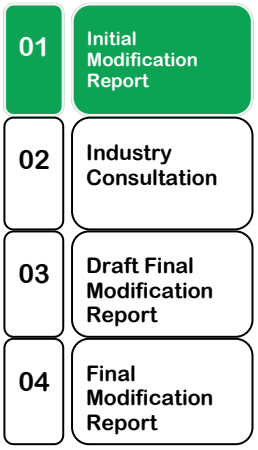
STC Initial Modification Report	At what stage is this document in the process?

CM070: 'Consequential STC Updates following implementation of RfG and HVDC into the GB Grid Code'



Purpose of Modification: This proposal seeks to modify the STC to ensure consistency with the GB Grid Code following implementation of the European Connection Network Codes (RfG, HVDC and DCC).

The Proposer recommends that this modification should:

- proceed to Consultation

This modification will be raised on **22 March 2019** and will be presented by the Proposer to the Panel on **1 April 2019.** The Panel will consider the Proposer's recommendation and determine the appropriate route.

High Impact: In order to satisfy the requirements of EU law following the introduction of the European Third Energy Package, The GB Grid Code was updated in 2018 to reflect the requirements of the European Connection Network Codes (RfG, HVDC and DCC). Since the STC makes numerous references to the Grid Code Connection Conditions there is a need to update the STC in respect of these consequential Grid Code changes.

There is a high impact to Transmission Licensees in particular Offshore Transmission Licensees who are caught by the following criteria.

Transmission Licensees who own an AC Transmission System and that AC Transmission System was first connected to the Transmission System on or after 27 April 2019 and the purchase contracts for the main plant and apparatus had concluded on or after 17 May 2018 or:-

Transmission Licensees, who own a Transmission System comprising an HVDC System and that HVDC System was first connected to the Transmission System on

	or after 8 September 2019 and the purchase contracts for the Main Plant and Apparatus forming part of that HVDC Transmission System had concluded on or after 28 September 2018. This modification is particularly relevant for Offshore Transmission Licensee's which are developed under the Generator Build approach and once transferred are required to satisfy the applicable requirements of the STC. It is vital that as part of this process there is a seamless transfer between the requirements in the Grid Code and those in the STC at the point in time that the Transmission Assets are transferred from the Generator to the Offshore Transmission Licensee.
	**Medium Impact**:- Not applicable
	**Low Impact** There will no impact to existing Transmission Licensees unless they wish to install new HVDC equipment or undertake substantial modifications to their Offshore Transmission Networks.

Contents

Any questions?

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Timetable

The Code Administrator recommends the following timetable:

Modification Proposal issued to the STC Panel	22 March 2019
Panel Agree that CM070 should procedure using the Self- Governance route	1 April 2019
Issue Industry Consultation for 20 Workings Days	15 April 2019
Industry Consultation closes	16 May 2019
Issue Draft Self-Governance Modification Report to industry and the Authority for 5 Working Days	21 May 2019

Draft Final Modification Report issued to the STC Panel	21 May 2019
Panel Self-Governance vote	29 May 2019
Appeal Window commences for 15 Working Days	7 June 2019
Appeal Window closes	28 June 2019
Implementation	15 July 2019

Proposer Details

Details of Proposer: (Organisation Name)	National Grid
Capacity in which the STC Modification Proposal is being proposed: (i.e. STC Party, Party Representative or person or persons having a relevant interest as may be designated in writing for this purpose by the Authority	STC Party
Details of Proposer's Representative: Name: Organisation: Telephone Number: Email Address:	Antony Johnson National Grid (NGET) 01926 655466 Antony.Johnson@nationalgrid.com
Details of Representative's Alternate: Name: Organisation: Telephone Number: Email Address:	Rob Wilson National Grid (NGET) 01926 653398 Robert.Wilson2@nationalgrid.com
Attachments (Yes): Yes **If Yes, Title and No. of pages of each Attachment: Extracts from STC Legal text**	

Impact on Core Industry Documentation.

BSC	
Grid Code	
CUSC	
Other	

This Modification does not have any further impact on core Industry documentation. The Grid Code has already been updated to reflect these changes.

1 Summary

Defect

The GB Grid Code was updated in 2018 following implementation of the EU Connection Network Codes (RfG (Requirements for Generators), HVDC (HVDC Code) and DCC (Demand Connection Code)). These Codes resulted from the introduction of the European Energy Third Package which have been encapsulated into European law which takes precedence over GB law.

As a result of this EU Directive, the GB Grid Code has been updated to ensure consistency with the European Connection Network Codes which has resulted in several new sections in addition to numerous updates to other sections of the code.

The STC refers to certain parts of the Grid Code and as a consequence of these European Connection Network Codes, there is a requirement to update the STC to ensure consistency with the updated Grid Code.

What

As part of the European Connection Network Codes (RfG, HVDC and DCC), three new sections of the GB Grid Code have been introduced, these being the European Connection Conditions (ECC's), the European Compliance Processes (ECP's) and Demand Response Services Code (DRSC).

As the EU Connection Network Codes only apply to new plant then the existing sections of the GB Grid Code (ie the Connection Conditions (CC's) and Compliance Processes(CP's)) have been retained. The Demand Response Services Code (DRSC) is a new section of the Grid Code and has been introduced as part of the Demand Connection Code (DCC) relating to the provision of demand response providers so its application as part of this proposed STC modification is more limited.

The important element is that the STC makes several references to the Grid Code Connection Conditions and hence these sections need to be updated to now include the ECC's.

In addition, Section K of the STC places requirements on Offshore Transmission Licensees, many of these requirements are direct copies of the requirements in the Grid Code. As such, there is a requirement to ensure consistency with the updated Grid

Code, which is particularly important where an Offshore Transmission Network has been developed under the Generator Build arrangements and then transitions to the Offshore Transmission Licensee arrangements.

In addition, the HVDC Code places requirements on new HVDC Systems, so where a Transmission Licensee in future builds, designs and owns an HVDC System, then they would be required to satisfy the requirements of the HVDC Code.

Why

For existing Transmission Licensee's, the implications of these European Network Codes are limited. However, for future connections, in particular Offshore Transmission Systems and HVDC Systems which comprise of primary plant procured in 2018 and connected to the system in 2019, there would be a requirement for the applicable requirements of the Grid Code (which includes the requirements introduced as part of the European Connection Network Codes) to be satisfied. In particular, failure to comply with these requirements, particularly in respect of new HVDC Systems would effectively be non-compliant with the EU Codes and hence in breach of European law. .

How

It is proposed that the most eloquent solution to this issue is to update the STC to reference the new sections of the Grid Code, in particular the European Connection Conditions (ECC's). In addition, there will also be a requirement to update section K of the STC which relates to Offshore Transmission Licensee's.

To minimise future updates, it is proposed to refer back to the relevant clauses of the Grid Code so that whenever the Grid Code is changed in future, there is minimal impact to the STC.

2 Governance

Justification for Self-Governance Procedures

The proposer believes the modification should follow the self-governance procedure as the modification is unlikely to discriminate between different STC Parties and is unlikely to have a material effect on:

i) Existing or future electricity customers;

ii) Competition in the generation, distribution, or supply of electricity or any commercial activities connected with the generation, distribution or supply of electricity,

iii) The operation of the National Electricity Transmission System

iv) Matters relating to sustainable development, safety or security of supply, or the management of market or network emergencies

v) The STC Panel's governance procedures or the STC Panel's modification procedures

Requested Next Steps

This modification should: proceed to Industry Consultation.

3 Why change

The European Energy Third Package was introduced as a directive to promote cross border trade in Gas and Electricity. As a consequence of this, ENTSO-E (The European Network Transmission System Operators – Electricity) under the direction of the European Commission, have developed a set of Codes to facilitate the objectives of this directive. All of these codes were subject to a consultation phase and assessment by ACER (the European Regulators) ahead of the comitology stage which is effectively the process which by the Code is translated into European law.

Figure 1 shows the process of implementing the Codes into European law and Figure 2 shows the codes which have been developed.

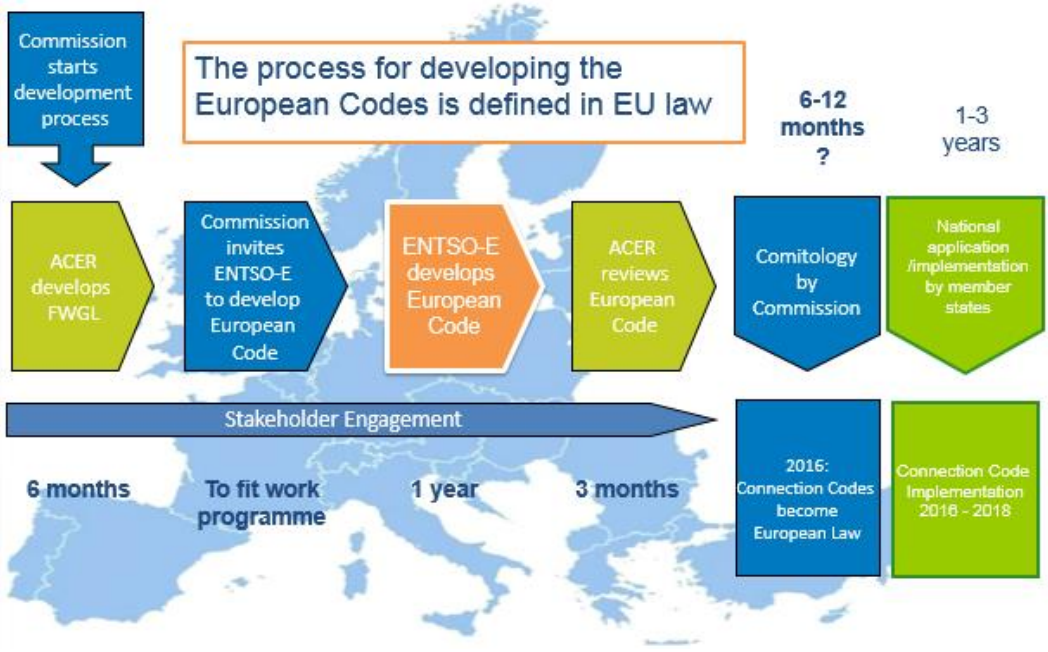


Figure 1 – European Network Code Development Process

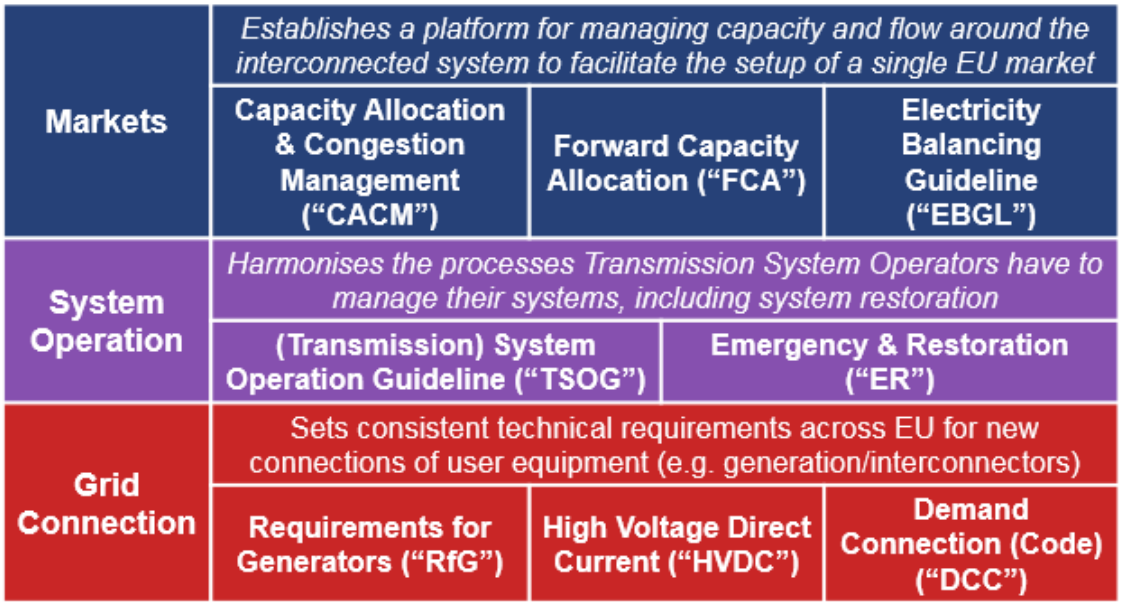


Figure 2 – An overview of the European Network Codes

The Connection Network Codes (RfG, HVDC and DCC) were approved into European law in 2016 and subsequently implemented into the GB Grid Code in 2018. The dates for which these requirements became binding are as follows and are summarised below on a per code basis.

RfG – Applicable to any Generator whose Main Plant and Apparatus connects to the System on or after 27 April 2019 and who had concluded purchase contracts for its Main Plant and Apparatus on or after 17th May 2018.

HVDC - Applicable to any HVDC System or DC Connected Power Park Module whose Main Plant and Apparatus connects to the System on or after 8 September 2019 and who had concluded purchase contracts or its Main Plant and Apparatus on or after 28th September 2018.

DCC - Applicable to any Demand owner whose Main Plant and Apparatus connects to the System on or after 18 August 2019 and who had concluded purchase contracts or its Main Plant and Apparatus on or after 18th August 2018.

To facilitate these changes and reflect the connection dates, the Grid Code had been updated to define two classes of User, these being a GB Code User who are effectively User's caught by the existing GB Grid Code arrangements and EU Code User's who will be caught by the EU Codes. The consequence of this is that GB Code User's will still need to comply with the requirements of the Connection Conditions and Compliance Processes and EU Code User's will need to comply with the requirements of the European Connection Conditions and European Compliance Processes. Other sections of the Grid Code (eg the Planning Code, Operating Codes and Balancing Codes etc) will continue to apply, being universally applicable to both GB Code User's and EU Code User's except were stated otherwise within the body of these codes.

So far as Transmission Licensee's are concerned, the impacts mainly affect Offshore Transmission Licensees and Transmission Licensees owning HVDC Systems. Transmission Licensees are not defined as User's under the Grid Code. The STC does however place obligations on Transmission Licensees (notably Section D Part One clause 2.2.6 amongst others) to satisfy specific requirements of the Grid Code including

the Connection Conditions. There is therefore a requirement to update the STC to also include references to the ECC's as well as the CC's.

Table 1 below lists the relevant clauses of the STC which refer back to the Grid Code Connection Conditions and where reference to the European Connection Conditions will need to be added.

STC Clause referring to Grid Code Connection Conditions
Section D Part One 2.2.6, 2.2.7.1, 2.2.8.3
Section D Part Two 15.6
Section G General Provisions – 2.2.1.2, 2.2.2
Corresponding changes to Glossary and Definitions

Table 1

In addition, Section K places obligations on Offshore Transmission Licensee's on the Technical, Design and Operational criteria and performance requirements for Offshore Transmission Systems. Since the majority of future Offshore Transmission Systems are expected to be designed and built under the Generator Build arrangements, it is imperative that the requirements in the Grid Code are consistent with those in the STC otherwise on the date of transfer there would be a disjoint.

Although the EU Connection Network Codes do not recognise the concept of the GB Offshore Transmission Regime, they do contain requirements for Offshore Generators, HVDC Systems and DC Connected Power Park Modules which would need to be factored into the requirements incumbent on Offshore Transmission Licensees. That said, the specific requirements applicable to HVDC Systems are very relevant as failure to satisfy the applicable Grid Code requirements would be in breach of the HVDC Code and hence European law.

In an attempt to keep this modification as straight forward as possible and as shown in the legal text, the proposal is to update the STC so that the references in future refer to both the Connection Conditions (CC's) and European Connection Conditions (ECC's). There is no reference to the Compliance Processes (CP's) in the STC and hence there is no need for an update to make reference to the European Compliance Processes (ECP's).

The STC Procedures have been checked and a number of them will require changing as detailed in PMO110.

There are no specific time constraints associated with this modification

4 Code Specific Matters

Technical Skillsets

Understanding of EU Connection Network Codes (RfG, HVDC and DCC), a thorough understanding of the GB Grid Code and the linkages between the Grid Code and STC.

Reference Documents

RfG available from the following link.

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R0631&from=EN

HVDC available from the following link.

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1447&from=EN

DCC available from the following link.

https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32016R1388&from=EN

5 Solution

In summary, the solution simply proposes to update the STC so that any references to the Grid Code Connection Conditions also make reference to the European Connection Conditions and other Grid Code clauses where these have changed as a result of the EU Connection Network Codes. In addition, Section K of the STC will need to be updated again to ensure consistency with the Grid Code, particularly in respect of HVDC Systems. Section K has been separated into two parts so as to clearly define the obligations applicable to existing Transmission Licensees and future Transmission Licensees.

As part of this process two new definitions have been introduced, namely Type 1 Transmission Owners and Type 2 Transmission Owners. A Type 1 Transmission Owner is defined as "A Transmission Owner who owns a Transmission System and that Transmission System was first connected to the System before 27 April 2019 and the purchase contracts for its Plant and Apparatus forming that Transmission System had been concluded before 17th May 2018" and a Type 2 Transmission Owner which is defined as "A Transmission Owner who owns a Transmission System and that Transmission System was first connected to the System on or after 27 April 2019 and the purchase contracts forming the major part of its Plant and Apparatus forming that Transmission System had been concluded on or after 17th May 2018. As a consequence of this, the opportunity has been taken to redefine the definition of Transmission Owner to "an Onshore Transmission Owner or an Offshore Transmission Owner which could include a Type 1 Transmission Owner or Type 2 Transmission Owner".

Taking Section D, Part One, Section 2.2.6 clause 2.2.6.1 it is proposed to amend the text as follows:- "the minimum technical, design and operational criteria and performance requirements set out or referred to in Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 1 Transmission Owners or European Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 2 Transmission Owners and in Planning Code 6.2 and/or 6.3; or…."

The term applicable refers to the point if the Transmission Owners Plant and Apparatus was procured or connected to the System in line with the connection dates as applicable to an EU Code User rather than a GB Code User, as this is the determining

factor as to whether the Transmission Licensees Plant and Apparatus is caught by the requirements of the Connection Conditions or European Connection Conditions.

6 Impacts & Other Considerations

The Grid Code changes that have been implemented as result of the EU Connection Codes (RfG, HVDC and DCC) will result in impacts to Transmission Owner's who procure new plant and apparatus, in particular those who install HVDC Systems and future Offshore Transmission Networks.

These requirements have been subject to the Grid Code Governance process, however as a consequence of the obligations in the STC which require Transmission Licensee's to satisfy the requirements of the Connection Conditions, there is a requirement for the STC to be updated to include the European Connection Conditions which will have an impact on Transmission Licensees.

This change will also have an impact on future Offshore Generators who are caught by the requirements of RfG who will be connecting to Offshore Transmission Licensees assets where it is important to have compatible requirements between Offshore Generators and Offshore Transmission Owners.

Does this modification impact a Significant Code Review (SCR) or other significant industry change projects, if so, how?

No.

Consumer Impacts

None

7 Relevant Objectives

Relevant Objective	Identified impact
(a) efficient discharge of the obligations imposed upon transmission licensees by transmission licences and the Act	Positive – necessary as a result of the EU Connection Network Codes
(b) development, maintenance and operation of an efficient, economical and coordinated system of electricity transmission	Positive – The EU Connection Codes aim to promote cross border trade which is seen as positive for Transmission Owners
(c) facilitating effective competition in the generation and supply of electricity, and (so far as consistent therewith) facilitating	Positive - The EU Connection Codes

such competition in the distribution of electricity	aim to promote cross border trade which is seen as positive for Transmission Owners
(d) protection of the security and quality of supply and safe operation of the national electricity transmission system insofar as it relates to interactions between transmission licensees	Positive – Particularly for Offshore Transmission Licensees where there is a interaction with Offshore Generators caught by RfG.
(e) promotion of good industry practice and efficiency in the implementation and administration of the arrangements described in the STC.	Neutral
(f) facilitation of access to the national electricity transmission system for generation not yet connected to the national electricity transmission system or distribution system;	Positive – This provides clarity to Transmission Owners and Generators alike.
(g) compliance with the Electricity Regulation and any relevant legally binding decision of the European Commission and/or the Agency.	Positive – Required as a result of the EU Connection Network Codes.

These changes are necessary to ensure consistency with the EU Connection Network Codes which is part of a suite of documents seeking to promote cross border trade in Electricity.

8 Implementation

As the Connection Code amendments have already been implemented into the GB Grid Code, these changes need to be implemented into the STC as soon as possible. This is important for i) the need for Transmission Licensees owning new HVDC Systems to comply with the requirements of the HVDC Code and ii) to ensure there are no issues with the transfer process where an Offshore Transmission System has been designed, constructed and commissioned under the Generator Build Arrangements and then subsequently transferred to an appointed Offshore Transmission Licensee.

9 Legal Text

The accompanying legal text is shown in Annex 1. In summary, Section D Part One 2.2.6, 2.2.7.1, 2.2.8.3, Section D Part Two clause 15.6 and Section G General Provisions – clause 2.2.1.2 and 2.2.2 have been updated to include the new references to the Grid Code. In addition, consequential changes have been made to Section J – Interpretation and Definitions to ensure consistency with the Glossary and Definitions in the Grid Code.

The legal text has been drafted on the current version (as at 22 March 2019) of the STC. If the Panel agree that this modification proceed to Industry Consultation the Code Administrator will ensure that the version of 1 April 2019 (post legal separation of the National Grid Transmission Owner and System Operator) is used for the Consultation.

10 Recommendations

Proposer's Recommendation to Panel

Panel is asked to:

- Agree that Self Governance procedures should apply
- Issue this modification directly to Consultation

Annex1: Legal text

Extracts from Section D Part One 2.2.6

……..

2.2.6 Without limitation to Section C, Part One, paragraph 2.2, in planning and developing its Transmission System, each Transmission Owner shall ensure that its Transmission System complies with:

2.2.6.1 the minimum technical, design and operational criteria and performance requirements set out or referred to in Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 1 Transmission Owners or European Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 2 Transmission Owners and in Planning Code 6.2 and/or 6.3 ~~as applicable~~; or

2.2.6.2 such other technical criteria or requirements as apply to any relevant part of its Transmission System by virtue of a current Transmission Derogation; and

in the case of an Offshore Transmission System, each Transmission Owner shall also ensure that:

2.2.6.3 its Transmission System meets the minimum technical, design and operational criteria and performance requirements set out or referred to in Section K of this Code;

2.2.7 Each Transmission Owner shall plan and develop its Transmission System taking into account the Planning Assumptions provided to it by NGET and any other information provided to it under this Code and on the basis that User Plant and Apparatus complies with:

2.2.7.1 the minimum technical design and operational criteria and performance requirements set out in Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 1 Transmission Owners or ~~European~~ European Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 2 Transmission Owners; or

2.2.7.2 such other criteria or requirements as NGET may from time to time notify the Transmission Owner are applicable to specified User Plant and Apparatus pursuant to sub-paragraph 2.2.8; and

2.2.7.3 in relation to each Connection Site, such technical design and operational criteria as are set out in the Connection Site Specification,

and, unless otherwise advised by the relevant Party, that each other Party complies with the provisions of this Code and any applicable Licence Standards in planning or developing any other part of the National Electricity Transmission System.

2.2.8 NGET shall notify each Transmission Owner whose Transmission System is likely to be materially affected by the design or operation of a User's Plant and Apparatus where NGET:

2.2.8.1 becomes aware that such User has or is likely to apply for a User Derogation;

2.2.8.2 is itself applying for a derogation under the Grid Code in relation to the Connection Site on which such User's Plant and Apparatus is located or to which it otherwise relates; or

2.2.8.3 is otherwise notified by such User that specified Plant or Apparatus is normally capable of operating at levels better than those set out in Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to GB Code User's or European Connection ~~——————————~~Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to EU Code User's.

2.2.9 Each Transmission Owner shall promptly notify NGET if such Transmission Owner becomes aware that a User's Plant or Apparatus has failed, or is likely to fail, otherwise than in accordance with a User Derogation, to comply with the technical design and operational criteria or performance requirements applying pursuant to sub-paragraph 2.2.7.

……..

Extracts from Section D Part Two

.....

15.6 In carrying out their obligations under this paragraph 15, the Parties shall, and NGET shall procure that Users shall, comply with Appendix 1 of the Connection Conditions as applicable to GB Code User's or Appendix E1 of the European Connection Conditions ~~to~~of the Grid Code as applicable to EU Code User's and ~~(~~as amended from time to time~~)~~.

…….

Extracts from Section G

……..

2.2.1 Notwithstanding that a Transmission Owner is not a party to the CUSC and is not thereby required to comply with the Grid Code, a Transmission Owner shall comply with:

2.2.1.1 the relevant appendix of Operating Code No 8 of the Grid Code as notified by NGET; and

2.2.1.2 (in carrying out its obligations under Section D, Part Two, paragraph 14), Appendix 1 of the Connection Conditions in respect of Type 1 Transmission Owners or Appendix 1 of the European Connection Conditions in respect of Type 2 Transmission Owners of the Grid Code as applicable,

(each as amended from time to time).

2.2.2 NGET shall comply with, and shall procure that a User shall comply with, the relevant appendix of OC8 and Appendix 1 of the Connection Conditions as applicable to GB Code User's or OC8 and Appendix E1 of the European Connection Conditions as applicable to EU Code User's of the Grid Code where and to the extent that such section applies to NGET and the User.

……

Extracts from Section J – Interpretation and Definitions

.....

"**AC Offshore Transmission System**"	An Offshore Transmission System which does not comprise a Transmission DC Converter
"**European Connection Conditions**"	that part of the Grid Code which is identified as the European Connection Conditions;
"**European Compliance Processes**"	As defined in the Grid Code
"**EU Code User**"	As defined in the Grid Code
"**EU Generator**"	As defined in the Grid Code
"**HVDC System**"	As defined in the Grid Code
"**GB Code User**"	As defined in the Grid Code
"**Main Plant and Apparatus**"	As defined in the Grid Code
"**Offshore Transmission System**"	As defined in the Grid Code
"**Onshore Transmission System**"	As defined in the Grid Code
"**Purchase Contracts**"	As defined in the Grid Code
"**Transmission Owner**"	an Onshore Transmission Owner or an Offshore Transmission Owner which could include a Type 1 Transmission Owner or Type 2 Transmission Owner.

"**Type 1 Transmission Owner**"	A Transmission Owner who owns a Transmission System and that Transmission System was first connected to the System before 27 April 2019 and the purchase contracts for its Plant and Apparatus forming that Transmission System had been concluded before 17th May 2018
"**Type 2 Transmission Owner**"	A Transmission Owner who owns a Transmission System and that Transmission System was first connected to the System on or after 27 April 2019 and the purchase contracts forming the major part of its Plant and Apparatus forming that Transmission System had been concluded on or after 17th May 2018
"**User**"	any person (other than NGET or a Transmission Owner) who is authorised to generate, participate in the transmission of, distribute or supply electricity or who is included in a class of person or persons which has been granted an exemption from section 6 of the Act and any person engaged in the sale or purchase of electricity or who otherwise purchases or acquires for purchase electricity; The term User includes an EU Code User and a GB Code User.

SECTION K: TECHNICAL, DESIGN AND OPERATIONAL CRITERIA AND PERFORMANCE REQUIREMENTS FOR OFFSHORE TRANSMISSION SYSTEMS

1. INTRODUCTION

1.1 This Section K sets out the minimum technical, design and operational criteria and performance criteria that Offshore Transmission Owners must ensure their Transmission System can satisfy. ~~in the following specific areas:~~

~~1.1.1 the reactive power capability deliverable at the Interface Point;~~

~~1.1.2 the performance requirements of voltage control systems;~~

~~1.1.3 Fault Ride Through Capability;~~

~~1.1.4 additional damping facilities for any Transmission DC Converters;~~

~~1.1.5 the provision of a **Frequency** signal to Users where necessary because of the use of Transmission DC Converters in an Offshore Transmission System;~~

~~1.1.6 operation under a range of System Frequencies;~~

~~1.1.7 earthing arrangements for transformers; and~~

~~1.1.8 the power quality requirements applicable at the Interface Point.~~

~~1.2 This Section K also provides for the Offshore Transmission Owner and The CompanyNGET to co-operate in relation to the assessment of compliance of Section K of this STC.~~

1.2 Section D Part One, clause 2.2.6 of the STC specifies that in planning and developing its Transmission System, each Transmission Owner (which includes Offshore Transmission Owners) shall ensure that its Transmission System complies with the minimum technical, design and operational criteria and performance requirements set out or referred to in Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 1 Transmission Owners or European Connection Conditions 6.1, 6.2, 6.3 and 6.4 as applicable to Type 2 Transmission Owners and in Planning Code 6.2 and/or 6.3 as applicable or such other technical criteria or requirements as apply to any relevant part of its Transmission System by virtue of a current Transmission Derogation and in the case of and Offshore Transmission System, each Transmission Owner shall ensure that its Transmission System meets the minimum technical design and operational criteria and performance requirements set out or referred to in section K of this code.

1.3 Annex 1 of Section K of the STC applies to:- ~~For~~

Offshore Transmission Owner~~Licensee~~'s who own an AC Offshore Transmission System and that AC Offshore Transmission System was first connected to the Onshore Transmission System before 27 April 2019 and the purchase contracts for its~~the Main~~ Plant and Apparatus forming the major part of that AC Offshore Transmission System had been concluded before 17th May 2018; or~~.~~

Offshore Transmission Owner~~Licensee~~'s who own an Offshore Transmission System comprising a~~ DC~~ Transmission DC Converter~~System~~ and that Offshore Transmission System was first connected to the Onshore Transmission System before 8 September 2019 and the purchase contracts for the Main Plant and Apparatus forming that Offshore Transmission System comprising a Transmission DC Converter had been concluded before 28 September 2018;

1.4 Annex 2 of Section K of the STC applies to:-

Offshore Transmission Owner~~Licensee~~'s who own an AC Offshore Transmission System and that AC Offshore Transmission System was first connected to the Onshore Transmission System on or after 27 April 2019 and the purchase contracts for the~~ Main~~ Plant and Apparatus forming the major part of that AC Offshore Transmission System had been concluded on or after 17th May 2018; or

Offshore Transmission Owner's who own an Offshore Transmission System and that Offshore Transmission System comprises one or more Transmission DC Converters and that Offshore Transmission System was first connected to the Onshore Transmission System on or after 8 September 2019 and the purchase contracts for the Main Plant and Apparatus forming that Offshore DC Transmission System had been concluded on or after 28 September 2018.~~—~~ For the avoidance of doubt, an Offshore Transmission System comprising one of more Transmission DC Converters would be assumed to constitute an HVDC System.~~;~~

~~;~~

ANNEX 1

1.1 Annex 1 of Section K sets out the minimum technical, design and operational criteria and performance criteria that applies to:-

Offshore Transmission Owner's who own an AC Offshore Transmission System and that AC Offshore Transmission System was first connected to the Onshore Transmission System before 27 April 2019 and the purchase contracts for the ~~Main~~ Plant and Apparatus forming the major part of that AC Offshore Transmission System had been concluded before 17th May 2018; or

Offshore Transmission Owner's who own an Offshore Transmission System comprising a DC Transmission System and that Offshore Transmission System was first connected to the Onshore Transmission System before 8 September 2019 and the purchase contracts for the Main Plant and Apparatus forming that Offshore Transmission System comprising a DC Transmission System had been concluded before 28 September 2018;

1.2 Section D Part One, clause 2.2.6 of the STC specifies that in planning and developing its Transmission System, each Transmission Owner (which includes Offshore Transmission Owner's) shall ensure that its Transmission System complies with the minimum technical, design and operational criteria and performance requirements set out or referred to in Connection Conditions 6.1, 6.2, 6.3 and 6.4 and in Planning Code 6.2 and/or 6.3 as applicable~~-~~ or such other technical criteria or requirements as apply to any relevant part of its Transmission System by virtue of a current Transmission Derogation. For the avoidance of doubt, Offshore Transmission Owners in respect of their Offshore Transmission System, would be expected to meet the same requirements as GB Generators undertaking OTSDUW Build in respect of their Offshore Transmission Systems which includes Transmission DC Converters~~-~~.

1.3~~4~~ In addition to the above requirements each Offshore Transmission Owner must ensure their Offshore Transmission System can satisfy in the following specific areas:

1.4~~1~~.1 the reactive power capability deliverable at the Interface Point;

1.41.2 the performance requirements of voltage control systems;

1.41.3 Fault Ride Through Capability;

1.41.4 additional damping facilities for any Transmission DC Converters;

1.41.5 the provision of a **Frequency** signal to Users where necessary because of the use of Transmission DC Converters in an Offshore Transmission System;

1.41.6 operation under a range of System Frequencies;

1.41.7 earthing arrangements for transformers; and

1.41.8 the power quality requirements applicable at the Interface Point.

1.52 This Section K also provides for the Offshore Transmission Owner and The CompanyNGET to co-operate in relation to the assessment of compliance. of Section K of this STC.

2. REACTIVE CAPABILITY AND VOLTAGE CONTROL

2.1 All Offshore Transmission Systems must be capable of delivering Reactive Power at the Interface Point as described in paragraphs 2.2, 2.3 and 2.4 of Section K below. The Reactive Power capability that an Offshore Transmission System must be able to provide at the Interface Point may be delivered using a combination of Plant owned by the Offshore Transmission Owner concerned and Plant owner by a Generator or Generators connected to that Offshore Transmission System. Where Generator Plant is out of service, these Reactive Power capability requirements will be reduced pro rata to the maximum Active Power capability of Generator Plant in service.

2.2 All Offshore Transmission Systems must be capable of enabling the Offshore Transmission Owner to comply with an instruction received from NGET relating to a variation of the voltage set point at the Interface Point within 2 minutes of such instruction being received.

For Offshore Transmission Systems connected to a Distribution System where the Network Operator has confirmed to NGET that its System is restricted in accordance with Section KB2, clause 2.2 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.

2.3 All Offshore Transmission Systems must be capable of transmitting Active Power equivalent to the Interface Point Capacity at any point between the limits 0.95 Power Factor lagging and 0.95 Power Factor leading at the Interface Point. The Reactive Power limits defined at the Interface Point Capacity:

2.3.1 at lagging Power Factor will apply to all Active Power transfer levels above 20% of the Interface Point Capacity as defined in Figure K1 below;

2.3.2 at leading Power Factor will apply at all Active Power transfer levels above 50% of the Interface Capacity as defined in Figure K1 below, and shall reduce linearly below 50% Active Power transfer as shown in figure K1 below unless the requirement to maintain the Reactive Power limits defined at the Interface Point Capacity at leading Power Factor down to 20% Active Power transfer is specified in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification.

2.4 When transferring Active Power equivalent to less than 20% of the Interface Point Capacity**:**

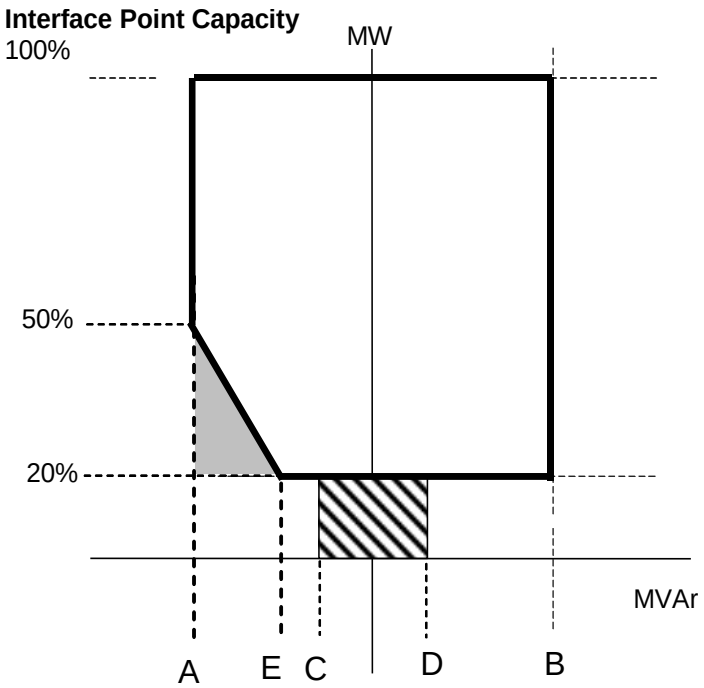
2.4.1 the automatic control system may continue to provide voltage control utilising any available reactive capability;

2.4.2 If voltage control is not being provided:

(a) the automatic control system shall be designed to be capable of a smooth transition between the shaded area bounded by CD and the non-shaded area bound by AB in Figure K1 below; and

(b) the Reactive Power delivered at the Interface Point shall be within a range of +/-5% of the Interface Point Capacity expressed in MVar.

Figure K1



Point A is equivalent (in MVAr) to 0.95 leading Power Factor at active power transfer equal to the Interface Point Capacity.

Point B is equivalent (in MVAr) to 0.95 lagging Power Factor active power transfer equal to the Interface Point Capacity.

Point C is equivalent (in MVAr) to -5% of active power transfer equal to the Interface Point Capacity.

Point D is equivalent (in MVAr) to +5% of active power transfer equal to the Interface Point Capacity.

Point E is equivalent (in MVAr) to -12% of active power transfer equal to the Interface Point Capacity.

2.5 Each Offshore Transmission System shall be capable of contribution to voltage control by continuous changes to the Reactive Power supplied at the Interface Point in accordance with the requirements specified in Appendix KB and without instability over the entire operating range of the Offshore Transmission System.

2.6 The requirement for additional voltage control facilities, including for example additional damping control facilities, where in NGET's view these are necessary for system reasons will be specified in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification.

2.7 Other control facilities, including constant Reactive Power output control modes (but excluding VAR limiters) are not required. However, if present in the voltage control system they will be disabled unless recorded in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification. Where an Offshore Transmission Owner retains the responsibility for the operation of such facilities such operation will only be in accordance with instructions to direct the configuration of the National Electricity Transmission System as given by NGET.

2.8 At the Interface Point the Active Power transfer from an Offshore Transmission System under steady state conditions should not be affected by voltage changes on the Onshore Transmission System in the Normal Operating Range by more than the change in Active Power losses at reduced or increased voltage. The Reactive Power output under steady state conditions should be fully available within the voltage range ±5% at 400kV, 275kV and 132kV.

3 FAULT RIDE THROUGH CAPABILITY

3.1 Fault Ride Through

3.1.1 For short circuit faults at Supergrid Voltage up to 140ms in duration:

(a) each Offshore Transmission System shall remain connected to the remainder of the Total System at the Interface Point without tripping of any Plant and/or Apparatus comprising that Offshore Transmission System, for a close-up solid three-phase short circuit fault or any unbalanced short circuit fault on the Onshore Transmission System operating at Supergrid Voltages for a total fault clearance time of up to 140 ms. A solid three-phase or unbalanced earthed fault results in zero voltage on the faulted phase(s) at the point of fault. The duration of zero voltage is dependent on local protection and circuit breaker operating times. This duration and the fault clearance times will be specified in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification. Following fault clearance, recovery of the Supergrid Voltage to 90% on the Onshore Transmission System (which may include the Interface Point) may take longer than 140ms as illustrated in Appendix A Figures KA.1.1 (a) and (b);

(b) each Offshore Transmission System shall be designed such that upon both clearance of the fault on the Onshore Transmission System as detailed in 3.1.1 (a) and within 0.5 seconds of the restoration of the voltage at the Interface Point to be within the Normal Operating Range Active Power transfer capability shall be restored to at least 90% of the level available immediately before the fault. During the period of the fault as detailed in 3.1.1 (a) each Offshore Transmission System shall generate maximum reactive current without exceeding the transient rating limit at the Interface Point; and

(c) each Transmission DC Converter forming part of an Offshore Transmission System shall be designed to meet the Active Power recovery characteristics as specified in the relevant Offshore TO Construction Agreement Transmission Interface Site Specification upon clearance of the fault on the Onshore Transmission System as detailed in 3.1.1 (a).

3.1.2 For Supergrid Voltage dips greater than 140ms in duration, in addition to the requirements of 3.1.1 each Offshore Transmission System shall:

(a) remain connected to the Onshore Transmission System without tripping of any Plant and/or Apparatus forming part of that Offshore Transmission System, for balanced Supergrid Voltage dips and associated durations on the Onshore Transmission System anywhere on or above the heavy black line shown in Figure K2. Appendix KA and Figures KA.1.3 (a), (b) and (c) provide an explanation and illustrations of Figure K2;

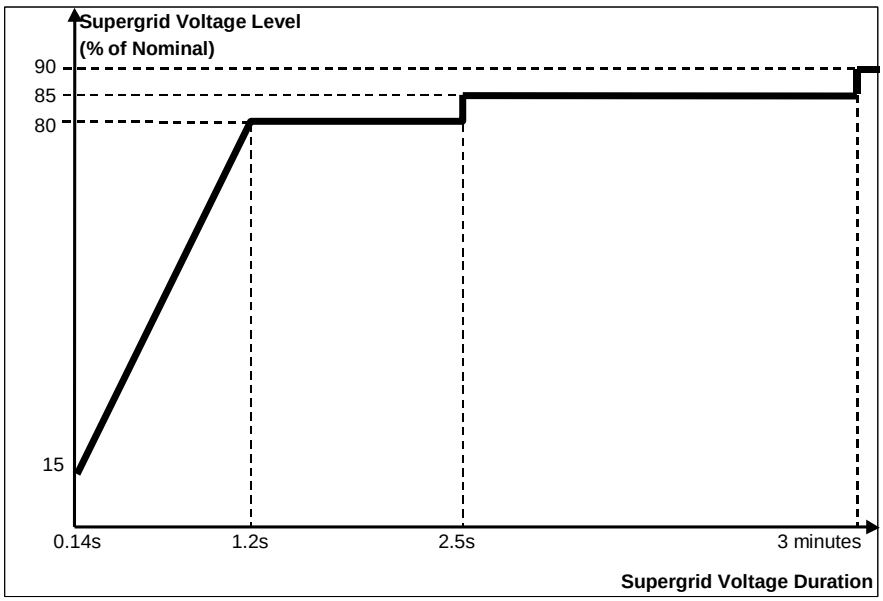


Figure K2

(b) provide Active Power transfer capability, during Supergrid Voltage dips on the Onshore Transmission System as described in Figure K2, at least in proportion to the retained balanced voltage at the Interface Point except in the case where there has been a reduction in the Active Power transfer of the Offshore Transmission System in the time range in Figure K2, which has been caused by a reduction in the Active Power generated by any Generating Units connected to such an Offshore Transmission System. In addition, during the voltage dip, each Offshore Transmission System shall generate maximum reactive current at the Interface Point; and

(c) restore Active Power transfer capability, following Supergrid Voltage dips on the Onshore Transmission System as described in Figure K2, within 1 second of restoration of the voltage at the Interface Point to be within the Normal Operating Range to at least 90% of the level available immediately before the occurrence of the dip except in the case of an Offshore Transmission System where there has been a reduction in the Intermittent Power Source of any Generating Units connected to such Offshore Transmission System in the time range in Figure K2 that restricts the Active Power transfer capability below this level.

3.1.3 In addition to meeting the requirements of Grid Code CC.6.1.5 (b) and CC.6.1.6 at the Interface Point, each Offshore Transmission System will be required to withstand, without tripping, the negative phase sequence loading incurred by clearance of a close-up phase-to-phase fault, by System Back-Up Protection on the Onshore Transmission System operating at Supergrid Voltage.

3.1.4 To avoid unwanted island operation, Offshore Transmission Systems connected to Onshore Systems in Scotland shall be tripped for the following conditions:

(a) frequency above 52Hz for more than 2 seconds;

(b) frequency below 47Hz for more than 2 seconds;

(c) voltage as measured at the Interface Point is below 80% for more than 2.5 seconds; and

(d) voltage as measured at the Interface Point is above 120% (115% for 275kV) for more than 1 second.

The times stated in (a) and (b) above are maximum trip times. Shorter times may be used to protect the integrity of an Offshore Transmission System or Power Stations connected to it.

4 ADDITIONAL DAMPING CONTROL FACILITIES FOR TRANSMISSION DC CONVERTERS

4.1 Offshore Transmission Owners must ensure that any Transmission DC Converters do not cause a sub-synchronous resonance problem on the Total System. Each Transmission DC Converter shall to be provided with sub-synchronous resonance damping control facilities.

4.2 Where specified in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification, each Transmission DC Converter forming part of an Offshore Transmission System is required to be provided with power oscillation damping or any other identified additional control facilities.

5. FREQUENCY CAPABILITES AND SIGNALS

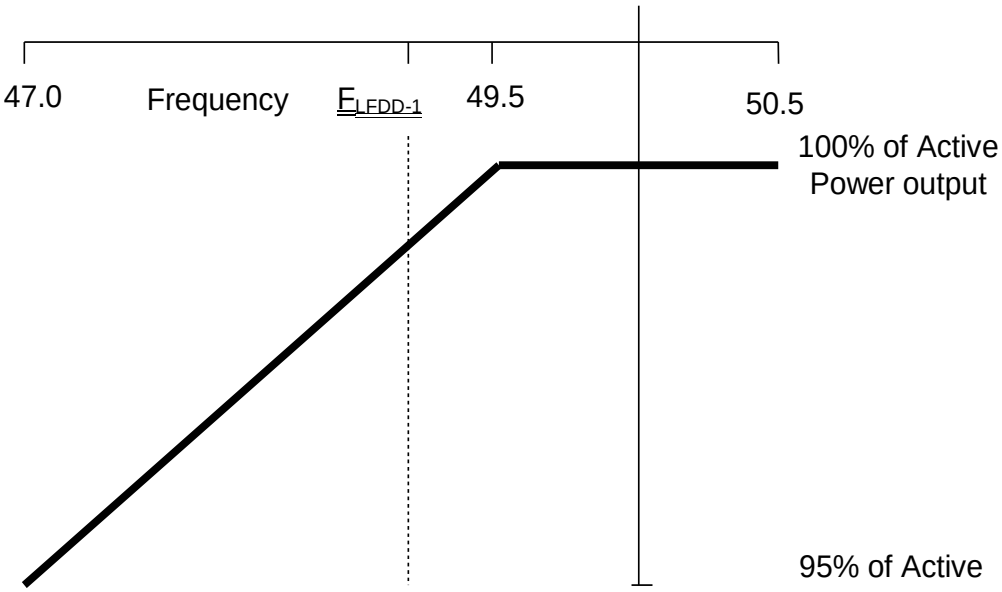
5.1 Each Offshore Transmission Owner which utilises a Transmission DC Converter as part of the Offshore Transmission System shall provide to each User, in respect of its Offshore Power Station(s) connected to and/or using such Offshore Transmission System, a continuous signal indicating the real-time Frequency measured at the Interface Point.

5.2 The Frequency signal referred to in 5.1 above shall be provided to the Offshore Power Station in a manner and in timescales notified to the Offshore Transmission Owner by NGET through the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification.

5.3 Each Offshore Transmission System which includes a Transmission DC Converter must be capable of:

(a) continuously maintaining constant Active Power transfer for System Frequency changes within the range 50.5 to 49.5 Hz; and

(b) (subject to the provisions of Grid Code CC.6.1.3) maintaining its Active Power transfer at a level not lower than the figure determined by the linear relationship shown in Figure 2 for System Frequency changes within the range 49.5 to 47 Hz, such that if the System Frequency drops to 47 Hz the Active Power transfer does not decrease by more than 5%.



Note: **Frequency** F_{LFDD-1} is the relay trip setting of the first stage of the Automatic Low **Frequency Demand Disconnection** Scheme

Figure K3

5.4 As stated in Grid Code CC.6.1.3, the System Frequency could rise to 52Hz or fall to 47Hz. Each Offshore Transmission System or any constituent element must be capable of:

5.4.1	Frequency Range	Requirement
	51.5Hz - 52Hz	Operation for a period of at least 15 minutes is required each time the Frequency is above 51.5Hz.
	51Hz - 51.5Hz	Operation for a period of at least 90 minutes is required each time the Frequency is above 51Hz.
	49.0Hz - 51Hz	Continuous operation is required
	47.5Hz - 49.0Hz	Operation for a period of at least 90 minutes is required each time the Frequency is below 49.0Hz.

5.4.2	47Hz - 47.5Hz	Operation for a period of at least 20 seconds is required each occasion the Frequency is below 47.5Hz.

For the avoidance of doubt, disconnection, by frequency or speed based relays is not permitted within the frequency range 47.5Hz to 51.5Hz, unless NGET has agreed to any Frequency-level relays and/or rate-of-change-of Frequency relays which will trip such Offshore Transmission System and any constituent element within this Frequency range, under the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification.

5.5 Offshore Transmission Owners will be responsible for protecting all their Transmission DC Converters against damage should Frequency excursions outside the range 52Hz to 47Hz ever occur. Should such excursions occur, it is up to the Offshore Transmission Owner to decide whether to disconnect his Apparatus for reasons of safety of Apparatus, Plant and/or personnel.

6. NEUTRAL EARTHING

6.1 At nominal System voltages of 132kV and above the higher voltage windings of any transformer comprising part of an Offshore Transmission System must be star connected with the star point suitable for connection to earth. The earthing and lower voltage winding arrangement shall be such as to ensure that the Earth Fault Factor requirement of paragraph Grid Code CC.6.2.1.1 (b) will be met on the National Electricity Transmission System at nominal System voltages of 132kV and above.

7. POWER QUALITY REQUIREMENTS

7.1 Each Offshore Transmission Owner is required to ensure that its Offshore Transmission System complies with the criteria set out in Section D, Part One, paragraph 2.2.6 in respect of any Interface Points.

7.2 Each Offshore Transmission Owner will carry out a Voltage Waveform Quality Assessment when designing its Offshore Transmission System and proposing any changes to the design of its Offshore Transmission System in accordance with Section D.

8. COMPLIANCE ASSESSMENT

8.1 Each Offshore Transmission Owner shall provide to NGET such information and assistance in relation to that Offshore Transmission Owner's Transmission System as required by NGET to enable NGET to undertake an assessment of the capability of the Offshore Transmission System to satisfy certain criteria as specified in this Section K. The Offshore Transmission Owner is responsible for carrying out any testing when requested by NGET and retains the responsibility for the safety of personnel and plant during test.

APPENDIX KA

FAULT RIDE THROUGH REQUIREMENT FOR OFFSHORE TRANSMISSION SYSTEMS

KA.1 SCOPE

KA.1.1 The fault ride through requirement is defined in Section K paragraphs 3.1. This Appendix provides illustrations by way of examples only of Section K paragraph 3.1.1(a) and further background and illustrations to Section K paragraph 3.1.2(a) and is not intended to show all possible permutations.

KA.2 SHORT CIRCUIT FAULTS AT SUPERGRID VOLTAGE UP TO 140MS IN DURATION

KA.2.2 For short circuit faults at Supergrid Voltage up to 140ms in duration on the Onshore Transmission System, the fault ride through requirement is defined in Section K paragraph 3.1.1 (a). Figures KA.1.1 (a) and (b) illustrate two typical examples of voltage recovery for short-circuit faults cleared within 140ms by two circuit breakers (a) and three circuit breakers (b) respectively.

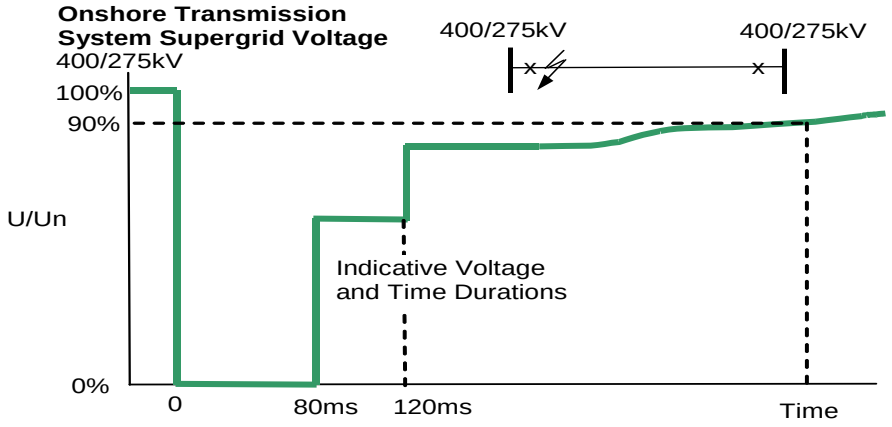
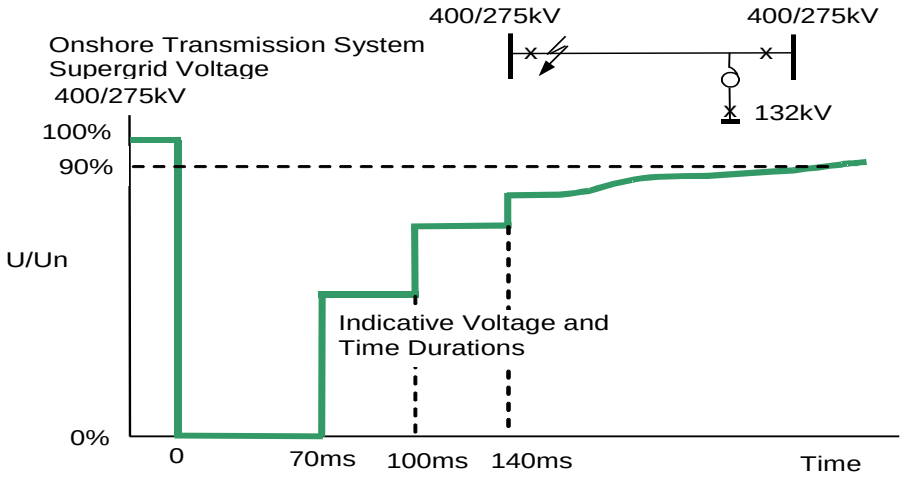


Figure KA.1.1 (a)



Typical fault cleared in 140ms:- 3 ended circuit

Figure KA.1.1 (b)

KA.3 SUPERGRID VOLTAGE DIPS GREATER THAN 140MS IN DURATION

KA.3.1 For balanced Supergrid voltage dips on the Onshore Transmission System having durations greater than 140ms and up to 3 minutes the fault ride through requirement is defined in Section K paragraph 3.1.2 (a) and Figure K2 which is reproduced in this Appendix as Figure KA.1.2 and termed the voltage–duration profile.

KA.3.2 This profile is not a voltage-time response curve that would be obtained by plotting the transient voltage response at a point on the Onshore Transmission System to a disturbance. Rather, each point on the profile (i.e. the heavy black line) represents a voltage level and an associated time duration which connected Offshore Transmission Systems must withstand or ride through.

KA.3.3 Figures KA.1.3 (a), (b) and (c) illustrate the meaning of the voltage-duration profile for voltage dips having durations greater than 140ms.

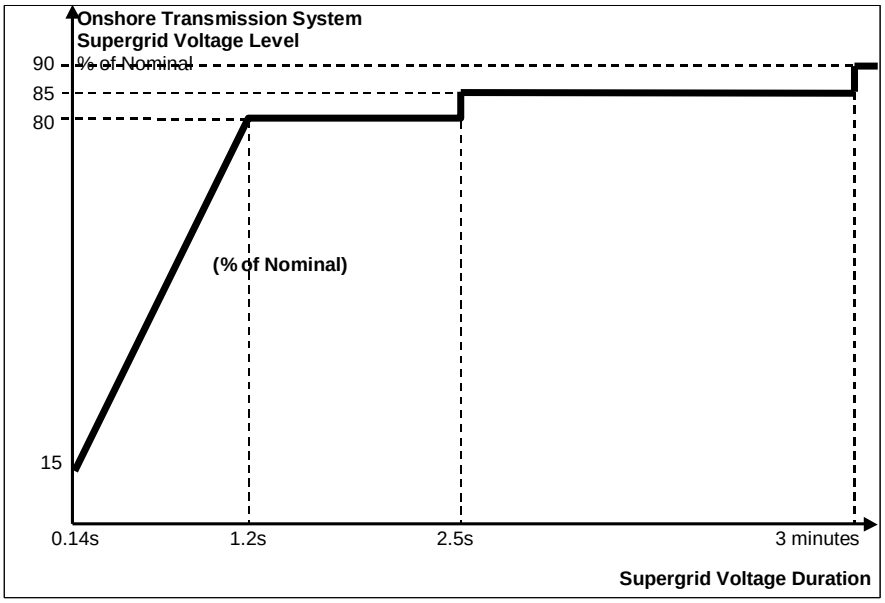
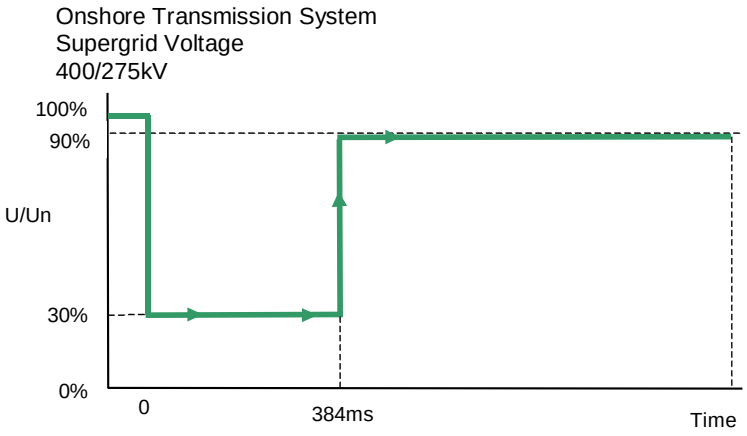
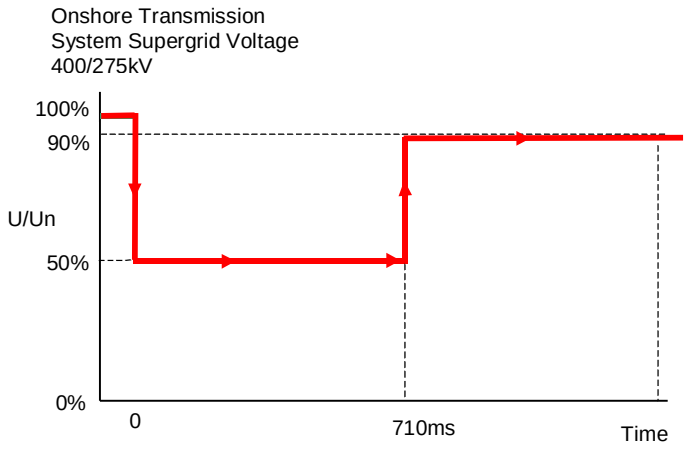


Figure KA.1.2



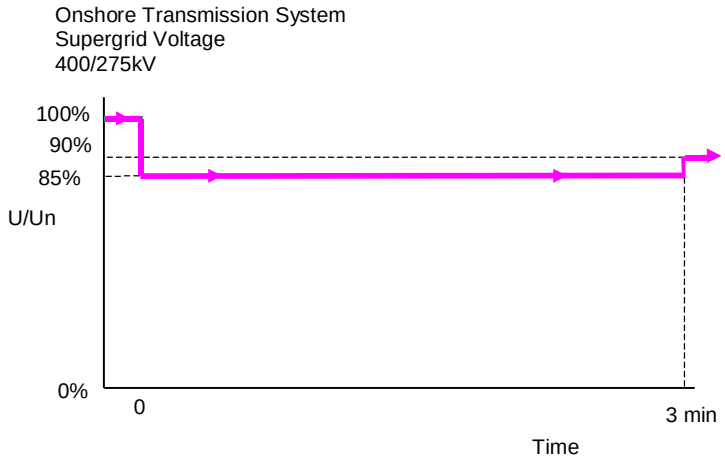
30% retained voltage, 384ms duration

Figure KA.1.3(a)



50% retained voltage, 710ms duration

Figure KA.1.3(b)



85% retained voltage, 3 minutes duration

Figure KA.1.3(c)

APPENDIX KB

PERFORMANCE REQUIREMENTS FOR CONTINUOUSLY ACTING AUTOMATIC VOLTAGE CONTROL SYSTEMS FOR OFFSHORE TRANSMISSION SYSTEMS

KB.1 SCOPE

KB.1.1 This Appendix sets out the performance requirements of continuously acting automatic voltage control systems for Offshore Transmission Systems that must be complied with by the owner of such an Offshore Transmission System. This Appendix does not limit any site specific requirements that may be included in an Offshore TO Construction Agreement or Transmission Interface Site Specification where in NGET's reasonable opinion these facilities are necessary for system reasons.

KB.2 REQUIREMENTS

KB.2.1 NGET requires that the continuously acting automatic voltage control system for the Offshore Transmission System shall meet the following functional performance specification. If a Network Operator has confirmed to NGET that its network to which an Embedded Offshore Transmission System is connected is restricted such that the full reactive range under the steady state voltage control requirements (KB.3) cannot be utilised, NGET may specify in the relevant TO Construction Agreement or Transmission Interface Site Specification alternative limits to the steady state voltage control range that reflect these restrictions.

KB.3 STEADY STATE VOLTAGE CONTROL

KB.3.1 The Offshore Transmission System shall provide continuous steady state control of the voltage at the Interface Point with a Setpoint Voltage and Slope characteristic as illustrated in Figure KB.3 (a).

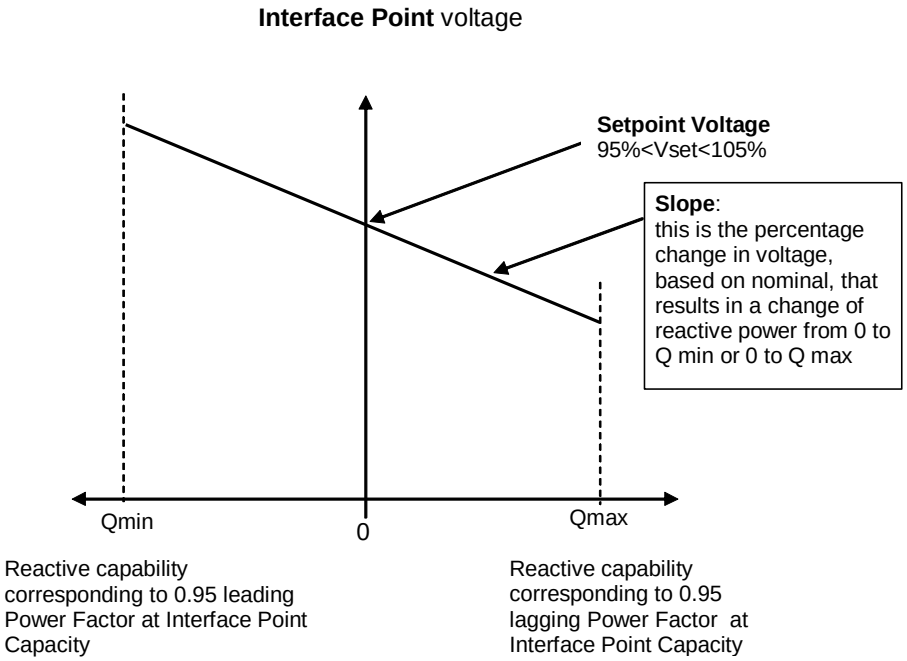


Figure KB.3 (a)

KB.3.2 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% which must be achievable to a tolerance of ±0.25%. 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 owner of the Offshore Transmission System to implement an alternative Setpoint Voltage within the range of 95% to 105%. For Embedded Offshore Transmission Systems the Setpoint Voltage will be discussed between NGET and the relevant Network Operator.

KB.3.3 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% which must be achievable to a tolerance of ±0.5% 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 owner of the Offshore Transmission System to implement an alternative slope setting within the range of 2% to 7%. For Embedded Offshore Transmission Systems the Slope setting will be discussed between NGET and the relevant Network Operator.

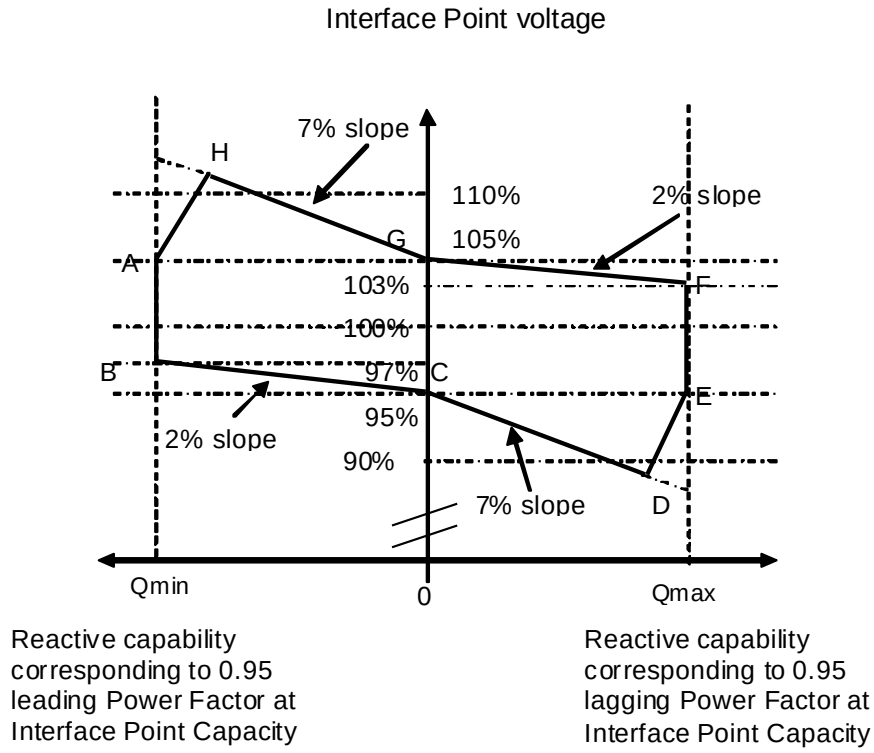


Figure KB.3 (b)

KB.3.4 Figure KB.3 (b) shows the required envelope of operation for Offshore Transmission Systems. The enclosed area within points ABCDEFGH is the required capability range within which the Slope and Setpoint Voltage can be changed.

KB.3.5 Should the operating point of the Offshore Transmission System deviate so that it is no longer a point on the operating characteristic (figure KB.3 (a)) 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.

KB.3.6 Should the Reactive Power output of the Offshore Transmission System reach its maximum lagging limit at an Interface Point voltage above 95%, the Offshore Transmission System shall maintain maximum lagging Reactive Power output for voltage reductions down to 95%. This requirement is indicated by the line EF in figure KB.3 (b). Should the Reactive Power output of the Offshore Transmission System reach its maximum leading limit at an Interface Point voltage below 105%, the Offshore Transmission System shall maintain maximum leading Reactive Power output for voltage increases up to 105%. This requirement is indicated by the line AB in figure KB.3 (b).

KB.3.7 For Interface Point voltages below 95%, the lagging Reactive Power capability of the Offshore Transmission System 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 figure KB.3 (b). For Interface Point voltages above 105%, the leading Reactive Power capability of the Offshore Transmission System 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 figure KB.3 (b). Should the Reactive Power output of the Offshore Transmission System reach its maximum lagging limit at an Interface Point voltage below 95%, the Offshore Transmission System shall maintain maximum lagging reactive current output for further voltage decreases. Should the Reactive Power output of the Offshore Transmission System reach its maximum leading limit at an Interface Point voltage above 105%, the Offshore Transmission System shall maintain maximum leading Reactive Power output for further voltage increases.

KB.4 TRANSIENT VOLTAGE CONTROL

KB.4.1 For an on-load step change in Interface Point voltage, the continuously acting automatic control system shall respond according to the following minimum criteria:

KB.4.1.1 the Reactive Power output response of the Offshore Transmission System shall commence within 0.2 seconds of the application of the step. It shall progress linearly although variations from a linear characteristic shall be acceptable provided that the MVAr seconds delivered at any time up to 1 second are at least those that would result from the response shown in figure KB.4;

KB.4.1.2 the response shall be such that, for a sufficiently large step, 90% of the full reactive capability of the Offshore Transmission System, as required by Section K, paragraph 2.3 (or, if appropriate, KB.3.6 or KB.3.7), will be produced within 1 second

KB.4.1.3 the magnitude of the Reactive Power output response produced within 1 second shall vary linearly in proportion to the magnitude of the step change

KB.4.1.4 the settling time shall be no greater than 2 seconds from the application of the step change in voltage and the peak to peak magnitude of any oscillations shall be less than 5% of the change in steady state Reactive Power within this time.

KB.4.1.5 following the transient response, the conditions of KB3 apply.

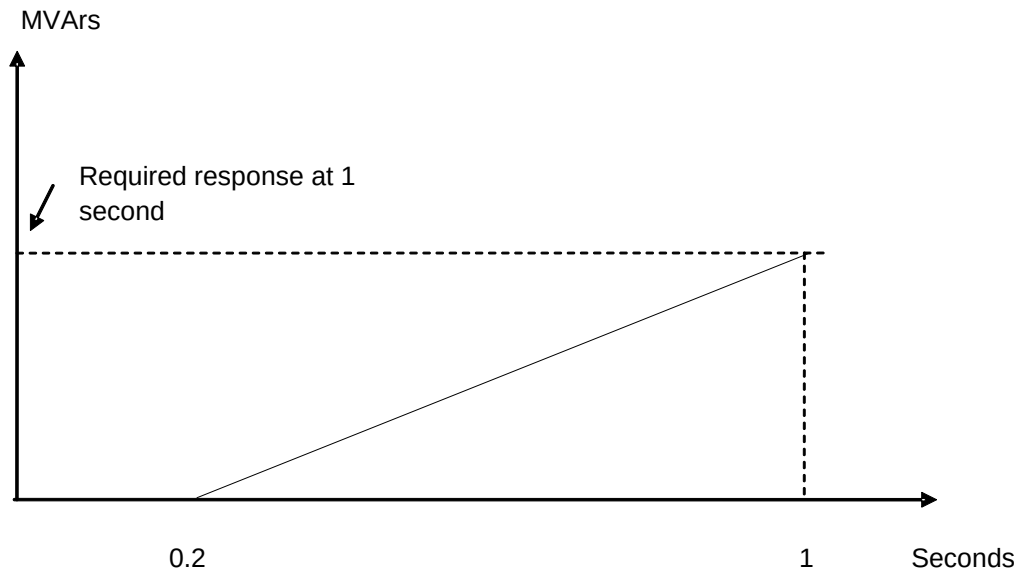


Figure KB.4

KB.5 POWER OSCILLATION DAMPING

KB.5.1 The requirement for the continuously acting voltage control system to be fitted with a Power System Stabiliser (PSS) shall be specified in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification if, in NGET's view, this is required for system reasons. However if a Power System Stabiliser is included in the voltage control system its settings and performance shall be agreed with NGET and commissioned in accordance with STCP19-4.

KB.6 OVERALL VOLTAGE CONTROL SYSTEM CHARACTERISTICS

KB.6.1 The continuously acting automatic voltage control system is required to respond to minor variations, steps, gradual changes or major variations in Interface Point voltage.

KB.6.2 The overall voltage control system shall include elements which provide a limited bandwidth output. The bandwidth limiting must be consistent with the speed of response requirements and ensure that the highest frequency of response cannot excite torsional oscillations on other plant connected to the network. A bandwidth of 0-5Hz would be judged to be acceptable for this application. All other control systems employed within the Offshore Transmission System should also meet this requirement

KB.6.3 The response of the voltage control system (including the Power System Stabiliser if employed) shall be demonstrated by applying suitable step disturbances into the voltage control system of the Offshore Transmission System, or by changing the actual voltage at a suitable point as specified by NGET. The damping shall be judged

to be adequate if the corresponding Active Power response to the disturbances decays within 2 seconds of the application of the step.

ANNEX 2

1.1 Annex 2 of Section K sets out the minimum technical, design and operational criteria and performance criteria that applies to:-

Offshore Transmission Owner's who own an AC Offshore Transmission System and that AC Offshore Transmission System was first connected to the Onshore Transmission System on or after 27 April 2019 and the purchase contracts for the ~~Main~~ Plant and Apparatus forming the major part of that AC Offshore Transmission System had been concluded on or after 17th May 2018; or

Offshore Transmission Owner's who own an Offshore Transmission System and that Offshore Transmission System comprises one or more Transmission DC Converters and that Offshore Transmission System was first connected to the Onshore Transmission System on or after 8 September 2019 and the purchase contracts for the Main Plant and Apparatus forming that Offshore DC Transmission System had been concluded on or after 28 September 2018. For the avoidance of doubt, an Offshore Transmission System comprising one of more Transmission DC Converters would be assumed to constitute an HVDC System.

1.2 Section D Part One, clause 2.2.6 of the STC specifies that in planning and developing its Transmission System, each Type 2 Transmission Owner (which includes Offshore Transmission Owner's) shall ensure that its Transmission System complies with the minimum technical, design and operational criteria and performance requirements set out or referred to in European Connection Conditions 6.1, 6.2, 6.3 and 6.4 and in Planning Code 6.2 and/or 6.3 as applicable or such other technical criteria or requirements as apply to any relevant part of its Transmission System by virtue of a current Transmission Derogation. For the avoidance of doubt, Offshore Transmission Owners in respect of their Offshore Transmission System, would be expected to meet the same requirements as EU Generators undertaking OTSDUW Build in respect of their Offshore Transmission Systems which includes Transmission DC Converters including HVDC Systems.

1.3 In addition to the above requirements each Offshore Transmission Owner must ensure their Offshore Transmission System can satisfy in the following specific areas:

1.3.1 In all cases, where an obligation is placed on a EU Generator undertaking OTSDUW Build (which includes those with Transmission DC Converters and HVDC Systems) any site specific requirements being pursuant to the Bilateral Agreement, to be placed upon the Offshore Transmission Owner would be specified in the Offshore Transmission Owner Construction Agreement or Transmission Interface Site Specification.

1.3.2 The Reactive Capability requirements at the Interface Point applicable to Offshore Transmission Licensees are the same as EU ~~Code~~ Generators undertaking OTSDUW Build as defined in ECC.6.3.2.4. The Reactive Power capability that an Offshore Transmission System must be able to provide at the Interface Point may be delivered using a combination of Plant owned by the Offshore Transmission Owner concerned and Plant owned by a Generator or Generators connected to that Offshore Transmission System. Where Generator Plant is out of service, the Reactive Power capability requirements will be reduced pro-rata to the maximum Active Power capability of Generator Plant in service.

1.3.3 All Offshore Transmission Systems must be capable of enabling the Offshore Transmission Owner to comply with an instruction received from The Company relating to a variation on the voltage setpoint at the Interface Point within 2 minutes of such instruction being received.

1.3.4 Control facilities, including constant Reactive Power output control modes (but excluding VAR limiters) are not required. However, if present in the voltage control system they will be disabled unless recorded in the relevant Offshore TO Construction Agreement or Transmission Interface Site Specification. Where an Offshore Transmission Owner retains the responsibility for the operation of such facilities such operation will only be in accordance with instructions to direct the configuration of the National Electricity Transmission System as given by The Company.

1.3.5 Each Transmission Owner which utilises a Transmission DC Converter as part of the Offshore Transmission System shall provide to each User, in respect of its Offshore Power Station(s) connected to and/or using such Offshore Transmission System, a continuous signal indicating the real-time Frequency measured at the Interface Point as required under ECC.6.3.3 (f) of the Grid Code.

1.3.6 Each Transmission Owner which utilises a Transmission DC Converter as part of its Offshore Transmission System shall be required to satisfy the applicable requirements of ECC.6.3.6.1.2, ECC.6.3.7, ECC.6.3.12 and ECC.6.3.13 with any site specific requirements being specified in the Offshore Transmission Owner Construction Agreement or Transmission Interface Site Specification.

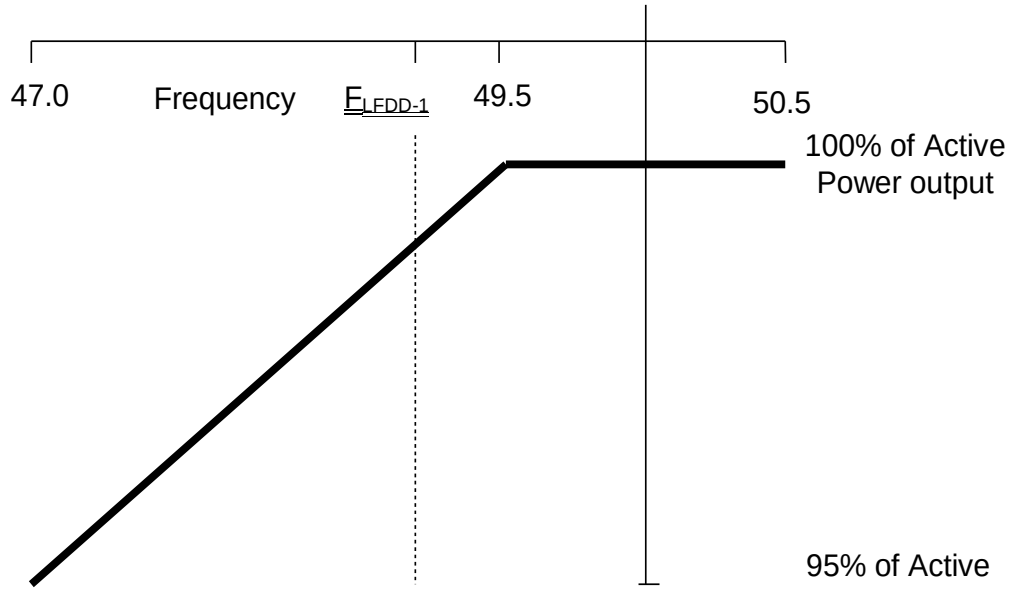
1.3.7 Each Transmission Owner which utilises a Transmission DC Converter as part of its Offshore Transmission System shall be required to satisfy the applicable requirements of ECC.6.3.17 with any site specific requirements being specified in the Offshore Transmission Owner Construction Agreement or Transmission Interface Site Specification.

1.3.8 Each Offshore Transmission System which includes a Transmission DC Converter (including and HVDC System) must be capable of:

(a) continuously maintaining constant Active Power transfer for System Frequency changes within the range 50.5 to 49.5 Hz; and

(b) (subject to the provisions of Grid Code ECC.6.1.2) maintaining its Active Power transfer at a level not lower than the figure determined by the linear relationship shown in Figure K3~~2~~ for System Frequency changes within the range 49.5 to 47 Hz, such that if the System Frequency drops to 47 Hz the Active Power transfer does not decrease by more than 5%.

4



Note: **Frequency** F_{LFDD-1} is the relay trip setting of the first stage of the Automatic Low **Frequency Demand Disconnection** Scheme

Figure K~~4~~3

1.3.9 All Offshore Transmission Systems must be capable of enabling the Offshore Transmission Owner to comply with the requirements of ECC.6.5.6. In addition, Offshore Transmission Owners shall be required to satisfy the applicable requirements of ECC.6.6 with any detailed requirements being specified in the Offshore Transmission Owner Construction Agreement or Transmission Interface Site Specification.

1.4 Each Offshore Transmission Owner is required to comply with the requirements of the European Compliance Processes (ECP's) as applicable to EU Generators undertaking OTSDUW Build. For the avoidance of doubt, this would include Offshore Transmission Owners in respect of Transmission DC Converters including HVDC Systems as applicable. Each Offshore Transmission Owner shall provide to The Company such information and assistance in relation to that Offshore Transmission Owner's Transmission System as required by The Company to enable The Company to undertake an assessment of the capability of the Offshore Transmission System to satisfy certain criteria as specified in this section K.