction with system inertia given increased inverter connections from offshore transmission, interconnectors, wind and PV. We want to ensure that any move to secure inertia is done through a market mechanism so that the most cost effective services can come forward. A market approach will also allow wind turbine manufacturers who have the Intellectual Property and contractual capabilities to provide inertia in their turbine to secure an early benefit. Given the potential for large amounts of PV (Germany is anticipated to have 25GW of PV installed by end of 2011) and that PV does not provide inertia we want to see a market solution to facilitate competition.

Allowing more wind to connect to spurs will provide the potential for a gradual and intermittent increase in the spinning reserve requirement and allow the gradual trialling and development of improved and greater commercial services in inertia and frequency response.

¹ http://www.nationalgrid.com/uk/Electricity/Balancing/services/balanceserv/reserve_serv/stor/

11. Further increases

Given the cost benefit analysis undertaken for wind alone it may be that further increases the infeed loss on transmission spurs in the future to accommodate wind could be cost effective, particularly as progress is made with demand participation in frequency response. Our recommendations should enable more confident assessments to be made of any future further steps for infeed losses due to transmission spur faults, including larger offshore connections if they do prove to be a viable option in the future.

Conclusions:

1. Based on the revised cost benefit analysis we support connection of wind to spurs where the total generation can be between 1320 MW and 1800MW, especially where the wind capacity is mixed with other generation sources.
2. We recommend that connection of single source not renewable generation to spurs is revisited for its cost-benefits.
3. We recommend that the carbon cost of providing reserves is investigated.
4. We recommend that demand response solutions which are very low carbon are developed.
5. We recommend that the SQSS review group assesses the need to provide reserve for a double circuit loss – except in exceptional weather conditions.
6. We recommend that new and improved commercial services for inertia and frequency services are developed as an alternative to rigid Code requirements.
7. We recommend that the review group should modify the SQSS to treat the loss from faults on transmission spurs as a separate consideration from the loss of generation.

We are willing to discuss our concerns in more detail on request from the SQSS review group.

Yours sincerely,



Guy Nicholson, CEng, MIET, MEI, Head of Grid for RenewableUK

Appendix 1 – Cost benefit revisited

Data		Type of generation		Gas	Wind	Gas after wind	Low wind	High Wind	
A		Capacity	MW	900	1140	900	660	2400	
B		Load factor	%	85%	35%	85%	35%	35%	
C		hour per year	h	8760	8760	8760	8760	8760	
Benefits	D	AxBxC	Generation per year	TWh	6.70	3.50	6.70	2.02	7.36
	E		Carbon saving	t-CO2/MWh	0.1	0.43	0.1	0.43	0.43
	F		Cost of carbon	£/t	52	52	52	52	52
Costs	G	DxE	Annual carbon saving	Mt/year	0.67	1.50	0.67	0.87	3.16
	H	FxG	Monetary saving	£M/annum	34.85	78.15	34.85	45.25	164.53
	I		Cost of reserve full year	£M/annum	150	150	150	150	150
	J		Operation of reserve % year	%	70%	30%	40%	20%	40%
	K	IxC	Hours of operation	h	6132	2628	3504	1752	3504
	L		MW additional reserve	MW	480	480	480	480	480
	M		Carbon cost	t-CO2/MW/h	0.043	0.043	0.043	0.043	0.043
Cost Benefit	N	KxLxM	Carbon used	Mt/annum	0.13	0.05	0.07	0.04	0.07
	O	NxF	Cost of carbon used	£M/annum	6.58	2.82	3.76	1.88	3.76
	P	IxJ	Cost of reserve contract	£M/annum	105.00	45.00	60.00	30.00	60.00
	Q		Total cost of reserve	£M/annum	111.58	47.82	63.76	31.88	63.76
	R	H-Q	Cost benefit	£M/annum	- 76.73	30.33	- 28.91	13.37	100.77

Review Group reply

Guy Nicholson
RenewableUK
Greencoat House
Francis Street
London SW1P 1DH

Ref: RenUK-GSR007

16th November 2010

Dear Guy,

NETS SQSS – Largest Power Infeed Loss, Amendment to GSR007 proposals

Thank you for your response to the above consultation.

You have made comments on a number of issues, including:

- the cost and volume of future response holding
- the appropriateness of the current SQSS treatment of infeed losses due to transmission faults
- the carbon benefits of different generation types
- the Grid Code and commercial arrangements appropriate for the future system

Most of the comments form part of wider discussions, and we do not believe that they directly affect the case for the amendment proposal. It is, however, important to ensure that your concerns and suggestions are considered in the wider debates, such as those of the Grid Code Review Panel, and we will welcome your contributions.

Cost and volume of response

In assessing the appropriate generation that will provide response and reserve, the system operator considers a number of factors. Principal amongst these are the level of response that can be relied on, and the price of the services submitted by each generator. This is consistent with our licence obligations to economically ensure system security. At present, there is no provision for a carbon merit order. In practice, currently, and for the next few years, this means that response and reserve will mainly come from conventional generation. This is the assumption that we have made in our analysis. Beyond the next few years, the provision of these services will be dependent on the outcome of the Grid Code / BSSG Frequency Response working group.

You are concerned that our costing of response omits the Carbon content thereof. Formally, our costing is based on current response prices, which must embody current Carbon prices, as factored in by response providers. Even if one were to assume an increase in Carbon prices in future years, it is not at all clear how different providers of response would factor this in to their response prices. In any event, our current perception is that Carbon prices form <10% of current response prices. Please note that, in these analyses, we think it important to distinguish the automatic service of Response from the manual service of Reserve.

We agree with your comments that the load factor of generation on spurs will affect the level of reserve and response holding required at any time. As the system operator, NGET only contracts for the levels actually required at any particular time – we will not hold response to the infeed loss limit when the risk is not there. Also, the system operator is under incentive to optimise the holding of response – if it is cheaper to reduce the single generation risk rather than hold additional response nationally (this is usually not the case), we will adopt that solution.

SQSS requirements

We agree that generation losses due to transmission system faults are relatively rare. It is for this reason that the loss of generation due to a double-circuit fault only triggers the Infrequent Infeed loss limit. However, they can and do occur, and will impact system reliability and security, particularly if we have not planned for them in system operation. The question of whether the SQSS should differentiate between losses caused by generation or transmission events is outside the scope of this work, and must be informed by a fuller debate on the value that users place on reliability. We intend to begin this debate in our customer consultations that will be part of the transmission price control review process.

Carbon benefits of different generation types

Whilst the carbon benefits vary for different types of generation, we are obliged to ensure that the SQSS does not discriminate between generation types. On this basis we have presented the merits of the proposal against a credible future generation background. We believe that the proposal has benefit against this background. You raise South Holland CCGT as a particular case. Our non-discrimination obligation means that we cannot refuse to hold extra response against a South Holland risk, but nevertheless hold extra response against other Wind risks.

Future Grid Code and commercial requirements

We note your comments about the future provision of reserve and system inertia. Both of these issues are being considered in the joint Grid Code / BSSG Frequency Response working group. We will appreciate your contribution to ensuring that the outcome of this work is timely and best meets the needs of the industry and consumers.

Other comments

The limit on the capacity of generation that a spur can accommodate is based on the infeed loss limit, as you imply. Where generation connections take the capacity on a spur beyond the limit, we will need to provide additional transmission capacity to accommodate it. One of the main reasons for the amendment proposal is that we believe it will be very difficult to gain consent for new circuits where generation wishes to connect to a spur prior to the anticipated increase in the infeed loss limit.

We agree that there are no current plans to use cables of 1800MW off-shore. However, developments in off-shore networks are expected in the near future, and increasing the cable capacity that can be utilised may provide more options for developers.

You note that further increases to the infeed loss limit may be cost effective in accommodating new wind generation. The NETS SQSS is kept under review at all times. Future changes to the infeed loss limit may be made if they are shown to be beneficial, taking account of economics and security.

You have requested that in future we include a fuller analysis of all of the options when undertaking consultations. We always endeavour to provide sufficient information to allow users to fully understand the reasons for and merits of our proposals: it is important to us that we receive informed responses that will help us submit the most appropriate recommendations to Ofgem. We believe that the analysis provided in this consultation was sufficient for a number of reasons, including:

- this proposition was to amend the existing GSR007 proposal that was based on extensive analysis. This analysis demonstrated the benefit of raising the infeed loss limit
- the range of results that can be obtained from a reasonable range of input data is very wide, and so the analysis can only be used to indicate the general relative order of costs and benefits – detailed analysis could not introduce greater certainty
- the nature of the issue addressed, that the existing proposal may be deterring generators from applying for connection, makes prediction of the level of generation used to underpin any analysis very difficult, and means that the qualitative arguments must be given a high weighting in assessing the merits of the proposal

However, we welcome your feedback on this and will seek to include as much information as we can in future consultations.

Once again, thank you for your comments. We will be submitting our recommendations to Ofgem later this month. Please contact me (mark.perry@uk.ngrid.com – 01926 655468) should you wish to discuss any issues further. I look forward to working with you on the next phase of the review.

Yours sincerely

Mark Perry

Annex 3 – Proposed NETS SQSS wording

This proposed wording is unchanged from the consultation.

Existing NETS SQSS text is in black font. Additions are shown in red font. Deletions are in red font with a strike through.

7. Generation Connection Criteria Applicable to an Offshore Transmission System

- 7.3 This section presents the planning criteria applicable to the connection of one or more offshore power stations to an offshore transmission system. The criteria in this section apply from the offshore grid entry point/s (GEP) at which each offshore power station connects to an offshore transmission system, through the remainder of the offshore transmission system to the point of connection at the first onshore substation, which is the interface point (IP) in the case of a direct connection to the onshore transmission system or the user system interface point (USIP) in the case of a connection to an onshore user system.
- 7.4 The generation connection criteria, applicable to an *offshore transmission system*, presented in this section, are based on a series of cost benefit analyses. The scope of those analyses was bounded by certain pragmatic assumptions, which recognised the technology available at the time the analyses were carried out. Accordingly, the generation connection criteria presented in this section should only be applied up to those limits. **The criteria have been updated since the initial analysis to account for developments in cable and HVDC technology.** The limits are:
- 7.2.1 the capacity for *offshore power park modules* was limited to a maximum of 1500MW. **Following review of the values of *normal infeed loss risk* and *infrequent infeed loss risk*, this capacity limit will equal the *infrequent infeed loss risk* from April 1st 2014.**
 - 7.2.2 the type of intermittent power source powering the offshore *Power Park Module* was limited to wind.
 - 7.2.3 the capacity of offshore gas turbines was limited to a maximum of 200MW per platform;
 - 7.2.7 the distance from an offshore *grid entry point* on an *offshore platform* to the *interface point* or *user system interface point* (as the case may be) at the *first onshore substation* was limited to a maximum of 100km;
 - 7.2.8 the length of any overhead line section of an *offshore transmission system* was limited to a maximum of 50km; and
 - 7.2.9 Radial offshore network configurations only have been considered. Until reviewed, section 4 shall apply in respect of interconnected offshore networks.

The above limits will be subject to periodic review in the light of technological developments and experience. The limits should not be exceeded without justification provided by further review.

Terms and Definitions

Normal infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency by more than 0.5Hz. Until ~~reviewed~~ 31st March 2014, this is 1000MW. From April 1st 2014, this is 1320MW.

Infrequent infeed loss risk

The level of *loss of power infeed* risk which is covered over long periods operationally by frequency response to avoid a deviation of system frequency outside the range 49.5Hz to 50.5Hz for more than 60 seconds. Until ~~reviewed~~ 31st March 2014, this is 1320MW. From April 1st 2014, this is 1800MW.

Loss of Power Infeed

The output of a *generating unit* or a group of *generating units* or the import from *external systems* disconnected from the system by a *secured event*, less the demand disconnected from the system by the same *secured event*. For the avoidance of doubt if, following such a *secured event*, demand associated with the normal operation of the affected *generating unit* or *generating units* is automatically transferred to a supply point which is not disconnected from the system, e.g. the station board, then this shall not be deducted from the total *loss of power infeed* to the system. For the purpose of the operational criteria, the *loss of power infeed* includes the output of a single *generating unit*, CCGT Module, boiler, nuclear reactor or DC Link bi-pole lost as a result of an event. *In the case of an offshore generating unit or group of offshore generating units, the loss of power infeed is measured at the interface point, or user system interface point, as appropriate.*