GC0065 Consequential Changes from STC Modification CA049

What stage is this document at?

01	Workgroup Report
02	Industry Consultation
03	Report to the Authority

This proposal seeks to modify the Grid Code to place an obligation on developers of offshore transmission networks to provide OFTOs with the capability to vary the reactive flows at the Interface Point within two minutes.

This document 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: **19 September 2013**
Length of Consultation: **15 Working Days**
Responses by: **11 October 2013**

National Grid recommends:
GC0065 should be implemented as it better facilitates Applicable Grid Code objectives (i) and (ii)

High Impact:
None identified

Medium Impact:
None identified

Low Impact:
Owners and Developers of Offshore Networks

Contents

About this document

This Industry Consultation outlines the information required for interested parties to form an understanding of a defect within the Grid Code seeks the views of interested parties in relation to the issues raised by this document.

Parties are requested to respond by **11 October 2013** to grid.code@nationalgrid.com

Document Control

Version	Date	Author	Change Reference
0.1	04 September 2013	National Grid	Draft Industry Consultation
1.0	19 September 2013	National Grid	Final Industry Consultation

Any Questions?

Contact:

Thomas Derry

Thomas.Derry@nationalgrid.com

01926 654 208

Proposer:

Audrey Ramsay

National Grid Electricity

1 Executive Summary

1.1 As the capacity of offshore transmission increases, the System Operator will become increasingly reliant on the Offshore Transmission Owners (OFTOs) reactive capability at the offshore to onshore interface to manage onshore voltages. To cope with changing system conditions, OFTOs will be expected to vary the reactive flows at the interface point shortly after being instructed by the National Electricity Transmission System Operator (NETSO). Generators are obliged to respond to similar instructions within 2 minutes hence it is proposed to place the same obligation on OFTOs.

1.2 To ensure that OFTOs are able to fulfil this obligation, System Operator Transmission Owner Code (STC) Modification CA049 was implemented to ensure offshore networks are built with control systems which will enable reactive flows to be varied within these timescales.

1.3 As a result of the changes made to the STC, consequential text changes are now required within the Grid Code to ensure that User's building offshore networks under OTSDUW (Offshore Transmission System Development User Works) arrangements build the networks with the same capability.

1.4 Views are invited upon the proposals outlined in the report which should be received by **11 October 2013**. Further information on how to submit a response can be found in Section 5 of this document.

National Grid View

1.5 National Grid supports the implementation of GC0065 as it better facilitates the Applicable Grid Code Objectives (i) and (iii). This is achieved by ensuring that offshore transmission networks are built in a way which will enable NGET to use the reactive capability at the interface point in a timely manner for the purpose of managing voltages on the onshore network.

2 Why Change?

Background

2.1 The National Electricity Transmission System Operator (NETSO) uses reactive compensation equipment connected to the Onshore Transmission System and the reactive capability of onshore Generating Units to keep system voltages within limits defined in the National Electricity Transmission System Security and Quality of Supply Standard (NETS SQSS). Generators are instructed to vary the reactive power at the Grid Entry Point by the NETSO and are obliged (through the Grid Code) to respond to these instructions within 2 minutes of receipt.

2.2 As the capacity of offshore generation increases and displaces onshore generation, the loss in onshore reactive compensation will need to be replaced both in terms of quantity and timescales for delivery following instruction.

2.3 OFTOs are obliged under the STC to provide reactive assets with a capability similar to Generators at the Interface Point but response times are not mentioned explicitly. Changes were made to Section K were progressed via STC Modification CA049[1] to place an obligation on OFTOs to respond within the same timescales as Generators (i.e. 2 minutes).

2.4 STC Modification CA049 was approved by the Authority on 11 June 2013 and implemented on 25 June 2013.

2.5 Following the obligation placed in the STC, an additional obligation is required within the Grid Code to oblige offshore developers to build offshore networks with adequate control.

2.6 At the July 2013 GCRP, it was agreed that as the requirement is for a consequential text change to the Grid Code, the issue did not require a Workgroup and could progress to industry consultation.

[1] Changes to STC Section K were progressed via STC Modification CA049 *Amendment to Section K to provide OFTOs with the capability to respond to Reactive Power Instructions within 2 minutes*
http://www.nationalgrid.com/uk/Electricity/Codes/sotocode/Modifications/

3 Solution

3.1 To ensure that offshore developers build offshore networks with adequate control, changes to the Connection Conditions have been proposed which replicate the requirements under the STC.

3.2 The text required to give effect to the proposal is contained in Annex 1 of this document.

3.3 Without the proposed changes, there will be no obligation on Users developing offshore transmission networks to provide the capability to respond to a reactive instruction within 2 minutes.

4 Impact & Assessment

Impact on the Grid Code

4.1 GC0065 requires amendments to the following parts of the Grid Code:

- Connection Conditions

4.2 The text required to give effect to the proposal is contained in Annex 1 of this document.

Impact on National Electricity Transmission System (NETS)

4.3 There is no impact identified for the NETS following the proposed changes.

Impact on Grid Code Users

4.4 The proposed changes will ensure that offshore developers build offshore transmission networks that are capable of responding to reactive instruction within 2 minutes.

Impact on Greenhouse Gas emissions

4.5 There is no impact identified on Greenhouse Gas emissions following the proposed changes.

Assessment against Grid Code Objectives

4.6 National Grid considers that GC0065 would better facilitate the Grid Code objective:

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

The modification will ensure that offshore transmission networks are built in way which will enable NGET to use the reactive capability at the interface point in a timely manner for the purpose of managing voltages on the onshore network. This will mitigate the cost of managing onshore voltages by avoiding:-

- *Running generation for voltage control*
- *Installing additional compensation equipment onshore*

(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);

The proposal has a neutral impact on this objective

(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; and

The modification will ensure that offshore transmission networks are built in way which will enable NGET to use the reactive capability at the interface point in a timely manner for the purpose of managing voltages on the onshore network. This will mitigate the cost of managing onshore voltages by avoiding:-

- *Running generation for voltage control*
- *Installing additional compensation equipment onshore*

(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 proposal has a neutral impact on this objective

Impact on core industry documents

4.7 The proposed modification does not impact on any core industry documents

Impact on other industry documents

4.8 The proposed modification does not impact on any other industry documents

Implementation

4.9 National Grid proposes that, should the proposals be approved, the proposed changes be implemented 10 business days after an Authority decision.

5 Consultation Responses

5.1 Views are invited upon the proposals outlined in this consultation, which should be received by **11 October 2013**.

Your formal responses may be emailed to:

grid.code@nationalgrid.com

5.2 Responses are invited to the following questions:

(i) Do you support the proposed implementation approach?

(ii) Do you believe that GC0065 better facilitates the appropriate Grid Code objectives?

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 & 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 Grid Code Review Panel or the industry and may therefore not influence the debate to the same extent as a non confidential response.

(ii) Please note 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 Grid Code Issue 5 Revision 4.

APPENDIX 7 - PERFORMANCE REQUIREMENTS FOR CONTINUOUSLY ACTING AUTOMATIC VOLTAGE CONTROL SYSTEMS FOR ONSHORE NON-SYNCHRONOUS GENERATING UNITS, ONSHORE DC CONVERTERS, ONSHORE POWER PARK MODULES AND OTSDUW PLANT AND APPARATUS AT THE INTERFACE POINT

CC.A.7.1 Scope

CC.A.7.1.1 This Appendix sets out the performance requirements of continuously acting automatic voltage control systems for **Onshore Non-Synchronous Generating Units**, **Onshore DC Converters**, **Onshore Power Park Modules** and **OTSDUW Plant and Apparatus** at the **Interface Point** that must be complied with by the **User**. This Appendix does not limit any site specific requirements that may be included in a **Bilateral Agreement** where in **NGET's** reasonable opinion these facilities are necessary for system reasons.

CC.A.7.1.2 Proposals by **Generators** to make a change to the voltage control systems are required to be notified to **NGET** under the **Planning Code** (PC.A.1.2(b) and (c)) as soon as the **Generator** anticipates making the change. The change may require a revision to the **Bilateral Agreement**.

CC.A.7.2 Requirements

CC.A.7.2.1 **NGET** requires that the continuously acting automatic voltage control system for the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter** or **Onshore Power Park Module** or **OTSDUW Plant and Apparatus** shall meet the following functional performance specification. If a **Network Operator** has confirmed to **NGET** that its network to which an **Embedded Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **Onshore Power Park Module** or **OTSDUW Plant and Apparatus** is connected is restricted such that the full reactive range under the steady state voltage control requirements (CC.A.7.2.2) cannot be utilised, **NGET** may specify in the **Bilateral Agreement** alternative limits to the steady state voltage control range that reflect these restrictions. Where the **Network Operator** subsequently notifies **NGET** that such restriction has been removed, **NGET** may propose a **Modification** to the **Bilateral Agreement** (in accordance with the **CUSC** contract) to remove the alternative limits such that the continuously acting automatic voltage control system meets the following functional performance specification. All other requirements of the voltage control system will remain as in this Appendix.

CC.A.7.2.2 Steady State Voltage Control

CC.A.7.2.2.1 The **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **Onshore Power Park Module** or **OTSDUW Plant and Apparatus** shall provide continuous steady state control of the voltage at the **Onshore Grid Entry Point** (or **Onshore User System Entry Point** if **Embedded**) (or the **Interface Point** in the case of **OTSDUW Plant and Apparatus**) with a **Setpoint Voltage** and **Slope** characteristic as illustrated in Figure CC.A.7.2.2a. It should be noted that where the **Reactive Power** capability requirement of a directly connected **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **Onshore Power Park Module** in Scotland, or **OTSDUW Plant and Apparatus** in Scotland as specified in CC.6.3.2 (c), is not at the **Onshore Grid Entry Point** or **Interface Point**, the values of Qmin and Qmax shown in this figure will be as modified by the 33/132kV or 33/275kV or 33/400kV transformer.

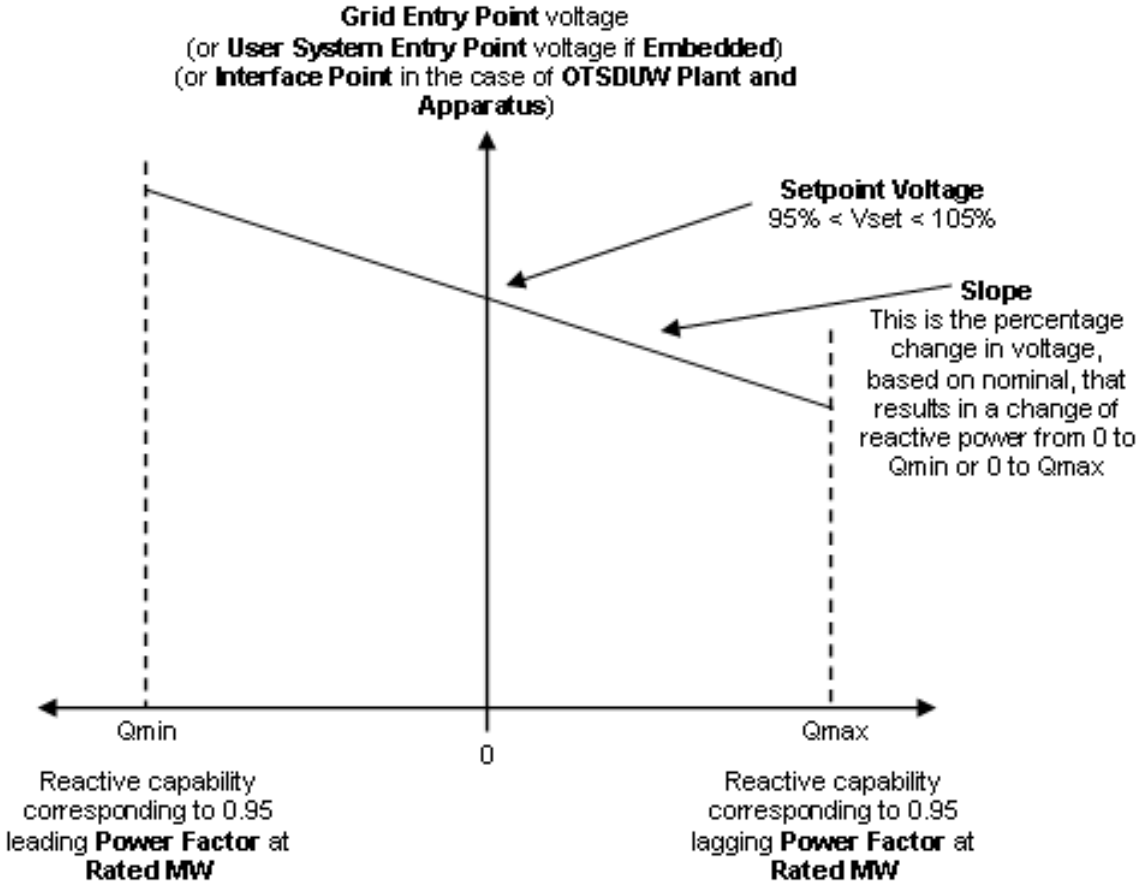

Figure CC.A.7.2.2a

CC.A.7.2.2.2 The continuously acting automatic control system shall be capable of operating to a **Setpoint Voltage** between 95% and 105% with a resolution of 0.25% of the nominal voltage. For the avoidance of doubt values of 95%, 95.25%, 95.5% … may be specified, but not intermediate values. The initial **Setpoint Voltage** will be 100%. The tolerance within which this **Setpoint Voltage** shall be achieved is specified in BC2.A.2.6. For the avoidance of doubt, with a tolerance of 0.25% and a Setpoint Voltage of 100%, the achieved value shall be between 99.75% and 100.25%. **NGET** may request the **Generator** to implement an alternative **Setpoint Voltage** within the range of 95% to 105%. For **Embedded Generators** the **Setpoint Voltage** will be discussed between **NGET** and the relevant **Network Operator** and will be specified to ensure consistency with CC.6.3.4.

CC.A.7.2.2.3 The **Slope** characteristic of the continuously acting automatic control system shall be adjustable over the range 2% to 7% (with a resolution of 0.5%). For the avoidance of doubt values of 2%, 2.5%, 3% may be specified, but not intermediate values. The initial **Slope** setting will be 4%. The tolerance within which this **Slope** shall be achieved is specified in BC2.A.2.6. For the avoidance of doubt, with a tolerance of 0.5% and a **Slope** setting of 4%, the achieved value shall be between 3.5% and 4.5%. **NGET** may request the **Generator** to implement an alternative slope setting within the range of 2% to 7%. For **Embedded Generators** the **Slope** setting will be discussed between **NGET** and the relevant **Network Operator** and will be specified to ensure consistency with CC.6.3.4.

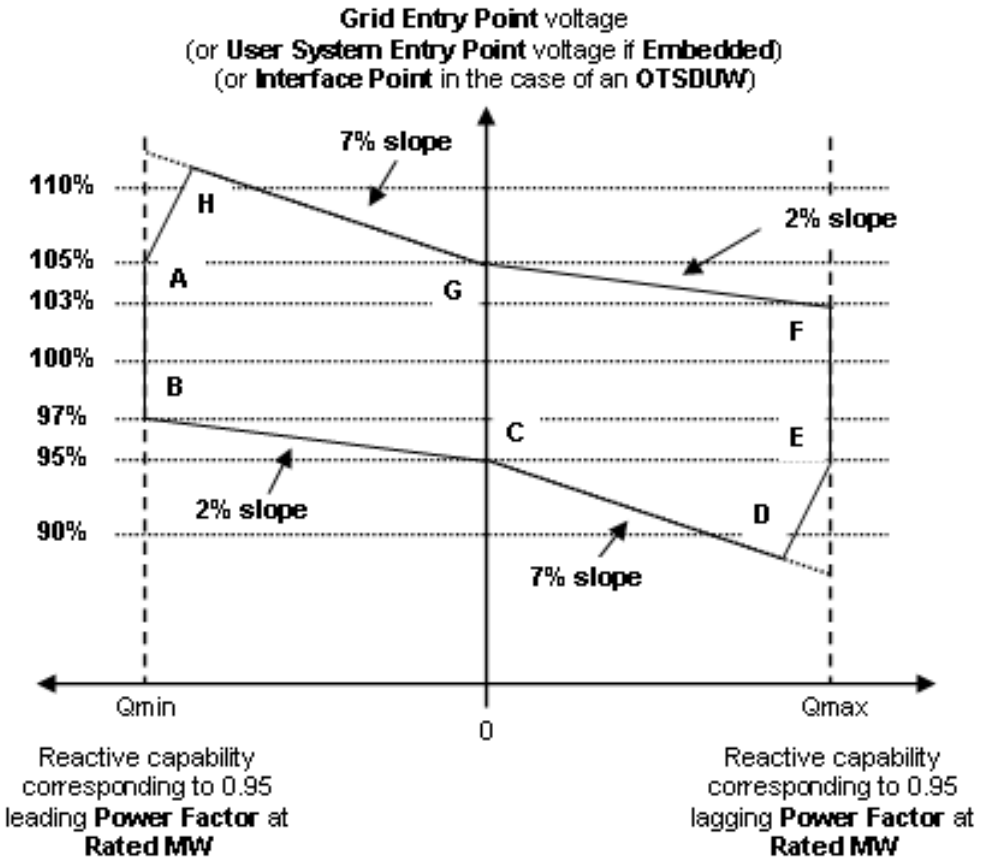

Figure CC.A.7.2.2b

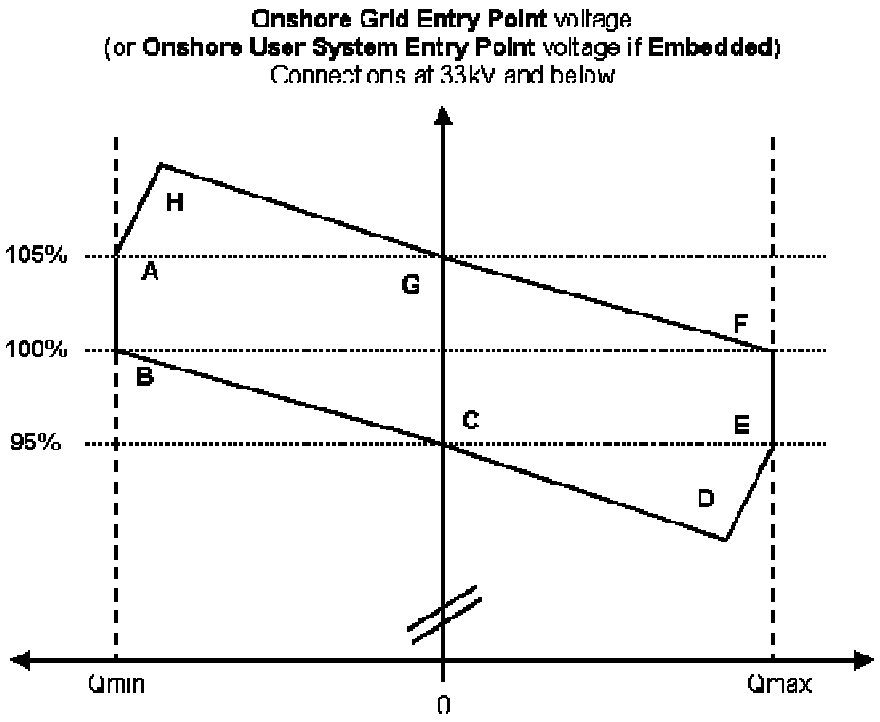

Figure CC.A.7.2.2c

CC.A.7.2.2.4 Figure CC.A.7.2.2b shows the required envelope of operation for **Onshore Non-Synchronous Generating Units**, **Onshore DC Converters**, **OTSDUW Plant and Apparatus** and **Onshore Power Park Modules** except for those **Embedded** at 33kV and below or directly connected to the **National Electricity Transmission System** at 33kV and below. Figure CC.A.7.2.2c shows the required envelope of operation for **Onshore Non-Synchronous Generating Units**, **Onshore DC Converters** and **Onshore Power Park Modules Embedded** at 33kV and below or directly connected to the **National Electricity Transmission System** at 33kV and below. Where the **Reactive Power** capability requirement of a directly connected **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** in Scotland, as specified in CC.6.3.2 (c), is not at the **Onshore Grid Entry Point** or **Interface Point** in the case of **OTSDUW Plant and Apparatus**, the values of Qmin and Qmax shown in this figure will be as modified by the 33/132kV or 33/275kV or 33/400kV transformer. The enclosed area within points ABCDEFGH is the required capability range within which the **Slope** and **Setpoint Voltage** can be changed.

CC.A.7.2.2.5 Should the operating point of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** deviate so that it is no longer a point on the operating characteristic (figure CC.A.7.2.2a) defined by the target **Setpoint Voltage** and **Slope**, the continuously acting automatic voltage control system shall act progressively to return the value to a point on the required characteristic within 5 seconds.

CC.A.7.2.2.6 Should the **Reactive Power** output of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** reach its maximum lagging limit at a **Onshore Grid Entry Point** voltage (or **Onshore User System Entry Point** voltage if **Embedded** or **Interface Point** in the case of **OTSDUW Plant and Apparatus**) above 95%, the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** shall maintain maximum lagging **Reactive Power** output for voltage reductions down to 95%. This requirement is indicated by the line EF in figures CC.A.7.2.2b and CC.A.7.2.2c. Should the **Reactive Power** output of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** reach its

maximum leading limit at a **Onshore Grid Entry Point** voltage (or **Onshore User System Entry Point** voltage if **Embedded** or **Interface Point** in the case of **OTSDUW Plant and Apparatus**) below 105%, the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** shall maintain maximum leading **Reactive Power** output for voltage increases up to 105%. This requirement is indicated by the line AB in figures CC.A.7.2.2b and CC.A.7.2.2c.

CC.A.7.2.2.7 For **Onshore Grid Entry Point** voltages (or **Onshore User System Entry Point** voltages if Embedded or **Interface Point** voltages) below 95%, the lagging **Reactive Power** capability of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** should be that which results from the supply of maximum lagging reactive current whilst ensuring the current remains within design operating limits. An example of the capability is shown by the line DE in figures CC.A.7.2.2b and CC.A.7.2.2c. For **Onshore Grid Entry Point** voltages (or **User System Entry Point** voltages if **Embedded** or **Interface Point** voltages) above 105%, the leading **Reactive Power** capability of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** should be that which results from the supply of maximum leading reactive current whilst ensuring the current remains within design operating limits. An example of the capability is shown by the line AH in figures CC.A.7.2.2b and CC.A.7.2.2c. Should the **Reactive Power** output of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** reach its maximum lagging limit at an **Onshore Grid Entry Point** voltage (or **Onshore User System Entry Point** voltage if **Embedded** or **Interface Point** in the case of **OTSDUW Plant and Apparatus**) below 95%, the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter** or **Onshore Power Park Module** shall maintain maximum lagging reactive current output for further voltage decreases. Should the **Reactive Power** output of the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** reach its maximum leading limit at a **Onshore Grid Entry Point** voltage (or **User System Entry Point** voltage if **Embedded** or **Interface Point** voltage in the case of an **OTSDUW Plant and Apparatus**) above 105%, the **Onshore Non-Synchronous Generating Unit**, **Onshore DC Converter**, **OTSDUW Plant and Apparatus** or **Onshore Power Park Module** shall maintain maximum leading reactive current output for further voltage increases.

CC.A.7.2.2.8 All **OTSDUW Plant and Apparatus** must be capable of enabling **User's** undertaking **OTSDUW** to comply with an instruction received from **NGET** relating to a variation of the **Setpoint Voltage** at the **Interface Point** within 2 minutes of such instruction being received.

CC.A.7.2.2.9 For **OTSDUW Plant and Apparatus** connected to a **Network Operator's System** where the **Network Operator** has confirmed to **NGET** that its **System** is restricted in accordance with CC.A.7.2.1, clause CC.A.7.2.28 will not apply unless **NGET** can reasonably demonstrate that the magnitude of the available change in **Reactive Power** has a significant effect on voltage levels on the **Onshore National Electricity Transmission System**.