

Grid Code Review Panel

GC0077/GSR018 Sub-Synchronous Oscillations Workgroup Report and Progression to Consultation

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Summary

Transmission System Users have requested that the Grid Code and the National Electricity Transmission System Security and Quality of Supply Standards (NETS SQSS) are modified to clarify the accountabilities of managing the risks of Sub-Synchronous Oscillations. These risks might arise due to the interaction between some Generating Units on one side and transmission plants, e.g. series compensation and HVDC Links, on the other side.

The Panel is invited to note the GSR018 Workgroup Report and agree to proceed to a combined consultation on the changes proposed to Grid Code as well as NETS SQSS.

Users Impacted

High – None Identified

Medium – Transmission Licensees and Generators.

Low – Networks Operators

Description & Background

Transmission System Users have requested that the Grid Code and the National Electricity Transmission System Security and Quality of Supply Standards (NETS SQSS) are modified to clarify the accountabilities of managing the risks of Sub-Synchronous Oscillations that might arise due to the interaction between some Generating Units on one side and transmission plants, e.g. series compensation and HVDC Links, on the other side

“GC0077: Suppression of Sub-Synchronous Resonance from Series Capacitive Compensation” proposed a modification to the Grid Code to place an obligation on NGET to ensure that User’s Plant and Apparatus are not subject to Unacceptable SSO conditions. It also proposed to stipulate that NGET may specify SSO related requirements in the Bilateral Agreement with the relevant Users. The Industry Consultation on this proposal highlighted some issues that need to be addressed.

A related NETS SQSS Modification Proposal was raised at the December 2013 NETS SQSS Review Panel Meeting in relation to the treatment of Sub-Synchronous Oscillations (SSO) within the NETS SQSS. The NETS SQSS Review Panel recommended the formation of a Sub-Synchronous Oscillations Workgroup. The Workgroup was tasked to report on the following points:

- The need to include SSO related provisions within the NETS SQSS;
- The SSO phenomena that needs to be considered;
- The definition of acceptable or Unacceptable SSO conditions; and

1 The Code Administrator will provide the paper reference following submission to National Grid.

- The operating conditions and secured events for which acceptable or Unacceptable SSO conditions should be assessed.

The Grid Code Review Panel agreed to delay any conclusion on the GC0077 Modification Proposal until the related NETS SQSS proposal had come to a conclusion and tasked the Workgroup to report on the requirement for changes to the Grid Code arising from the Workgroup's proposals.

The Workgroup discussions have been concluded and the Workgroup Report has been submitted to the NETS SQSS Review Panel who approved the Workgroup report.

The Workgroup Report is submitted to the Grid Code Review Panel for information and consideration in development of a combined Grid Code and SQSS consultation.

Proposed Solution

The Workgroup proposed that the NETS SQSS should to be modified to:

- include a definition for Sub-Synchronous Oscillations and a definition for Unacceptable Sub-Synchronous Oscillations;
- specify within the relevant sections that, prior to any fault, and following any of the secured events already defined within these sections there shall be no Unacceptable Sub-Synchronous Oscillations; and
- specify within Section 2 and Section 7 of the NETS SQSS that in relation to the power plant under consideration, Sub-Synchronous Oscillations criteria should be met when the Generating Unit is operating at the output level where it is most vulnerable to Sub-Synchronous Oscillations.

No changes have been proposed to the secured events, to the background conditions specified in Section 4, or to the background conditions for plants other than the plant under consideration specified in Section 2 and Section 7 as these were considered sufficient.

The Workgroup discussed how these requirements will be met in practice and any potential modifications to the Grid Code that are require to allow Transmission Licensees to comply with the additional NETS SQSS criteria. The Workgroup concluded that the Grid Code Modification Proposal GC0077 is sufficient to achieve this. For clarity, GC0077 proposal stipulates that:

- NGET is required to ensure that no User's plant is subjected to Unacceptable Sub-Synchronous Oscillations in accordance with the relevant Licence Standards; and
- where there is a need, NGET may set some site specific requirements related to damping or mitigation of Sub-Synchronous Oscillations on Users in line with established procedures for connection and modification

The Workgroup discussed other implementation considerations and the concerns that have been raised by the industry through the GC0077 consultation. This includes the following issue:

- SSO mitigation strategy in design and operational timescales;
- SSO monitoring equipment (site specific);
- Mandatory SSO protection (ruled out);
- funding for User Works triggered by the series compensation and the Western HVDC Link;
- practical application of the criteria proposed; and

- Interactions with Section 13 of the CUSC “Minimum Enabling Works”

The Workgroup considers that the NETS SQSS modification proposed and the discussions had during the Workgroup meetings are sufficient to address all the issues raised in the previous consultation on the Grid Code Modification Proposal GC0077. Hence, both modifications should be considered within a combined consultation

Assessment against Grid Code Objectives

The improvement in performance proposed, aims to allow manufacturers, developers and generators to benefit from the cost reduction offered by Hybrid STATCOM / SVC's whilst restoring some of the capability lost, thereby improving system security and operability.

Clarification of the Grid Code will minimise the financial risk, posed by non-compliance to developers and manufacturers. It will also minimise the risk of Transmission Licensees having to make up a shortfall in reactive capability with alternative sources.

We believe the proposed changes to the Grid Code better facilitate the Grid Code Objectives:

(i) to permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity;

- The modification proposal clarifies the accountabilities in terms of management of Sub-Synchronous Oscillations on the Transmission System. Whilst doing so, it provides NGET with a tool to enforce, where necessary and where economic to do so, reasonable SSO-related site specific requirements on Transmission System Users in line with established procedures for connection and modification.. This ensures that the risks are managed using the most coordinated, economic, and efficient means.

(ii) to facilitate competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor restrict competition in the supply or generation of electricity);

By clarifying that Transmission Licensees will develop and that NGET will operate a Transmission System that is free from Unacceptable Sub-Synchronous Oscillations, under all agreed scenarios, Users will have enough assurance to invest in new plant and to continue to operate their existing plant that are connected in close proximity to the series capacitors and/or the HVDC links.

(iii) subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;

The modification proposal clarifies the accountabilities related to management of risks of Sub-Synchronous Oscillations. This gives comfort to Transmission System Users that their plant will not be exposed to material risks. While doing so, the modification proposal provides means to ensure that the most appropriate and cost effective countermeasure against Sub-Synchronous Oscillations has been implemented. This is by clarifying that NGET may specify some site specific conditions on some Users to ensure that the Transmission System is not exposed to any Sub-Synchronous Oscillation risks.

(iv) to efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency.

The modification proposal has no impact on this Grid Code objective.

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Impact & Assessment

Impact on the National Electricity Transmission System (NETS)

The proposal clarifies how Sub-Synchronous Oscillations risks on the National Electricity Transmission System Users will be managed.

Impact on Greenhouse Gas Emissions

None

Impact on core industry documents

Modifications to the NETS SQSS and the Grid Code as per Annex 2 and Annex 3 of the Workgroup report

Impact on other industry documents

None

Supporting Documentation

GSR018 SSO Workgroup Report

Annex 1 – Draft consultation questions

GC0077 Industry Consultation (Published on July 2014)

Responses to GC0077 Industry Consultation

Recommendation

The Grid Code Review Panel is invited to:

- approve the recommendations of the Workgroup; and
- agree to progress the report through a combined Grid Code/NETS SQSS industry consultation.

Document Guidance

This proforma is used to raise an issue at the Grid Code Review Panel, as well as providing an initial assessment. An issue can be anything that a party would like to raise and does not have to result in a modification to the Grid Code or creation of a Working Group.

Guidance has been provided in square brackets within the document but please contact National Grid, The Code Administrator, with any questions or queries about the proforma at grid.code@nationalgrid.com.

Annex 1 – Draft Consultation Questions

Responses are invited to the following questions:

- (i) Does the modification proposed provide Transmission System Users with enough assurance that their Plant is not going to be subjected to unacceptable risks due to Sub-Synchronous Oscillations? If not, please clarify why.
- (ii) Does the modification proposed strike the right balance between operational risks and the cost of constraints required to mitigate this risk? If not, please provide evidence.
- (iii) Does the modification proposed strike the right balance between capital investment and operational expenditure? If not, please provide evidence.
- (iv) The workgroup concluded that although the System Instability criteria stipulated within the NETS SQSS apply in principle to Sub-Synchronous Oscillations, the letter of the definition is not necessarily applicable as it is almost impossible to be met. Does this constitute any operational risk to the Transmission System and/or User's Plant? If yes, please specify these risks.
- (v) Do you agree that the definitions for Sub-Synchronous Oscillations and Unacceptable Sub-Synchronous Oscillations should be generic such that it covers all well-established phenomena that might result in Unacceptable SSO; it does not restrict Transmission Licensees from investigating any other potential interactions that might arise due to new generation and transmission technologies; it applies equally to all types of generation and transmission plant? If not, please clarify your rationale.
- (vi) Do the definitions proposed for both Sub-Synchronous Oscillations and Unacceptable Sub-Synchronous Oscillations meet the criteria mentioned above? If not, please clarify why.
- (vii) Do you agree to the choice of word "Insufficient damping" within the definition of Unacceptable Sub-Synchronous Oscillations rather than specifying a numerical value, e.g. zero? If yes, please advise what level of damping is deemed to be sufficient taking into account the potential differences between different types of plants and between units of the same type but of different rating.
- (viii) The modification proposal places the responsibility of mitigating the risks of Unacceptable Sub-Synchronous Oscillations arising because of transmission plant on Transmission Licenses. However, it allows them to partially or fully fulfil this obligation via reasonably specifying some site specific requirements on Transmission System Users. Do you agree to this approach? If no, please clarify your concerns.
- (ix) In order to comply with the generic definition of Unacceptable Sub-Synchronous Oscillations, it is expected that, where necessary, Transmission Licensees will specify to a Generator an electrical damping characteristic, in case of Synchronous Generating Units, or a network impedance characteristic, in case of Power Park Modules, and require that the Generator design their plant such that it does not result in Unacceptable Sub-Synchronous Oscillations. Do you agree to that approach? If no, please propose alternatives.
- (x) Do you agree to the general outline proposed for the process of defining and/or agreeing the damping characteristics or the network impedance characteristics? Please highlight any risks that might arise from this approach.
- (xi) Do the modifications proposed protect Transmission Access rights for all Transmission System Users? If not, please specify why.

- (xii) Is there any evidence that Users will be inappropriately or adversely affected by the changes proposed? If so please provide details.
- (xiii) Do you believe that GC0077 better facilitates the appropriate Grid Code objectives?
- (xiv) Do you believe that GSR018 better facilitates the appropriate NETS SQSS objectives?
- (xv) Are there further technical considerations to be taken into account?
- (xvi) Please provide any other comments you feel are relevant to the proposed change.