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 rational 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 2018[1]. The proposal was subject to industry consultation in February 2009 (consultation GSR007[2]) 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.

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

[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/EEEB8EDB-6AA5-4D44-BFDC-763ECE251E73/31739/SQSS1320Reportfinalv10_040209_.pdf

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

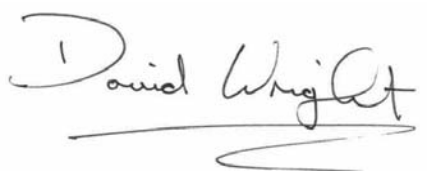
Or

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



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 x 85% load factor[4] 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 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 factor[5] 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.

<u>Benefit for offshore generation</u>

- 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 ÷ 10.9 = £14.5m 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.