

## Stage 02: Industry Consultation

National Electricity Transmission System Security  
and Quality of Supply Standards (NETS SQSS)

# GSR014: Review of Requirement of Onshore Connection Facilities for Offshore Wind Farm Connections: Industry Consultation

What stage is this  
document at?

01 Work-Group  
Report

02 Industry  
Consultation

03 Report to the  
Authority

Based upon the results of the GSR014 Work-Group, this proposal seeks to modify NETS SQSS Section 7.13.1.1: Onshore Connection Facilities: AC Circuits.

This proposed NETS SQSS Modification is open for Industry Consultation. Any interested party is able to make a response in line with the guidance set out in Section 5 of this document.

Published on: [DD / MM / YYYY]  
Length of Consultation: 25 Working Days  
Responses by: [DD / MM / YYYY]



***The NETS SQSS Review Panel recommends:***

That GSR014 should be implemented as it better facilitates the applicable NETS SQSS objectives.



***High Impact:***

None.



***Medium Impact:***

None.



***Low Impact:***

OFTOs and OTSDUW parties.

GSR014 Industry  
Consultation

Date [DD/MM/YYYY]

Version 1.1

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## About this Document

This Industry Consultation outlines the information required for interested parties to form an understanding of a potential defect within the National Electricity Transmission System Security and Quality of Supply Standards (NETS SQSS) and seeks the views of interested parties in relation to the issues raised by this document.

Parties are requested to respond by [DD / MM / YYYY] to the following email address: [box.sqss@nationalgrid.com](mailto:box.sqss@nationalgrid.com)

## Document Control

Version	Date	Author	Change Reference
1.0	04 / 06 / 2014	National Grid	Draft Industry Consultation
1.1	30 / 07 / 2014	National Grid	Final Industry Consultation



### Any Questions?

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## 1 Executive Summary

- 1.1 The GSR014 Working-Group has conducted a cost benefit analysis (CBA) using the Spackman<sup>1</sup> approach to determine the optimum design of offshore transmission connections to onshore electricity networks. Specifically, the CBA considered whether two HV switch-bays (Figure 1 Design 1) or one HV switch-bay (Figure 1 Design 2) should be installed where the offshore wind farm connects to the onshore transmission network.
- 1.2 For the purpose of this analysis it was assumed that the onshore elements for the connection of the offshore transmission system, for which schematic diagrams are presented in Figure 1 below, would operate at 400kV. Furthermore, such systems shall comprise of underground cables, circuit breakers, disconnectors, transformers and the onshore substation that connects the offshore system to the onshore system.

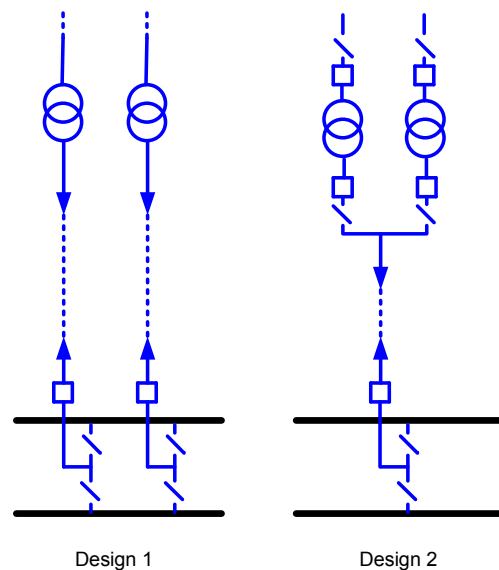


Figure 1. Schematic diagram of the offshore transmission system designs considered.

- 1.3 A balancing exercise between the following two broad categories of costs was conducted to determine the optimal network design:
  - The cost of offshore transmission system investment that comprises of:
    - The cost of underground cables
    - The cost of transformers
    - The cost of onshore switchgear
  - The capitalised cost of the expected constrained energy due to preventative and corrective maintenance over the period of the asset life.
- 1.4 Note that costs that are common to both one switch-bay and two switch-bay designs were not included within the CBA. This includes the offshore switchgear costs.
- 1.5 Based upon evaluation of these two primary cost components for the two offshore transmission system configurations considered, the Working-Group has identified optimal designs for a range of wind farms with capacities of 250MW, 500MW and 1000MW and has included sensitivities around the onshore cable length.

<sup>1</sup> The Spackman approach is the most appropriate method for CBAs in cases where a firm finances the investment but benefits mainly accrue to consumers and / or the wider public. The Spackman method was published by the Joint Regulators Group (JRG), 25 July 2012.

- 1.6 The CBA calculated the cost benefit over the assumed twenty year life of the wind farm assuming a pre-tax weighted average cost of capital (WACC) of 7.9%, an interest during construction (IDC) rate of 7.9% and a social time preference rate (STPR) of 3.5%. The working-group also conducted a sensitivity analysis using a range of WACC (6.9% and 8.9%) to confirm that the conclusions of the report remain unchanged.
- 1.7 The energy costs used in the CBA were assumed to be £150/MWh, which is equal to two ROCs plus the energy price. This value also coincides with the strike price under EMR for offshore wind farms with connections dates pre-2017. This price shall be reduced to £135/MWh for wind farms connecting post-2017. However, this change in energy price does not have a material impact on the overall conclusions of this report.
- 1.8 The Spackman approach was used to compare the costs and benefits between Design 1 and Design 2, both shown in Figure 1 above.
- The capital costs used were the transmission investment costs of each design. The transmission capital costs were converted into an annual cost using the IDC value of 7.9%. This produces a stream of financing costs or an appropriate time profile of annualised costs.
  - The benefits used were the avoided constraint costs which were calculated for each design and included for each year. The STPR of 3.5% was then applied in discounting these costs, as recommended by HM Treasury Green Book.
- 1.9 The results show that using the Spackman approach, Design 1 gives a higher NPV benefit compared to Design 2 when tested over a range of generation capacities for both AIS and GIS switchgear designs.
- 1.10 Based upon these results as presented in the Working-Group Report, it is proposed that a number of changes are implemented to NETS SQSS Section 7.13.1.1. The legal text required to implement these proposals is provided within Annex 1 of this document.
- 1.11 Views are invited upon the proposals outlined in this Industry Consultation, which should be received by [DD / MM / YYYY]. Further information on how to submit a response can be found in Section 5 of this document.

## 2 Why Change?

- 2.1 The National Electricity Transmission System Security and Quality of Supply Standards (NETS SQSS) provides a coordinated set of criteria and methodologies that transmission licensees are required to use in the planning, development and operation of the National Electricity Transmission System (NETS).
- 2.2 The NETS SQSS was originally developed across 1990 to 2005 for application to the onshore transmission system in England, Wales and Scotland. In June 2009, additional criteria, namely NETS SQSS Sections 7, 8, 9 and 10 were introduced for offshore transmission systems.
- 2.3 During the June 2009 revision, an issue was raised by National Grid as the Transmission Owner (TO) to revisit the wording of Section 7.13.1.1 that currently reads as:
- In the case of offshore power park module only connections, and where the offshore grid entry point capacity is 120MW or more, following a planned outage or a fault outage of a single AC offshore transformer circuit at the onshore AC transformation facilities, the loss of power infeed shall not exceed the smaller of either: 50% of the offshore grid entry point capacity; or the full normal infeed loss risk.*
- 2.4 This current wording commonly results in onshore designs to connect an offshore wind farm having two transformers, each rated at 50% of the offshore grid entry point capacity, and two high voltage bays at the onshore TO substation.
- 2.5 It is believed that the work undertaken in developing the offshore NETS SQSS criteria was not conclusive on the need for two bays to connect an offshore wind farm. The purpose of Section 7.13.1.1 is to ensure that in the event of a permanent fault on a transformer, the wind farm would not be completely disconnected from the transmission system for the duration of the transformer replacement time, which could be in the region of 18 months. The principles behind Section 7.13.1.1 were not believed to be intended to cover the short term loss of power infeed of the whole wind farm up to the normal infeed loss.
- 2.6 Therefore the aim of this study was to investigate whether the current implied requirement for two transformers and two high voltage substation bays where offshore cables connect to the onshore network is justified or whether two transformers connected to a cable and a single bay would be sufficient.
- 2.7 The GSR014 Working-Group investigation didn't show that the single bay option was economic. In fact, there was a firm cost benefit case for Design 1 (i.e. two bays). The proposed change to the NETS SQSS will make the use of Design 1 clearer. In practice the vast majority of offshore designs have adopted this two bay approach already. The proposed NETS SQSS changes will formalise the position.

### 3 Solution

- 3.1 The detailed results from the CBA using the Spackman approach and the calculations of constraint costs are as contained in the Working-Group Report. Over the range of sensitivities considered, the NPV of the benefit of Design 1 compared to Design 2 ranged between £6m and £37m.
- 3.2 Based upon these results it is proposed that a number of changes are made to NETS SQSS Section 7.13.1.1. The legal text required to implement these proposals is provided within Annex 1 of this document.

## 4 Impact & Assessment

### NETS SQSS Working-Group Assessment

#### 4.1 National Grid

The NGET representatives (SO and TO) are supportive of this amendment.

#### 4.2 Offshore Transmission Owners (OFTOs)

The OFTO representative is supportive of this amendment. The proposed GSR014 amendment will have no impact on existing OFTO systems.

#### 4.3 Generators

The Generator representatives are supportive of this amendment.

#### 4.4 The Crown Estate

The Crown Estate representative is supportive of this amendment.

### Impact on the NETS SQSS

#### 4.5 GSR014 requires amendments to the following parts of the NETS SQSS:

- Section 7.13.1.1: Onshore Connection Facilities: AC Circuits.

#### 4.6 The text required to give effect to this proposal is contained in Annex 1 of this Industry Consultation document.

### Impact on the National Electricity Transmission System (NETS)

#### 4.7 The proposed changes are expected to lead to reduced costs and more economic operation over the lifetime of the offshore transmission assets. In addition, the proposed changes are expected to increase the overall level of security of the National Electricity Transmission System. Furthermore, in the vast majority of all offshore designs to date, these have adopted the two bay approach already.

### Impact on NETS SQSS Users

#### 4.8 There is at [least one] existing single bay connection that would not be compliant with the proposed revised requirements of Section 7.13.1.1. If the new requirement is made retrospective the impact could be quite significant on [these] NETS SQSS users. It is therefore proposed that the requirement is not made retrospective.

### Impact on Greenhouse Gas Emissions

#### 4.9 The proposed modification will have no impact on Greenhouse Gas Emissions.

## Assessment Against NETS SQSS Objectives

4.10 The NETS SQSS Review Panel considers that the proposed changes would better facilitate the NETS SQSS objectives:

- (i) facilitate the planning, development and maintenance of an efficient, coordinated and economical system of electricity transmission, and the operation of that system in an efficient, economic and coordinated manner;

*The proposed changes are expected to lead to reduced costs and more economic operation over the lifetime of the offshore transmission assets.*

- (ii) ensure an appropriate level of security and quality of supply and safe operation of the National Electricity Transmission System;

*The proposed changes are expected to increase the overall level of security of the National Electricity Transmission System.*

- (iii) facilitate effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating such competition in the distribution of electricity; and

*The proposal has a neutral impact on this objective.*

- (iv) facilitate electricity Transmission Licensees to comply with their obligations under EU law.

*The proposal has a neutral impact on this objective.*

## Impact on Core Industry Documents

4.11 The proposed modification does not impact on any core industry documents.

## Impact on Other Industry Documents

4.12 The proposed modification does not impact on any other industry documents.

## Implementation

4.13 The NETS SQSS Review Panel proposes that GSR014 should be implemented 10 business days after an Authority decision. Views are invited on this proposed implementation date.



## 5 Consultation Responses

- 5.1 Views are invited upon the proposals outlined in this consultation, which should be received by [DD / MM / YYYY].

Your formal responses may be emailed to:

[.box.sqss@nationalgrid.com](mailto:.box.sqss@nationalgrid.com)

- 5.2 Responses are invited to the following questions:

- (i) The proposal is underpinned by economic analysis of two designs for a range of scenarios. Has the analysis considered a wide enough range of scenarios and designs to reach a generic conclusion? Are the costs (capital and operational) and availability data used in the analysis reasonable?
- (ii) The proposed modification is not intended to apply retrospectively to connections completed before 31<sup>st</sup> December 2014 and it is proposed that this qualifying date be introduced. Are you in agreement with this approach and date?
- (iii) Do you agree with a proposed effective date of 1<sup>st</sup> January 2015 for these changes to come into effect?
- (iv) The Working-Group report indicates that there are circumstances when the cost benefit analysis may demonstrate that a single bay option is economic for future connections. For example where an existing substation is not able to be extended, or requires uneconomic and extensive civil works. In these cases, the proposed modification will require that a lifetime derogation is required. Is this a reasonable requirement against the benefits of the proposal?
- (v) What additional clarity or other benefits does the proposal bring to the criteria of the NETS SQSS?
- (vi) Do you support the proposed implementation approach of 10 business days following an Authority decision?

- 5.3 If you wish to submit a confidential response please note the following:

- (i) Information provided in response to this consultation will be published on National Grid's website unless the response is clearly marked "Private and Confidential". We will contact you to establish the extent of the confidentiality. A response marked "Private and Confidential" will be disclosed to the Authority in full but, unless agreed otherwise, will not be shared with the NETS SQSS Review Panel or the industry and may therefore not influence the debate to the same extent as a non-confidential response.
- (ii) Please note that an automatic confidentiality disclaimer generated by your IT System will not in itself mean that your response is treated as if it had been marked "Private and Confidential".

This section contains the proposed legal text to give effect to the proposals. The proposed new text is in red and is based on NETS SQSS Version 2.2.

**7.13.1.1** *With effect from 31<sup>st</sup> December 2014, in the case of new offshore power park module only connections, and where the offshore grid entry point capacity is 120MW or more, following a planned outage or a fault outage of a single AC offshore ~~transformer~~ transmission circuit at the onshore AC transformation facilities or between the onshore AC transformation facilities and the Onshore Transmission System, the loss of power infeed shall not exceed the smaller of either: 50% of the offshore grid entry point capacity; or the full normal infeed loss risk. (For the avoidance of doubt, connection offers signed by all parties before 31<sup>st</sup> December 2014 for connections which are configured with two AC transformers banked onto a single 400kV or 275kV switch-bay are deemed to be compliant with Section 7.13.1.1.)*