STC Working Group on Offshore Electricity Transmission – February 2008

Working Group Report

07 MARCH 2008

CONTENTS

1. SUMMARY 1
2. INTRODUCTION 3
3. WORKING GROUP DISCUSSIONS 5
- **Background Papers** 5
- **Switching Responsibilities on the Offshore Transmission Systems** 5
- **Offshore Technical Rules and Technical Compliance** 7
- **Offshore Technical Requirements based on Grid Code Subgroup Recommendations** 8
- **STC Governance** 9
- **Accession to the STC** 10
- **The STC Framework as Applied to Offshore Transmission** 11
  - The TO Construction Offer as Applied to OFTOs 12
  - Service Capability Specification/Availability and Performance Criteria 13
  - TO Revenue 13

4. CONCLUSIONS AND RECOMMENDATIONS 14
- **Extension of the STC and STCPs to Offshore** 14
- **Technical Requirements and Technical Compliance** 15
- **Enduring Operation of an Offshore Transmission System** 16
- **STC Payment Provisions** 16
- **Governance** 16
- **Switching Responsibilities** 17

APPENDIX A WORKING GROUP REPRESENTATIVES

APPENDIX B COMMITTEE MEMBERSHIP AND VOTING PROPOSALS

APPENDIX C STC DRAFTING AS A CONSEQUENCE OF THE OFFSHORE GRID CODE SUBGROUP RECOMMENDATIONS

1. Summary

1.1 The STC Working Group was formed in October 2007 to assist Ofgem and BERR in their decisions relating to the provisions of the System Operator Transmission Owner Code (STC) as they relate to Offshore Electricity Transmission. The working group was made up of representatives of potential offshore generation developers, potential Offshore Transmission Owners (OFTOs), and existing STC Parties.

1.2 The first STC Working Group Report on Offshore Electricity Transmission was issued on October 31st 2007. The report made recommendations in 7 areas which Ofgem asked the working group to progress further during February 2008. The group were also asked to consider mechanisms for the management of money flows or securities both between OFTOs and NGET (acting as Great Britain System Operator or 'GBSO') and from NGET to OFTOs.

1.3 The group discussed the changes required to STC governance and accession arrangements to accommodate new OFTOs. The group agreed that there was a need to involve new OFTOs in STC decision making as soon as there was reasonable certainty that an OFTO was likely to proceed through to construction of offshore assets. This need is driven by the expectation that OFTOs will either need to comply or work towards compliance with many STC obligations at this stage.

1.4 Group members also recognised the need to accommodate this requirement by introducing new governance mechanisms which deal with the expected increase in the number of STC parties. The changes proposed to deal with this are based on tried and tested mechanisms used to manage other industry codes, most notably the Connection and Use of System Code (CUSC) and the Distribution Connection and Use of System Agreement (DCUSA).

1.5 The group discussed how best to specify and enforce necessary technical and performance criteria on offshore networks. The group considered;

- Requirements at the user interface;
- Requirements at the onshore interface;
- Transmission system performance Criteria;
- General offshore equipment requirements;
- Offshore network capability requirements; and
- Equipment and services provided by OFTOs to facilitate and accommodate Users' obligations under the Grid Code, including reactive power and frequency control.

1.6 A review of the arrangements in the current STC and STCPs (the code procedures) demonstrated that many existing tools could be extended to offshore transmission. These include the following obligations which are currently met by TOs:

- To comply with a Transmission Licence (including the need to comply with the GBSQSS and STC);
- To ensure certain aspects of the Grid Code are complied with and can be complied with by users (including transmission system performance criteria and equipment specifications);
- To provide interface specifications and safety rules;

- To plan and co-ordinate works with other STC parties and users during construction programmes;
- To develop and abide by a commissioning programme; and
- To warrant that commissioned equipment is fit for purpose and meets agreed technical and performance specifications, with provisions for testing and witnessing of testing.

1.7 The group recommends that these obligations are extended offshore and that additional provisions are put in place to manage the new onshore interface. The group also agreed that the requirements based on recommendations made by the Grid Code Subgroup on offshore relating to provisions of reactive power, fault ride-through and facilitation of frequency response should be set out in a new section within the STC.

1.8 A number of operational models which could be applied offshore were discussed by the group, with a particular focus on how best to manage operational and safety switching and the facilities required to do this. The group discussed, but did not fully agree on, an approach intended to accommodate the most effective and economic solution for individual developments whilst setting out clear requirements for the capability and resilience of offshore control infrastructure.

1.9 Further consideration was given to the relationship between the STC (the Code itself), the STCPs and the STC Schedules. The group agreed that this structure could accommodate the provisions required to manage offshore transmission and favoured that new provisions were integrated into the existing code and procedure structure where possible.

1.10 The group also recommended the extension of the existing concept of a TO Construction Agreement to offshore. They recognised that this could be a key component linking the OFTO, as selected by a tender process, to NGET and hence through to the user via their construction agreement. This could be based on the existing TOCA proforma with the addition of specific provisions linking to the OFTO selection process and new STC provisions to manage the inclusion of a new network rather than the extension of existing networks which the STC is currently designed to deal with.

1.11 Some consideration was also given to the mechanisms required in the STC to allow OFTOs to lodge securities with NGET acting as GBSO and for NGET to provide securities to OFTOs to guard against any failure on NGET's part to pay OFTO charges. It was agreed that these provisions could if necessary be accommodated in the Billing and Payment section (Section E) of the STC which currently only deals with the payment of TO charges.

2. Introduction

2.1 The STC Working Group on Offshore Transmission was reconvened at Ofgem and BERR's request and met three times in February 2008.

2.2 Invitations were extended to attendees of the October 2007 meetings. Representatives of all parties bar one were able to attend. A wider invitation placed in Ofgem's January Regulatory Policy Update resulted in some requests for information. A full list of attendees is provided in Appendix A.

2.3 Meetings were chaired by a representative from NGET who also prepared this working group report. NGET also fulfilled technical secretariat duties.

2.4 Ofgem and BERR had previously asked NGET to prepare six pieces of work following on from the October 2007 working group report which were presented at the first working group meeting in February and used as a basis for further discussion. These were:

- Carry out a detailed assessment of the STC (on a clause by clause basis) assessing the impact on the STC of each of the possible switching models considered by the STC working group;
- Identify STC clauses for which more detailed arrangements are defined in an STCP;
- Develop proposals to amend the STC governance arrangements that could implement the STC working group's recommended changes to STC Committee representation;
- Consider options for changes to the STC governance that are needed to accommodate additional STC parties and develop a recommendation;
- Identify CUSC contractual obligations that NGET considers should be specifically backed off in a contractual arrangement between NGET and an OFTO; and
- Develop proposals for new contractual arrangements under the STC framework based on the CUSC back-off requirements identified.

2.5 The group were asked to abide by its original terms of reference in meeting the following new deliverables:

- Develop STC governance arrangements to include offshore transmission owners (OFTOs) and define voting mechanisms and party entry processes for new OFTO parties acceding to the STC.
- Further assess the options identified for switching responsibilities on the offshore transmission system.
- Define technical requirements for the OFTO and GBSO in respect of the offshore transmission system interface points (ie with offshore generator and onshore network licensee).
- Develop a process for the GBSO to assess technical compliance of the offshore transmission system before the system may be energised.
- Consider how the STC and STC procedures (STCPs) should be extended offshore.
- Develop STC payment provisions to include obligations for an OFTO to provide financial commitment[1] (eg guarantees, security) before and during construction of an offshore transmission system and consider

[1] Form of financial commitment was the subject of a current Ofgem consultation. STC WG was required to consider the mechanism for managing money flows from OFTO to GBSO.

mechanisms for the GBSO to provide security to the OFTO during enduring operations.

- Develop a new contractual agreement under the STC framework to apply between an OFTO and the GBSO during the enduring operation of an offshore transmission system.

3. Working Group Discussions

Background Papers

3.1 NGET presented 6 papers to the first working group meeting in line with Ofgem and BERR's requests for additional analysis following the first working group report. The topics covered by four of these were discussed in subsequent meetings and are discussed later in this report.

3.2 Two of these papers were reviewed at the first meeting only and informed the group's deliberations in the following two sessions.

3.3 The first of these documented the relationship between the STC and the STCPs and highlighted that many of the STCPs set out the procedures required to meet the obligations set out in Section C (Transmission Services and Operations) and Section D (Planning Co-ordination). A number of STCPs relate to Section E (Payments and Billing) whilst there are further links between STCPs and Section G (General Provisions).

3.4 A second of these set out the obligations placed upon NGET by the CUSC and highlighted the obligations which NGET would be reliant on an OFTO to deliver in an offshore environment and hence needed to be backed off in the STC. These generally fall into the following categories:

- Timing and production of Connection Offers, Bilateral Agreements and Short term TEC Products;
- Pre-Conditions to be met by Users before the energisation of their connection to the GB Transmission System by the relevant Transmission Owner (e.g. entering into agreements with NGET, proving that technical capabilities are in place, etc);
- Obligations connected with the transmission of electricity to or from a Connection Site;
- Connection Site Specifics (e.g. Maintenance, Removal, De-energisation, or Replacement of Connection Assets, installation of Metering Systems);
- The Construction Process (in connection with a new connection, modification or replacement); and
- Execution and planning of Outages on the GB Transmission System.

3.5 The paper also noted that these obligations had been backed off in the existing STC and were largely applicable to offshore transmission.

Switching Responsibilities on the Offshore Transmission Systems

3.6 NGET presented its paper on Offshore Operational Models at the first of the February working group sessions.

3.7 This referenced three models discussed previously:

- Model 1: NGET directs configuration of the transmission system whilst in operational service but the OFTO carries out both operational and safety switching actions.

- Model 2: NGET has the means to operate key transmission equipment via remote control and equipment is handed over to the OFTO for safety switching as necessary for maintenance.

- Model 3: Only NGET can operate transmission equipment.

3.8 The current STC Provisions relating to control and operation of the transmission network activities were summarised as:

1) TOs are obliged to provide NGET with a means to direct the configuration of their transmission system;
2) TOs have a means of specifying capability limits for their equipment;
3) NGET has an obligation to ensure equipment is operated within these capability limits;
4) NGET has an obligation to ensure the transmission system is operated within licence standards;
5) Operationally significant alarms, analogues and indications are passed to NGET by the TOs;
6) There is a process for agreeing switching actions;
7) Equipment alarms are classified, graded in terms of immediacy of operational impact, along with responsibility for responding to them;
8) Safety rules are specified;
9) TO's have the right to act to re-configure their network for public or site safety reasons;
10) Contingency arrangements are defined for a loss of control facilities;
11) Management processes and levels of resilience are specified for the communications links between NGET and the TOs; and
12) Limitation of Liability.

3.9 The paper went on to describe where these provisions were placed (either within the STC or STCPs) and then discussed the changes required to implement any one of the three models for offshore transmission.

3.10 The working group discussed the paper and agreed that it was necessary to break the operational switching and safety switching activities down further to reach a better understanding of relevant events and required actions. The need to address contingency requirements (for control systems and communications as well as back up control room arrangements) was also noted.

3.11 The group also discussed whether a standard arrangement was needed to ensure that operational arrangements were robust and that users saw the same level of service, no matter which part of the transmission system they connected to. The option of contracting out operational services was also highlighted.

3.12 The issue was again discussed at the second working group session. On this occasion, the group were asked to consider how often different switching activities would be performed, who was best placed to perform these and the resources and facilities required.

3.13 The group agreed that there was a need to set out robust operational arrangements within the STC for offshore transmission.

3.14 In discussion, the point was raised that new OFTOs may not have access to the same control infrastructure that existing STC parties have and may not wish to construct and maintain fully functional 24/7 control rooms for assets that are likely to be switched regularly on the directions of NGET but on an irregular basis for their own requirements.

3.15 A counter argument was put forward that having invested heavily in sophisticated transmission equipment, OFTOs may wish to maintain full control of their assets.

3.16 A number of different issues were raised which would affect which arrangement would be the most economic such as the costs of communications over dual routes, the provision of back up facilities and the relaying of alarms and signals to a third party.

3.17 The Scottish TO's were of the view that the existing Operational Switching, Asset and Real Time Management mechanisms currently operating in Scotland under the existing STC Framework have worked effectively and efficiently since their introduction in 2005 and therefore should be adopted for the offshore arena.

3.18 NGET agreed with the Scottish TOs that the Operational Switching arrangements put in place in Scotland at BETTA go-live were appropriate and had worked effectively, but expressed of the view that alternative arrangements may be more effective and efficient in the offshore arena.

3.19 One group member highlighted that users were largely unaware of a formal distinction between operational and safety switching, and that they were keen to ensure that these roles, and hence responsibilities, were clearly understood.

3.20 A proposal was tabled such that two models would be accommodated in the STC. The first of these would be based on Model 1 (the same or similar to existing switching, event management and contingency arrangements as applied in Scotland via the current STC). The second of these would be based on Model 2, where NGET would have direct control of key items of transmission equipment and the contingency requirements for OFTO control room facilities would be less onerous.

3.21 The group reached a degree of consensus on this proposal. However, during drafting of this report one group member indicated that they disagreed with this proposal and that the arrangements that apply in Scotland should be applied offshore unless further work determined that a single alternative arrangement was appropriate. Another member suggested that Model 1 should be recommended as the default model.

Offshore Technical Rules and Technical Compliance

3.22 The group discussed how technical rules and technical compliance is managed under the current arrangements applying to onshore transmission under the following headings:

- Technical Specifications;
- Performance Characteristics;
- Design;
- Commissioning; and
- Compliance.

3.23 In terms of Technical Specifications, it was noted that:

- Section C of the STC specifies the provision of Transmission Services and Service Capability Specifications in accordance with the STC, GBSQSS and the applicable Transmission Licence; and
- Section D of the STC refers to the Grid Code Connection Conditions (CC6.2) and the Planning Code (PC 6.2) in respect of the equipment

specifications, policies and procedures to be applied at the connection point. Ultimately these refer to the RES ("Relevant Electrical Standards") in England and Wales or NGTS's or SPTTS's in Scotland as specified in users' bilateral agreements with NGET.

3.24 For Performance Characteristics, Section D of the STC stipulates requirements to be met at the user connection point by referring to the Connection Conditions (CC.6.1, CC.6.2 and CC.6.3) in the Grid Code where the performance characteristics for the GB Transmission System, the Plant and Apparatus requirements at a Connection Site and General Generating Unit requirements are defined.

3.25 STCP19-2 (Construction Process and Scheme Closure) and STCP19-4 (Commissioning and Decommissioning) currently deal with how NGET and TOs (together with users as applicable) exchange information relating to new transmission infrastructure and co-ordinate construction works prior to equipment being brought into service. STCP 19-3 (Operational Notification and Compliance Testing) is focussed on the compliance testing of User equipment.

3.26 Responsibility for designing the transmission network such that it is fit for purpose and provides the required transmission access, meets licence standards, complies with the GBSQSS and exhibits the necessary performance characteristics currently lies with the TOs in Scotland or NGET in England in Wales. The STC and STCPs set out how a TO warrants that equipment is suitable for use before it can be commissioned.

3.27 It was noted that none of the current specifications have reference to reliability, only to plant characteristics.

3.28 Group members agreed that the technical, design and operational criteria currently applied at the user interface onshore could reasonably be applied to the onshore interface of offshore networks.

3.29 It was also agreed that certain high level equipment criteria need to be applied to offshore networks ie. equipment should be IEC approved (or equivalent) and suitable for use in the marine environment. The precise specification for equipment at the user interface would be set out by the OFTO and could take account of user requirements. The group's expectation was that this would be agreed for inclusion in an Offshore TO Construction Agreement.

3.30 It was also agreed that, in the absence of any compelling argument to do otherwise, that the transmission system performance characteristics that users see onshore (ie CC.6.1, CC.6.2 and CC.6.3 and the applicable sections of PC.6.2) should apply offshore where they are relevant.

3.31 Furthermore, the group agreed that principles embodied in the current STC arrangements by which a TO certifies that its transmission network meets equipment, design and performance criteria (subject to NGET's right to request tests or witness tests) should be extended offshore.

Offshore Technical Requirements based on Grid Code Subgroup Recommendations

3.32 The group was invited to review drafting proposed for placement within the STC which was intended to reflect recommendations made by the offshore Grid Code Subgroup. These recommendations were designed to set requirements at the onshore interface which, when combined with the recommended requirements for offshore users, meant that there was no net

change in technical requirements delivered at the onshore interface point from those currently placed upon a generator at its entry point. The specific recommendations were that:

- The reactive capability provided currently by onshore users should be delivered, entirely or in part, by the installation and continued operation of appropriate reactive equipment on the offshore transmission network with the necessary total capability measured at the onshore interface point;
- Offshore transmission equipment, particularly HVDC equipment, should facilitate the delivery of users' obligations in terms of fault ride through capability; and
- Offshore users connected via an HVDC network should be provided with appropriate data signals such that they can meet their frequency response obligations.

3.33 A mechanism for agreeing and setting the division of responsibilities for reactive power capability between the offshore generator and the OFTO was discussed. It was proposed that this could be fixed at the design stage, and that this could be stipulated within the Offshore TO Construction Agreement and hence reflected in the user's Ancillary Services Agreement.

3.34 The group were advised of differences between the proposed drafting and the comparable Grid Code drafting. These arise where Grid Code obligations are dependant on connection date (only the most recent criteria have been included in the proposed STC drafting), where clarification is required to relate to an offshore transmission system or where requirements are met through a transfer of power rather than power output.

3.35 The group was also informed that two versions of the drafting were required at this stage, reflecting the pre and post Grid Code amendment G/06 ("Power Park Modules and Synchronous Generating Units") versions of Grid Code drafting.

3.36 The group agreed that these new technical requirements, which stipulate the capabilities that an OFTO must provide, would be best placed within a new section in the STC, as there are no similar or related sections, both in style and content, within the STC at the moment.

STC Governance

3.37 NGET presented its thoughts on committee representation and voting as expressed in response to Ofgem's additional information request at the first February working group meeting. This incorporated working group deliberations and recommendations from the October working group sessions, which recognised the need to give new OFTOs appropriate representation in the management of the STC and to cater for the increased number of STC parties.

3.38 Proposals for new mechanisms were based on processes currently used in other industry codes. Proposed voting arrangements are based on the framework set out in the DCUSA for example, whilst the proposals for appointment of committee members are based on CUSC arrangements.

3.39 The working group agreed that that given an adequately representative committee constitution, STC Committee representatives should agree the appointment of a chairperson rather than requiring all STC Parties to agree.

3.40 Discussion and comments in these areas were then reflected in the proposals presented to the final working group meeting.

3.41 The STC committee and voting proposals are summarised as:

- STC Committee Membership Comprising of:
  - An Independent Chair;
  - 2 representatives of National Grid Electricity Transmission;
  - 2 representatives of Scottish Power Transmission;
  - 2 representatives of Scottish Hydro Electric Transmission;
  - 2 representatives of Offshore Transmission Owners; and
  - A Committee Secretary provided by National Grid Electricity Transmission.
- Election of OFTO representatives by OFTO parties;
- Up to 2 alternate members for each of NGET, SPT, SHETL and OFTOs;
- Appointment of a chair by committee members;
- Arrangements for resignation and replacement of committee members based on CUSC arrangements and including the use of alternates;
- Additional STC party attendance at meetings (without voting rights);
- Quorum requirements of one attendee from each of the NGET, SPT, SHETL, or OFTO party categories;
- Voting arrangements based on DCUSA arrangements as well as reflecting affected parties or party categories; and
- Provision for voting by all STC parties where deemed necessary.

3.42 A further proposal was agreed that STC Amendment proposals should be subject to a 2 to 4 week process whereby each STC party is invited, but not obliged, to provide its Analysis and Impact Assessment. The STC Committee would provide its own Analysis and Impact Assessment in conjunction with this.

3.43 The group also noted that certain aspects of the STC amendment process were set out within the Transmission Licences and would need to be reviewed as part of the Licensing working group being set up by Ofgem.

3.44 Detailed proposals are described in Appendix B to this report.

Accession to the STC

3.45 The requirements for accession to the STC have not been considered in detail to date as they have not been necessary onshore (current parties effectively acceded at BETTA go-active). The group were therefore asked to consider and develop a process for the accession of new OFTOs to the STC.

3.46 NGET presented a paper on accession, which looked at the obligations OFTOs would be expected to meet at key stages in the tender, bidder selection, design and construction process.

3.47 The group discussed the paper in the context of recent discussions regarding the OFTO selection process, and reached agreement based on assumptions on:

- The point at which licences would be awarded relative to the award of a tender and acceptance of a ‘final’ offer based on this tender by a generator; and
- The identification of a ‘Preferred Bidder’ through the tender process.

3.48 The group agreed that this early stage, essentially the appointment of an OFTO designate, would seem the logical time for an OFTO to accede to the STC. This approach would place relevant STC obligations unambiguously on OFTOs, including the requirement to draw up and comply with an Offshore TO Construction Agreement. This could minimise the overlap with specific aspects of any tender regulations and minimise the number of new provisions to be included in an Offshore TO Construction Agreement compared to a proposal where this was required prior to accession.

The STC Framework as Applied to Offshore Transmission

3.49 In response to the sixth item under Ofgem's additional information requests, NGET produced a paper setting out proposals for assessing and if necessary adapting the STC Framework and the obligations contained within for Offshore Transmission. The paper was drafted in the context of the CUSC obligations identified and discussed above as well as other relevant Transmission Licence and Grid Code obligations. The paper was presented to the first February Working Group Meeting.

3.50 The features described within the paper were intended to both define and secure the offshore transmission service required to enable National Grid to discharge its obligations to offshore users who are physically connected to parts of the GB Transmission System that are provided by another transmission licensee.

3.51 Proposals were formulated in the context of the differentiating factors between the existing onshore TOs and potential Offshore Transmission Owners which could necessitate a different approach from the current STC framework. These were described as:

- The Offshore Transmission Owner is building an entirely new and discrete network rather than expanding on existing service provisions;
- The Offshore Transmission Owner will not be subject to the regular price reviews which are performed on the existing TOs; and
- The Offshore Transmission Owner may not have a track record of delivering electricity infrastructure under the UK's legal and regulatory framework.

3.52 Working group members noted that NGET identified the following areas of the STC which need to be developed to cater for these differences:

- **The TO Construction Offer as applied to OFTOs** – the terms under which the OFTO delivers the offshore infrastructure required to deliver the user's connection including an OFTO Construction Agreement
- **Technical, design and operational Performance Criteria** - design criteria and technical specifications as applied to offshore transmission network
- **User and network interfaces** – information and agreements required to manage both onshore and offshore interfaces.
- **Service Capability Specification** – the enduring capability of the offshore network as delivered after design, construction and commissioning.
- **Availability and Performance Criteria** – agreed methodology for defining performance and availability measures in relation to Transmission Service Provisions.

- **TO Revenue** – collection of and any adjustments to OFTO revenue necessitated by the OFTO Incentive arrangements.

3.53 The paper highlighted that the STC provisions relating to investment planning will also need to be adapted for offshore transmission to reflect the fact that the Offshore Transmission Owner will not have ongoing investment planning responsibilities equivalent to those borne by onshore licensees but will be affected by third party works.

3.54 The paper stated that the provisions in the STC relating to offshore transmission could be specified in the STC, the STCPs or a bilateral agreement. Where provisions are generic to all OFTOs then these provisions could be defined within offshore transmission specific STCPs. Specific provisions would need to be defined in a bilateral agreement between NGET and the OFTO concerned. It was noted that the only bilateral agreement under the current STC framework was the TO Construction Agreement.

3.55 The group expressed a preference to include new provisions relating to offshore transmission in the current STC sections and STCPs and far as is possible.

3.56 The areas listed in paragraph 3.52 above were discussed in the two subsequent meetings. Technical, design and operational performance criteria have been discussed previously in this report as have issues relating to user and network interfaces**.**

3.57 Discussions and conclusions in the other 4 areas are summarised below**.**

The TO Construction Offer as Applied to OFTOs

3.58 The group noted the importance of the TO Construction Offer and the resulting TO Construction Agreement (TOCA) in the Offshore Transmission regime as this sets out the terms by which the offshore transmission infrastructure would be built which would in turn be reflected in NGET's construction agreements with users.

3.59 The group were asked if the existing onshore TOCA terms should be amended for offshore. The group did not suggest any specific adjustments, although it should be noted that this position was taken based on the discussion and assumptions summarised in this report (ie this assumes for example that OFTOs accede to the STC 'early' and that STCPs on construction and commissioning can be adequately applied to offshore developments).

3.60 The group were also asked to consider making the proforma compulsory. This would mean that bidders could not add their own variations to standard clauses.

3.61 The group concluded that the proforma was essential, both to provide new entrants a useful starting point and to ensure a degree of consistency in construction agreements. The group noted the need to reflect NGET's requirements, and reflect users requirements through these.

3.62 It was also noted that the turnaround time for a 'final' connection offer to a user following on from finalisation of OFTO selection had not been discussed. Therefore the time taken for NGET to process the construction agreement may not be a valid concern, although the issue of material inconsistency of offers to users connecting to different networks could arise. The group therefore did not

recommend that Offshore TOCAs should be restricted to the standard proforma terms.

3.63 The group also discussed whether all aspects of the TOCA needed to be agreed as part of the initial offer. The group agreed that some detail, which may be required to meet specific STC obligations but not required to construct an offer to a user (eg the provision of a full Service Capability Specification) could be added later.

Service Capability Specification/Availability and Performance Criteria

3.64 NGET highlighted that the concept of the Service Capability Specification as defined within the current STC will play essential role in the offshore transmission regime by:

- Defining the power transfer capability of the offshore network that NGET must operate within;
- Setting the expected reactive capability of the offshore network; and
- Setting out changes in offshore network capability relating to issues with secondary equipment (eg communications, control and protection equipment).

3.65 NGET also highlighted a desire to use the Service Capability Specification as a basis for availability and performance measure reported under the current Licence Conditions (C17) and to use the service capability specification to define measures for use in incentive or compensation arrangements if necessary. It was also highlighted that the Service Capability Specification was necessary to provide the base against which actual offshore transmission service delivery would be measured (ie the contracted capability).

TO Revenue

3.66 The group noted that current STC provides for payment of TO charges, but not for any adjustment of revenues. The group acknowledged that adjustments to TO revenue could be managed through the STC, but in its initial meetings expressed a preference that any adjustments to OFTO revenue are managed by adjusting allowed revenue in the OFTO licence.

3.67 The group was then asked to consider mechanisms within the STC for an OFTO to lodge securities with NGET (acting as GBSO) prior to completion of an offshore network. The group asked for more information on this requirement but suggested that STC Section E (Payments and Billing) could be modified to facilitate payment from an OFTO to NGET (if a payment was required) or to set out credit or securities arrangements, with reference to STC schedules as necessary.

3.68 The group was also asked to consider mechanisms within the STC for NGET to provide securities to OFTOs to cater for any eventuality where NGET failed to pay OFTO charges (given that OFTOs only source of income would be via NGET). The group questioned the need for such a facility but again suggested that STC Section E could be modified as necessary.

4. Conclusions and Recommendations

4.1 The group reached conclusions and recommendations in all the areas requested in its revised terms of reference.

4.2 The conclusions are based on a number of assumptions on policy proposals which are either under development or under consultation. However, the group considers that the recommendations are sufficiently robust to set out the next stage of work on the changes to the STC under the programme to develop offshore transmission arrangements.

4.3 The group therefore asks Ofgem and BERR to consider the following recommendations relating to the provisions of the STC for offshore electricity transmission.

Extension of the STC and STCPs to Offshore

4.4 Having reviewed the information presented to the group, members reached the conclusion that the majority of the rights, obligations and processes required to manage the delivery and enduring operation of offshore transmission networks were already set out within the current STC and that new requirements could be accommodated within the current structure.

4.5 Group members also highlighted the important role that TO construction agreements could have in the overall offshore regime by providing the link between an OFTO and NGET and hence from NGET to the user.

Recommendation 1: The existing STC framework of the STC (the Code) the STCPs (the Code Procedures) and bilateral TO Construction Agreements should be applied to Offshore Transmission subject to the inclusion of the new provisions recommended in this report.

Recommendation 2: The STC should be kept under review to take account of any new offshore related provisions in the CUSC which place new obligations on NGET which NGET is in turn reliant on an OFTO to satisfy.

Recommendation 3: The terms of a TO Construction Offer and Agreement as applied to offshore transmission (the “Offshore TOCO” and the” Offshore TOCA”) should be set out as proforma in the STC Schedules.

Recommendation 4: The detailed provisions relating to Offshore TO Construction Agreements should be developed to ensure that the rights and obligations of OFTOs and the other STC parties are clearly defined during the design, construction and commissioning of new offshore transmission infrastructure.

Recommendation 5: The Offshore TO Construction Agreement provisions should be developed such that they set out the consequences and actions to be taken in the event of relevant material variations in construction costs and timescales for offshore transmission networks.

Recommendation 6: The current STCPs should be adapted to apply offshore unless there is a compelling need to develop separate new STCPs.

Technical Requirements and Technical Compliance

4.6 The group considered the management of technical requirements ranging from high level design criteria to detailed equipment specification and performance characteristics. The following recommendations are based on the assumption that users will have an input into the development of the equipment specifications for the offshore network where it has an impact on them.

Recommendation 7: The STC should specify that all OFTO Plant and Apparatus conforms to appropriate generic standards, such as IEC or equivalent, and should be suitable for operation in a marine environment.

Recommendation 8: The STC provisions which set out the terms of a TO Construction Agreement as applied to offshore transmission should stipulate that OFTOs specify detailed equipment requirements at the offshore user interface.

Recommendation 9: The principles of the current STCPs covering construction, compliance and commissioning of TO equipment whereby:

a) the TO warrants that equipment, design and performance criteria are met by all new parts of the transmission system before they are put into operational service; and

b) STC parties co-ordinate all works;

should be applied to offshore transmission.

Recommendation 10: New requirements should be defined within the STC which replicate at the onshore network interface, the deliverables currently provided by TOs at the User interface.

Recommendation 11: The Grid Code Subgroup recommendations relating to reactive power, fault ride through and provision of data signals should be implemented in a new section of the STC.

Enduring Operation of an Offshore Transmission System

4.7 The group considered the provisions of the current STC and took account of the additional detail set out in the STCPs in concluding that the agreement between NGET and TOs as set out in the current STC framework could be applied to offshore transmission.

4.8 The group recommends the development of a number of additional features to ensure that the transmission service delivered by an OFTO in enduring operation is clearly defined and that its definition and delivery is identified as a specific deliverable during the design, construction and commissioning of new offshore transmission infrastructure.

Recommendation 12: The STC provisions which set out the terms of a TO Construction Agreement as applied to offshore transmission should stipulate the provision of a Service Capability Specification, at the appropriate level of detail in all design and construction timescales.

Recommendation 13: The required content of an offshore Service Capability Specification should be set out in new STCP provisions.

Recommendation 14: The existing STC mechanisms for the management of deviation of operational capability from the Service Capability Specification should be applied offshore.

STC Payment Provisions

4.9 The group determined that, if required, new payment and security provisions could be placed within Section E of the STC.

Recommendation 15: If deemed necessary, provisions for new charges and placement of securities relating to offshore transmission should be incorporated into Section E of the STC.

Governance

4.10 The group developed a set of proposals designed to allow new OFTOs to participate fully in the enduring development of the STC whilst managing the expected increase in number of parties involved. Detailed proposals are set out in Appendix B to this report. Some consideration could be given to simplifying these proposals after wider consultation.

Recommendation 16: The detailed voting and representation proposals set out in this report should be implemented in Section B of the STC.

4.11 The group agreed that OFTOs should accede to the STC as early as possible in their selection process, providing that there is reasonable certainty that they will be selected. The working group discussed this in terms of a 'Preferred Bidder' stage.

Recommendation 17: The STC should be developed such that prospective Offshore TOs can accede to the STC as soon as there is reasonable certainty they will be selected under the OFTO selection process (ie at 'Preferred Bidder' stage under current proposals and terminology).

Recommendation 18: The accession process for an 'OFTO designate' should be set out in an STC Schedule or an STCP.

Switching Responsibilities

4.12 Group members were asked to consider a proposal that the STC should accommodate two pre-defined operational models which would give prospective OFTOs a degree of choice in their enduring operational arrangements, subject to specific economic and technical considerations for individual developments, yet provide a uniform level of resilience in control capabilities. The majority of group members agreed to this proposal, whilst one explicitly disagreed after further consideration. One further group member asked that existing arrangements should be used as the basis of a default arrangement.

4.13 The working group chair is of the view that sufficient consideration has been given in this area to proceed on the basis of the proposal presented to the working group, as described in Recommendation 19 below. Further work will be required to develop detailed processes if they are required. Further consideration will also be necessary over how affected parties would be involved in the process used to select the appropriate operational model for individual developments.

Recommendation 19: The STC should accommodate two operational models for offshore transmission, one where all switching is performed by the OFTO with configuration of in service assets directed by NGET, and another where certain items of transmission equipment are operated directly by NGET, with commensurate contingency arrangements for OFTO control facilities under each option.

4.14 An alternative recommendation was formulated by Scottish Hydro-Electric Transmission Limited and is incorporated in this report as recommendation 20. Recommendation 19 and Recommendation 20 are mutually exclusive.

> **Recommendation 20**: The STC should accommodate a single operational model for offshore transmission the contents of which should be determined by a Working Group and that such a group be given sufficient time to debate and arrive at a workable model.

4.15 Recommendation 20 has not been subject to group comment or review and the working group chair's recommendation remains that expressed under Recommendation 19.

Appendix A Working Group Representatives

Meeting No. 3: Held on 5th February 2008 10:30 in Room 0.3, Lakeside House, Northampton

Present:	
Graham Stein	Working Group Chairperson
Lilian Macleod	Working Group Secretary
Mark Duffield	National Grid Electricity Transmission
Joe Dunn	Scottish Power Transmission Ltd
Paul Jones	E.ON
Bridget Morgan	Ofgem
Kenny Stott	Scottish Hydro-Electric Transmission Ltd
Chris Whitley	National Grid Electricity Transmission
Apologies:	
Ham Hamzah	RWE
Robert Longden	Airtricity
John Norbury	RWE
Bec Thornton	National Grid Electricity Transmission

Meeting No.4: Held on 12th February 2008 10:30 in Room 0.3, Lakeside House, Northampton

Present:	
Graham Stein	Working Group Chairperson
Bec Thornton	Working Group Secretary
Mark Duffield	National Grid Electricity Transmission
Joe Dunn	Scottish Power Transmission Ltd (via teleconference)
Paul Jones	E.ON
Bridget Morgan	Ofgem
Kenny Stott	Scottish Hydro-Electric Transmission Ltd
Neil Sandison	Scottish Hydro-Electric Transmission Ltd
Chris Whitley	National Grid Electricity Transmission
Apologies:	
Ham Hamzah	RWE
Robert Longden	Airtricity
John Norbury	RWE

Meeting No.5: Held on 22nd February 2008 10:30 in Room 3.1, Lakeside House, Northampton

Present:	
Graham Stein	Working Group Chairperson
Mark Duffield	National Grid Electricity Transmission
Joe Dunn	Scottish Power Transmission Ltd
Paul Jones	E.ON
Bridget Morgan	Ofgem
Kenny Stott	Scottish Hydro-Electric Transmission Ltd (via teleconference)
Chris Whitley	National Grid Electricity Transmission
Robert Longden	Airtricity
Antony Johnson	National Grid Electricity Transmission
Apologies:	
Ham Hamzah	RWE
John Norbury	RWE
Bec Thornton	Working Group Secretary

Appendix B Committee Membership and Voting Proposals

System Operator – Transmission Owner Code (STC) Governance

Policy Recommendations

Purpose of this Paper

This paper aims to set out the key recommendations of the Offshore STC Working Group regarding the changes to Section B – Governance of the STC. The areas it examines and puts forward policy proposals on are as follows:

- STC Committee Membership and Introduction of Alternates
- Appointment of the STC Committee Chairperson
- Appointment of STC Committee Members
- Arrangements for the Resignation / Replacement of Committee Members
- Attendance by persons at the STC Committee
- Quorum arrangements
- Voting arrangements for matters put before the STC Committee including STCP Amendment Proposals
- Revised process for the assessment of STC Amendment Proposals

Detailed Policy Proposals

STC Committee Membership

The recommendation of the Offshore STC Working Group is that the STC Committee be reconstituted as follows:

- An Independent Chair
- 2 Representatives of National Grid Electricity Transmission plc
- 2 Representatives of SP Transmission Ltd
- 2 Representatives Scottish Hydro Electric Transmission Ltd
- 2 Representatives of Offshore Transmission Owners
- A Committee Secretary to be provided by National Grid Electricity Transmission

The above effectively represents the existing STC Committee membership with the addition of two further members for Offshore Transmission Owners (OFTOs). The representatives of NGET SPT and SHETL will continue to be through nominations from each company while the OFTO Representatives will be elected through a more formal election amongst OFTO Parties to the STC.

In tandem to the above reconstitution of the STC Committee it is proposed that each of NGET, SPT, SHETL and the OFTOs each have up to 2 Alternate members upon which to call should one or both of their Committee representatives be unable to attend a meeting of the STC Committee. The reason for this more formal approach is linked into the voting changes below that extend the 1 Party, 1 vote principle within the existing STC to 1 committee representative, 1 vote in this policy recommendation.

Appointment of STC Committee Chair

The Committee Chair is currently appointed “annually and with the agreement of all the Parties” clearly under the Offshore regime this will be difficult to ensure given the larger numbers of parties to the STC that are anticipated. Therefore the policy recommendation

is that rather than appoint the Chair through the agreement of all the STC Parties, the Chair will be appointed by the representatives of the STC Committee. This will be through an annual agreement or if needed vote at the appropriate STC Committee meeting. Any informal agreement such as the one currently in place at the STC Committee that sees the Chair rotate between the existing parties each year could still be made by the Committee.

Appointment of STC Committee Members and Alternates

The STC Committee members are now recommended to be appointed through two routes. The Committee Members and Alternates for the existing Onshore Parties, SHETL, SPT and NGET will continue to be appointed through nominations from each company to the STC Committee Secretary. The positions for Committee Representatives for the OFTOs will however be filled through elections.

The election process to be held annually will mirror that process for the CUSC (which is contained in Annex 8A to the CUSC). A similar process is to be codified within an annex to section B of the STC with the following key aspects:

- The STC Committee Secretary shall draw up a list of candidates (who have put forward themselves for election as an OFTO representative)
- The STC Committee Secretary shall then send out voting forms to all eligible OFTO parties to the STC.
- OFTO Parties shall if they vote return their forms indicating their first, second and third preference votes for the candidates for OFTO Committee representative.
- There shall be three voting rounds and candidates exceeding the threshold number of votes in each round shall be elected until the 2 OFTO representative posts have been filled. The two Alternate Committee representatives shall then be the candidates receiving the next two highest numbers of votes in the election.
- NB If there are either one or two nominations for the 2 OFTO representatives then those nominated shall automatically be appointed as the OFTO representative(s) and in those circumstances there will be no Alternate OFTO Representatives.

Arrangements for the Resignation and Replacement of STC Committee Members

It is recommended that section B, paragraph 6 will require additional provisions to deal with the resignation/removal of Committee Members. Due to the differing nature of election to the committee between representatives there will also be differences between the methods of replacement of Committee representatives.

- Members appointed by National Grid, SPT or SHETL may be removed by their nominating company at any time by giving notice to the Committee Secretary
- Members representing Offshore Transmission Licensees shall cease to be a Committee member if any of the following circumstances arise (list adapted from CUSC 8.5.1):

  a) upon expiry of his term of office unless re-appointed;
  b) if he:
     i) resigns from office by notice delivered to the Committee Secretary;
     ii) becomes bankrupt or makes any arrangement or composition with his creditors generally;
     iii) is or may be suffering from mental disorder and either is admitted to hospital in pursuance of an application under the Mental Health Act 1983 or the Mental Health (Scotland) Act 1960 or an order is made by a court having jurisdiction in matters concerning mental disorder for his

detention or for the appointment of a receiver, *curator bonis* or other person with respect to his property or affairs;

iv) becomes prohibited by law from being a director of a company under the Companies Act 1985;

v) dies; or

vi) is convicted on an indictable offence; or

c) should the member change employer and not provide to the STC Committee Secretary within 60 days a letter from his new employer confirming that his employer agrees that they may act as a Committee Member

d) if the STC Committee resolves (and the Authority does not veto such resolution by notice in writing to the Committee Secretary within 15 Business Days) that he should cease to hold office on grounds of his serious misconduct;

e) if the STC Committee resolves (and the Authority does not veto such resolution by notice in writing to the Committee Secretary within 15 Business Days) that he should cease to hold office due to a change in employer notwithstanding the fact that the new employer may have given their permission for that Committee Member to continue as a Committee Member.

In the event that a Committee Member representing offshore transmission licensees ceases to become a member then:

- an existing Alternate may be nominated by the outgoing representative as their replacement until the next annual election; or
- the alternate who received the most votes at the previous selection round would become a Committee Member until the mext annual election.

Attendance at Meetings

In line with the precedent established at other representative Panels it is proposed that section B paragraph 6.1.6 be amended to allow a single representative of any STC Party to have the same rights to attend (but not vote at, or be considered a Party Representative at) any STC Committee meeting.

Quorum Arrangements

The provisions for establishing a quorum at STC Committee meetings shall be amended such that a quorum exists where:

- At least one person representing NGET is present either in person or by teleconference
- At least one person representing Onshore Transmission Licensees is present either in person or by teleconference
- At least one person representing Offshore Transmission Licensees is present either in person or by teleconference

A quorum can still be established where the matters to be discussed at a committee meeting do not materially affect a group of parties and the committee members representing those parties notify the committee secretary that they do not wish to attend the committee meeting. In such cases provided at least one person representing the remaining groups of parties is present a quorum will be established.

Likewise in the scenario where there are no representatives appointed / elected to represent NGET and/or Onshore TOs and/or Offshore Transmission Licensees a quorum can still be formed provided at least one person from each of the other categories attends in person or by teleconference (subject of course to the above caveat that persons need not attend if the matters put to the STC Committee do not materially affect them).

Voting arrangements for matters put before the STC Committee including STCP Amendment Proposals

The recommendation of the STC Working group is that the existing process for putting matters to a vote at a STC Committee meeting be enhanced to include a mechanism for getting the views of all STC Parties.

The existing voting mechanism within the STC states that a matter put to the vote will be approved if there is a unanimous view in favour of it amongst all the STC parties (all of whom currently have a representative(s) at the STC Committee); the most common matter that is put to a vote at an STC Committee meeting being the approval (or otherwise) of proposed amendments to the STCPs.

It is proposed to replace this with mechanism with one that still allows the STC Committee the opportunity to unanimously approve a motion put to a vote but also allow, either where unanimous approval is not forthcoming or where the STC Committee believe it would be better to seek the views of all STC Parties to put the matter out to a more encompassing vote.

The voting mechanism would therefore proceed according to the following key steps:

Step 1: STC Committee members decide which Parties or "Party Categories" are affected by the matter being put to the vote. A Party Category can be one or more from:

- NGET
- SPTL
- SHETL
- Offshore TOs

Step 2: Once the Affected Parties/Party Categories are identified then the STC Committee may decide to either

(a) vote on the matter at that Committee Meeting
(b) put the matter straight out to a wider vote amongst STC Parties

Step 3a: In the event that the STC Committee decides that the matter is to be voted upon at the Committee, all Committee representatives present who represent either the STC Party(s) or Party Categories affected by the matter being voted upon shall cast one vote each. The matter which is being voted upon shall be deemed approved if there is a unanimous approval of the motion (for the avoidance of doubt any abstention shall be taken as a vote to approve the matter being voted upon). Otherwise the matter shall be deemed rejected. Where parties are not represented at a committee meeting as they did not attend because issues on the agenda did not impact on them, then no new issues should be voted on with out consulting the absent party category representatives.

Step 3b: Should the STC Committee decide that a matter should proceed to a wider vote amongst STC Parties or if the STC Committee Representatives having voted on a matter and not reached unanimous agreement then the following voting process (based upon the DCUSA voting process) shall be invoked:

As per the model in the DCUSA, parties with similar interests are grouped into Party Categories. For the STC under an Offshore Transmission regulatory framework it is proposed to establish the following Party Categories – i.e.

1. NGET
2. SPTL

3. SHETL
4. Offshore TOs

Within a Party Category individual Parties who are affiliated within the same corporate group will be classified as a single "Group" for the purposes of the voting and will receive a single vote for the corporate group again in a similar manner to that under DCUSA governance.

For matters put to a vote the following principles would then apply:

1. Where a matter is put to a vote, the STC Committee will decide which Party Categories are affected by the matter being voted upon – i.e. the "Affected Party Categories". In the absence of any such agreement Ofgem would be asked to decide the Affected Party Categories.
2. Each Group within an Affected Party Category will be sent a voting form setting out the decision to be taken
3. Each Group would have a number of days (as determined by the STC Committee and set out on the voting form) to return its vote.
4. Each Affected Party Category would approve the matter being voted upon if more than 65%[2] of the Groups who vote[3] within an Affected Party Category, vote to approve the matter, otherwise the Party Category will be deemed to reject the proposal.
5. The matter being voted upon will be deemed to be approved if **all** Affected Party Categories vote to approve the changes, otherwise it shall be deemed rejected.

Alongside the above provisions an additional provision within the DCUSA is also proposed to be adopted and adapted for use within the STC. This provision states where all Groups within an affected Party Category decline to vote then the overall decision on whether to approve or reject a matter is made solely by reference to those Party Categories where votes were received. Although it is felt unlikely that any of the three constituencies would not vote on an issue affecting them this mechanism has been included in the proposal to effectively provide a safety net.

Characteristics of the Proposed Voting Mechanism

The above mechanism would have the following characteristics:

- It would ensure that all OFTOs remain enfranchised by the voting process, overcoming one of the concerns voiced at the STC Working group that if the representatives of OFTOs at the STC Committee were to vote for a STCP Amendment (for example) this could be against the wishes of a number of other OFTOs (in theory possibly a majority of OFTOs).
- By grouping Parties according to corporate group it removes the likelihood that one company winning several OFTO tenders finds itself in the position where it has absolute voting control over the decision of the OFTO Party Category due to the fact it owns more that 65% of the STC Parties in the OFTO Party Category.
- Both National Grid and the Onshore TOs (assuming their number remains at 2) would retain their existing voting rights and so their views on future matters would not be diluted even where there may be significantly larger numbers of OFTOs.

[2] Note that the 65% threshold mirrors that for Part 2 matters in the DCUSA. The DCUSA voting process also contains a threshold for Part 1 matters of 50%. The 65% figure has been chosen for the STC as all matters put before a vote are those for which the STC has sole jurisdiction, for example the approval of amendments to STCPs. Therefore such matters are analogous to Part 2 matters in the DCUSA.

[3] Note here that if a Party does not vote then they are not included in the consideration of whether a motion put before a vote is passed or otherwise. For the avoidance of doubt there is no such concept of a non-vote being counted either as a vote for or a vote against the proposal. It is effectively an abstention.

- The above mechanism could be adapted to provide recommendations for amendments to the STC should the STC ever become one of the designated codes where Authority decisions on amendments can be referred to the Competition Commission for review.

Revised process for the assessment of STC Amendment Proposals

The STC Amendment process set out in the STC places a reliance on the joint assessment of the proposed amendment by all STC Parties; a diagram representing the existing process is attacheded to this paper.

Moving forward into an offshore transmission context with increasing numbers of STC parties the STC Amendment process is likely to become increasingly unmanageable if a joint assessment involving every STC Party is required for each STC Amendment. To manage this, a more consultative process will be employed one that is closer in nature to that within the CUSC.

To this end the following key changes to the assessment process for STC Amendment Proposals are recommended by the Offshore STC Working Group:

Evaluation Phase

The existing provisions allow for each STC Party in a Working Group to propose an Alternative Amendment. This will be amended to allow each Working Group member to propose an Alternative Amendment if they wish to.

Assessment and Report Phase

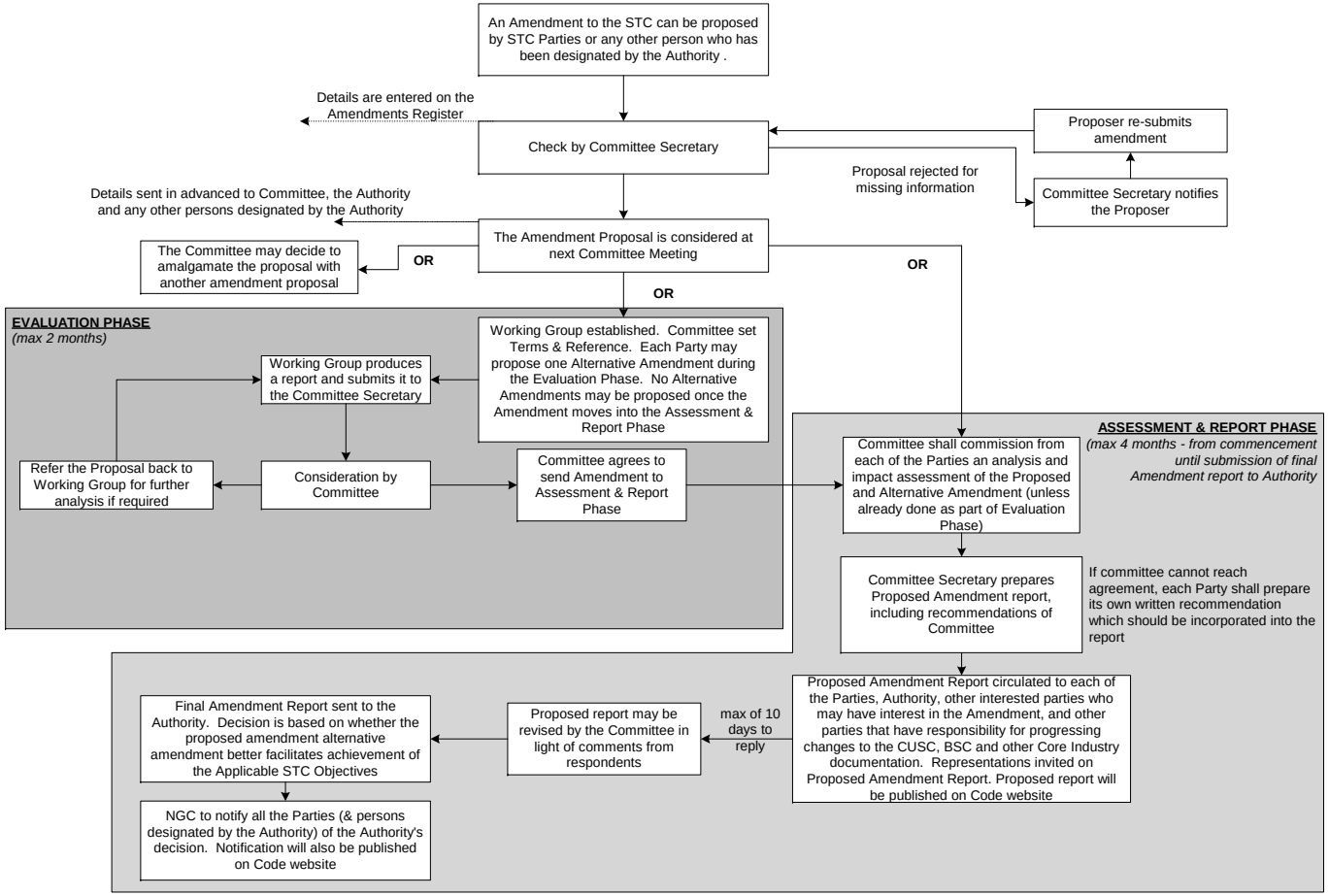
At present the Committee is obliged to commission from each STC Party and analysis and impact assessment of the impact of the proposed amendment on its transmission system and other systems. These are then included in the Draft Amendment Report circulated to authorised electricity operators for consultation. Moving forward it is recommended that the Proposed Amendment Report contain an analysis and impact assessment undertaken by the STC Committee (representing the committee's view) alongside the Analysis and Impact Assessments performed by any STC Party who wishes to do so. The Proposed Amendment report would then be issued for industry consultation and response.

In the final Amendment Report that is submitted to the Authority for decision, the responses received through the industry consultation will continue to be included (as they are now) in effect allowing STC Parties a further opportunity to express their views on an amendment proposal.

STC Committee Recommendation

The STC Committee is also obliged to place with the Amendment Report submitted to the Authority either its collective recommendation on whether the proposed amendment should be made or if it cannot agree the recommendation of each Party. Again it is proposed that instead of each Party putting forward its recommendation (which each Party can do through its formal response to the wider industry consultation or indeed through its analysis and impact assessment) instead each Committee Representative can put forward their recommendation. Again in practice it would be envisaged that this would result in a recommendation from each of NGET, SPT, SHETL and the Offshore Transmission Owner Representatives.

Addendum


An Amendment to the STC can be proposed by STC Parties or any other person who has been designated by the Authority .
Details are entered on the Amendments Register
Check by Committee Secretary
Proposer re-submits amendment
Proposal rejected for missing information
Committee Secretary notifies the Proposer
Details sent in advanced to Committee, the Authority and any other persons designated by the Authority
The Amendment Proposal is considered at next Committee Meeting
The Committee may decide to amalgamate the proposal with another amendment proposal
OR
OR
OR
EVALUATION PHASE
(max 2 months)
Working Group established. Committee set Terms & Reference. Each Party may propose one Alternative Amendment during the Evaluation Phase. No Alternative Amendments may be proposed once the Amendment moves into the Assessment & Report Phase
Working Group produces a report and submits it to the Committee Secretary
Refer the Proposal back to Working Group for further analysis if required
Consideration by Committee
Committee agrees to send Amendment to Assessment & Report Phase
ASSESSMENT & REPORT PHASE
(max 4 months - from commencement until submission of final Amendment report to Authority
Committee shall commission from each of the Parties an analysis and impact assessment of the Proposed and Alternative Amendment (unless already done as part of Evaluation Phase)
Committee Secretary prepares Proposed Amendment report, including recommendations of Committee
If committee cannot reach agreement, each Party shall prepare its own written recommendation which should be incorporated into the report
Proposed Amendment Report circulated to each of the Parties, Authority, other interested parties who may have interest in the Amendment, and other parties that have responsibility for progressing changes to the CUSC, BSC and other Core Industry documentation. Representations invited on Proposed Amendment Report. Proposed report will be published on Code website
max of 10 days to reply
Proposed report may be revised by the Committee in light of comments from respondents
Final Amendment Report sent to the Authority. Decision is based on whether the proposed amendment alternative amendment better facilitates achievement of the Applicable STC Objectives
NGC to notify all the Parties (& persons designated by the Authority) of the Authority's decision. Notification will also be published on Code website

Appendix C STC Drafting as a Consequence of the Offshore Grid Code Subgroup Recommendations

Overview of Drafting Methodology

The Offshore Grid Code Subgroup made a number of recommendations that impacted upon the SO-TO Code. These were intended to ensure that the relevant technical requirements applicable to Offshore Transmission Networks that are needed to facilitate the technical requirements in the Grid Code Connection Conditions were backed off in the STC. The major areas highlighted were:

- The obligation on the Offshore TO (OFTO) to provide a Reactive Power capability and Voltage Control.
- The obligation on the OFTO to provide a Fault Ride Through capability should it operate a HVDC network
- The obligation on the OFTO should it operate a HVDC network to install damping facilities for its DC Converters
- The obligation on an OFTO where it operates a HVDC network to pass to any generators connected to its network a signal indicating the system frequency of the Main Interconnected Transmission System onshore.

In addition Appendix 1A noted that a number of other obligations in the Connection Conditions, specifically in CC.6.3 should also be backed off onto Offshore HVDC Transmission Networks. These include:

- CC.6.3.3 – Active Power transfer for falling system frequency
- CC.6.3.11 – Neutral Earthing
- CC.6.3.12 – Frequency Sensitive Relays
- CC.6.3.13 – Plant Protection under extreme frequencies

For drafting purposes these obligations have been set out in a new “Section K” of the STC. The eventual location for the obligations is yet to be finalised however and may ultimately be nested within existing sections of the STC, possibly Section C. Any new STC definitions that have been introduced as a consequence of this drafting are highlighted in bold italics in this drafting. A table of proposed new STC definitions is also attached to this drafting.

Throughout the drafting references are made to the equivalent Grid Code clauses which have been backed off in this drafting. It should be noted that Grid Code Consultation G/06 proposes a number of changes to the Grid Code connection conditions that form the basis of this STC drafting. Therefore should the G/06 changes be approved by the Authority it is anticipated that this STC drafting will be updated to reflect those changes.

The drafting has been taken forward under the same assumptions as the Offshore Grid Code drafting, with a key assumption being that only radial Offshore Transmission to Onshore Transmission Connections are considered. Inevitably there are certain issues within the text relating to Embedded Transmission that are as yet unresolved. Where these occur a note is made in the drafting.

Reactive Power Drafting Methodology

The methodology used in the drafting is that the OFTO must provide a reactive range of 0.95pf leading and 0.95pf Lagging at the Interface Point. In the current Grid Code

where the reactive range requirements are placed entirely on generating units this range is expressed on the Rated MW output of the generating unit. In the case of an OFTO the concept of Rated MW is not directly comparable and so therefore a new parameter has had to be utilised in the drafting.

This parameter has been called the Interface Point Capacity. This parameter is meant to represent the total maximum active power export (measured at the Interface Point, a new term developed through the Grid Code drafting to represent the point of connection between the Offshore TO and Onshore TO) of all Power Stations connected to the Offshore Transmission System concerned. It is at this figure that the reactive range of 0.95pf leading / 0.95pf lagging is stated. The reactive range obligations then follow the existing obligations for non-synchronous generators and Power Park Modules in the Grid Code.

In addition the Grid Code clauses relating to voltage control have also been incorporated within the STC to apply to the OFTO at the Interface Point.

Fault Ride Through Methodology

The Fault Ride Through drafting has effectively mirrored the obligations for Generating Units and Power Park Modules to be found in the Grid Code section CC.6.3.15 and Appendix 4 to the Connection Conditions. The new text though lengthy is effectively as in the Grid Code. The changes made are predominantly to replace references to Generating Units or Power Park Modules with references to Offshore Transmission Systems. Also references to Connection Point are replaced with references to the Interface Point. Clauses within the Grid Code that have been removed are specifically those that dealt with transitional issues for older Power Park Modules and are not applicable for transfer to the newly built Offshore Transmission Systems.

The term “Supergrid Voltage” is currently utilised in the drafting for the Fault Ride through provisions. This term is under review as a consequence of the Offshore Grid Code drafting and may be subject to change as a result. If it does change then these STC provisions will be similarly updated.

Additionally there are a number of references to clauses within CC.6.1 of the Grid Code which sets out the capabilities and operating range of the GB transmission system both generally and specifically that Users could expect at their Connection Site. Where clauses in the Grid Code refer to generic capabilities so the reference to the Grid Code within this STC drafting has been retained; in other areas where the specific relationship between a User and the GB Transmission System at a Connection Site was referenced this text has been brought into this STC drafting (largely as extra definitions) and re-formulated as applying to OFTOs at the Interface Point.

Additional Damping for DC Converters

This section has been drafted to reflect the requirements currently within the Grid Code CC.6.3.16 that are applicable to owners of DC Converters onto owners of HVDC Offshore Transmission Systems.

Frequency Capabilities and Signal Methodology

The Offshore Grid Code subgroup recommended that the obligations contained in CC.6.3.3 relating to maintaining Active Power transfer in light of changes to the

System Frequency be extended to Offshore HVDC Transmission Systems. As such equivalent provisions have been incorporated within this STC drafting.

Another one of the key recommendations from the Offshore Grid Code Subgroup was that owners of HVDC Offshore Transmission Systems should be obliged to provide each generator connected to its system with a signal of the onshore frequency. This signal would then allow the offshore generating units connected to that offshore HVDC transmission system to provide a frequency response service in line with their obligations under the Grid Code Connection Conditions and BC3.

Neutral Earthing

Finally provisions equivalent to CC.6.3.11 regarding neutral earthing of transformers have also been included within this drafting, again following on from a direct recommendation of the Offshore Grid Code Subgroup.

Draft STC Provisions

Two sets of draft STC requirements are provided in the following sections, including some explanatory comments.

The first of these is based on current Grid Code requirements, the second being based on the new requirements set out in Grid Code amendment G/06. Subsequent changes to the Grid Code may need to be reflected in subsequent STC drafting.

Note that this drafting reflects the Grid Code prior to modifications proposed under Grid Code Consultation G/06.

SECTION K: OBLIGATIONS UNIQUE TO OFFSHORE TRANSMISSION NETWORKS

PART ONE: TRANSMISSION SERVICES

1. INTRODUCTION

1.1 This Section K, Part One deals with the provision of certain services by ***Offshore Transmission Owners*** to NGET, and sets out:

1.1.1 the process for each ***Offshore Transmission Owner*** to provide a reactive capability and a voltage control capability at the ***Interface Point***;

1.1.2 the obligation on each ***Offshore Transmission Owner*** to ensure that its ***Offshore Transmission System*** has a Fault Ride Through Capability,

1.1.3 the obligation on each ***Offshore Transmission Owner*** who owns an ***Offshore Transmission System*** which includes a DC Converter to provide additional damping facilities for DC Converters forming part of that ***Offshore Transmission System***,

1.1.4 the process for each ***Offshore Transmission Owner*** who owns an ***Offshore Transmission System*** which includes a DC Converter to provide a signal indicating the Frequency of the ***Onshore Transmission System*** to each User who owns a ***Offshore Power Station*** connected to that ***Offshore Transmission System*** and to ensure that the ***Offshore Transmission System*** can operate robustly under a range of System Frequencies, and;

1.1.5 the obligation on each ***Offshore Transmission Owner*** to ensure that any transformers forming pat of that Offshore Transmission System are capable of being neutrally earthed.

2. REACTIVE CAPABILITY AND VOLTAGE CONTROL

2.1 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*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an onshore Distribution System). With all plant in service, the Reactive Power limits defined at the ***Interface Point Capacity***

Comment [M1]: Section backs off the requirements of CC.6.3.2 (c) (part).
CC.6.3.2 (b) back-off not required as (b) is the default should the capability of CC.6.3.2 (c) not be required.

(a) 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 and / or,

(b) 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 / or,

With all Plant in service the Reactive Power limits 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 ***Interface Point Capacity*** at leading Power Factor down to 20% Active Power transfer is specified in the Service Capability Specification.

2.2 Each ***Offshore Transmission System*** shall be capable of contribution to voltage control by continuous changes to the Reactive Power supplied at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an onshore Distribution System).

2.3 In the case of an ***Offshore Transmission System*** a continuously acting automatic control system is required to provide control of the voltage at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an Onshore Distribution System) without instability over the entire operating range of the ***Offshore Transmission System***. When transferring Active Power equivalent to less than 20% of the **Interface Point Capacity** the automatic control system may continue to provide voltage control utilising any available reactive capability. If voltage control is not being provided, the automatic control system shall be designed to ensure a smooth transition between the shaded area bounded by CD and the non-shaded area bound by AB in Figure K1 below. The performance requirements for this automatic control system will be specified in the Services Capability Specification.

Comment [M2]: Assumption that the SCS will be the appropriate place to place any variations to the standard reactive requirements. May be superseded by any contractual agreement between the OFTO and the GBSO developed through the Offshore Transmission Project (STC Working Group)

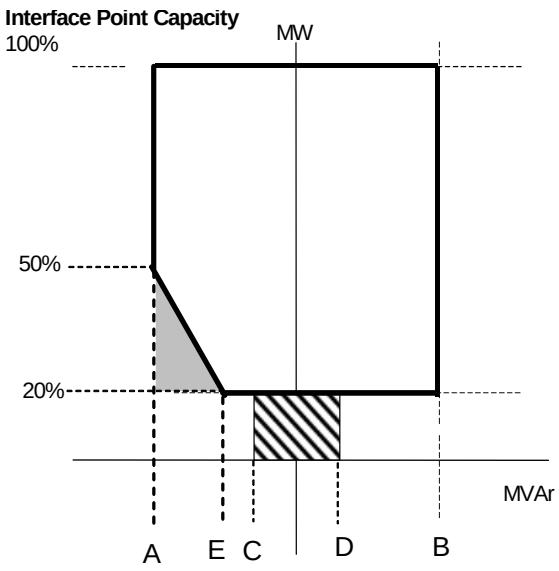
Comment [M3]: Back off of CC.6.3.6 (b)

Comment [M4]: Back off of CC.6.3.8 (c) and also remainder of CC.6.3.2 (c)

Comment [M5]: NB. This text is not a direct back off from the equivalent Grid Code text but has been added for clarity of the obligations.

Comment [M6]: Assumption that the SCS will be the appropriate place to place any variations to the standard reactive requirements. May be superseded by any contractual agreement between the OFTO and the GBSO developed through the Offshore Transmission Project

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***.

2.4 The requirement for 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 Services Capability Specification.

Comment [M7]: Back off of CC.6.3.8 (b).

Comment [M8]: Could be replaced by any contractual agreement between the GBSO and OFTO

2.5 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 Services Capability Specification. Operation of such facilities will only be in accordance with instructions to direct the configuration of the GB Transmission System as given by NGET.

Comment [M9]: CC.6.3.8 (d) back-off.

Comment [M10]: Could be replaced by any contractual agreement between the GBSO and OFTO

2.5 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.

Comment [M11]: This drafting is dependent on the switching model adopted in the STC for Offshore Transmission Systems; an issue discussed at the STC Working Group meetings

Comment [M12]: Back off of CC.6.3.4

3 FAULT RIDE THROUGH CAPABILITY

3.1 Fault Ride Through

Comment [M13]: Back off of CC.6.3.15

(a) Short circuit faults at Supergrid Voltage up to 140ms in duration

(i) Each ***Offshore Transmission System*** shall remain transiently stable and connected to the remainder of the Total System at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an Onshore Distribution System) 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 Services Capability Specification. Following fault clearance, recovery of the Supergrid Voltage to 90% may take longer than 140ms as illustrated in Appendix A Figures A.1.1 (a) and (b).

Comment [M14]: NB. Includes Embedded Transmission by default

Comment [M15]: Interface Point not currently defined to include Embedded Transmission.

Comment [M16]: Query over treatment of Embedded Transmission

Comment [M17]: Could be replaced by any contractual agreement between the GBSO and OFTO

(ii) Each ***Offshore Transmission System*** shall be designed such that upon both clearance of the fault on the GB Transmission System as detailed in 3.1 (a) (i) and within 0.5 seconds of the restoration of the voltage at the ***Interface Point*** to be within the ***Normal Operating Range*** (or within 0.5 seconds of restoration of the voltage at the ***Distribution System Entry Point*** to 90% of nominal or greater if Embedded), Active Power transfer 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 (a) (i) each ***Offshore Transmission System*** shall generate maximum reactive current without exceeding the transient rating limit at the ***Interface Point***.

Comment [M18]: May need to be reworded in line with any future Embedded transmission recommendations

(iii) Each DC Converter forming part of an ***Offshore Transmission System*** shall be designed to meet the Active Power recovery characteristics as specified in the Services Capability Specification upon clearance of the fault on the GB Transmission System as detailed in 3.1 (a) (i).

Comment [M19]: Query wording appropriate for HVDC Offshore systems?

Comment [M20]: May be superseded by any contractual agreement between the GBSO and OFTO

(b) Supergrid Voltage dips greater than 140ms in duration

In addition to the requirements of 3.1 (a) each ***Offshore Transmission System*** shall:

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

Comment [M21]: Again covers Embedded Transmission

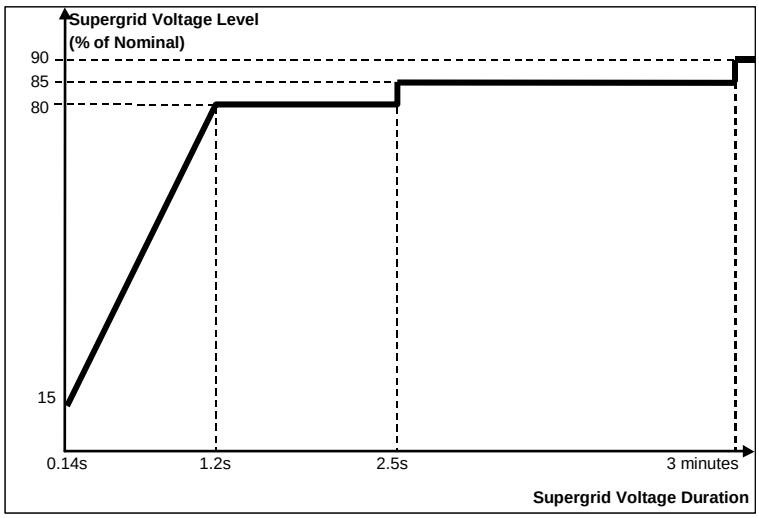


Figure K2

(ii) provide Active Power transfer, during Supergrid Voltage dips as described in Figure K2, at least in proportion to the retained balanced voltage at the ***Interface Point*** (or the retained balanced voltage at the ***Distribution System Entry Point*** if Embedded) 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 that restricts the Active Power transfer below this level. In addition during the voltage dip each ***Offshore Transmission System*** shall generate maximum reactive current at the ***Interface Point*** (or the ***Distribution System Entry Point*** if Embedded); and,

Comment [M22]: Query treatment for Embedded transmission

(iii) restore Active Power transfer, following Supergrid Voltage dips as described in Figure K2, within 1 second of restoration of the voltage at the ***Interface Point*** to be within the ***Normal Operating Range*** (or within 1 second of restoration of the voltage at the Distribution System Entry Point to 90% of nominal or greater if Embedded), to at least 90% of the level available immediately before the occurrence of the dip except in the case of ***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 below this level.

Comment [M23]: Query for Embedded Transmission

(c) Other Requirements

(i) 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.

(ii) To avoid unwanted island operation, ***Offshore Transmission Systems*** connected to ***Onshore Systems*** in Scotland shall be tripped for the following conditions:-

(1) Frequency above 52Hz for more than 2 seconds

(2) Frequency below 47Hz for more than 2 seconds

(3) Voltage as measured at the ***Interface Point*** or ***Distribution System Entry Point*** below 80% for more than 2 seconds

Comment [M24]: Query over treatment of Embedded Transmission

(4) Voltage as measured at the ***Interface Point*** or ***Distribution System Entry Point*** above 120% (115% for 275kV) for more than 1 second.

Comment [M25]: Query over treatment of Embedded Transmission

The times in sections (1) and (2) are maximum trip times. Shorter times may be used to protect the integrity of an ***Offshore Transmission System*** or Power Stations connected to it.

Comment [M26]: Back off of CC.6.3.16

4 ADDITIONAL DAMPING CONTROL FACILITIES FOR DC CONVERTERS

4.1 ***Offshore Transmission Owners*** who own ***Offshore Transmission Systems*** that contain DC Converters must ensure that any of their DC Converters will not cause a sub-synchronous resonance problem on the Total System. Each DC Converter is required to be provided with sub-synchronous resonance damping control facilities.

4.2 Where specified in the Services Capability Specification, each 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.

Comment [M27]: May be superseded by the contractual agreement between the GBSO and OFTO

5. FREQUENCY CAPABILITES AND SIGNALS

Comment [M28]: Back off of Frequency Signal recommendations

5.1 Each ***Offshore Transmission Owner*** in respect of each of its ***Offshore Transmission Systems*** which include a DC Converter 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 at which the ***Onshore Transmission System*** is operating.

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 Services Capability Specification.

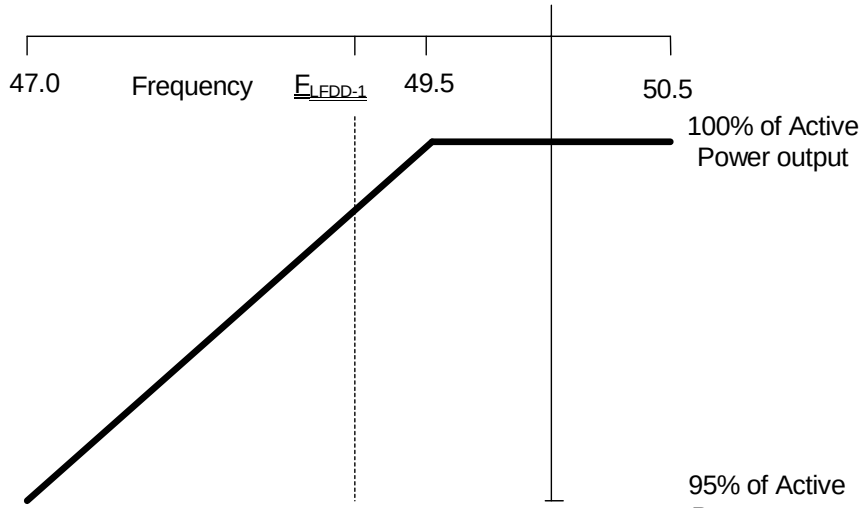
Comment [M29]: May be superseded by any contractual agreement between the GBSO and each OFTO

5.3 Each ***Offshore Transmission Owner*** in respect of each of its ***Offshore Transmission Systems*** which include a DC Converter must be capable of

Comment [M30]: Back off of CC.6.3.3

(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 2

(c) For the avoidance of doubt in the case of a ***Offshore Transmission Systems*** that contains DC Converters to which Generating Units using an Intermittent Power Source are connected where the mechanical power input will not be constant over time, the requirement is that the Active Power transfer shall be independent of System Frequency under (a) above and should not drop with System Frequency by greater than the amount specified in (b) above.

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*** which includes a DC Converter or any constituent element must continue to operate within this Frequency range for at least the periods of time given in Grid Code CC.6.1.3 unless NGET has agreed to any Frequency-level relays and/or rate-of-change-of-Frequency relays which will trip such ***Offshore Transmission System*** which includes a DC Converter and any constituent element within this Frequency range, under the Services Capability Specification.

Comment [M31]: Back off of CC.6.3.12

Comment [M32]: May be superseded by any contractual agreement between the GBSO and OFTO

5.5 ***Offshore Transmission Owners*** who own ***Offshore Transmission Systems*** which include a DC Converter will be responsible for protecting all their 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.

Comment [M33]: Back off of CC.6.3.13

6. NEUTRAL EARTHING

6.1 At nominal System voltages of 132kV and above the higher voltage windings of a transformer(s) 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 GB Transmission System at nominal System voltages of 132kV and above.

Comment [M34]: Back off of CC.6.3.11

APPENDIX A

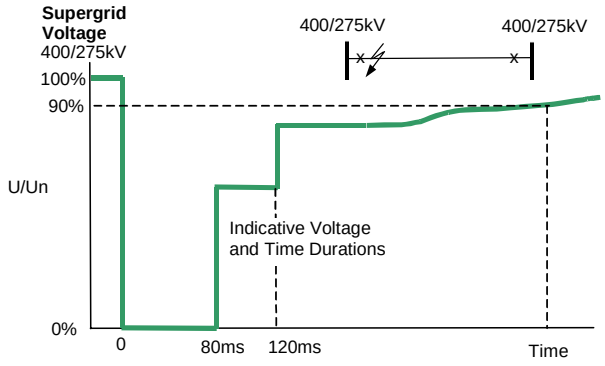
FAULT RIDE THROUGH REQUIREMENT FOR OFFSHORE TRANSMISSION SYSTEMS

A.1.1 SCOPE

The fault ride through requirement is defined in 3.1 (a), (b) and (c). This Appendix provides illustrations by way of examples only of 3.1 (a) (i) and further background and illustrations to 3.1 (b) (i) and is not intended to show all possible permutations.

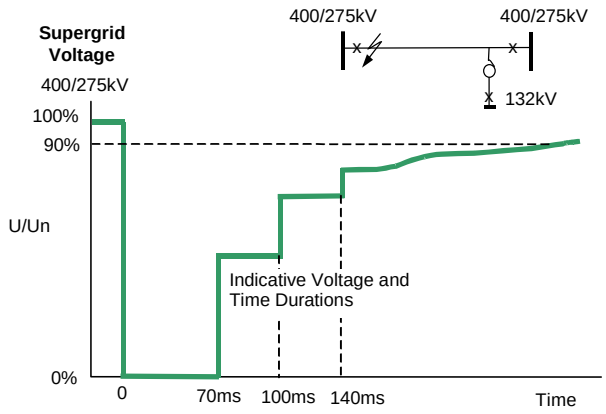
A.1.2 SHORT CIRCUIT FAULTS AT **SUPERGRID VOLTAGE** UP TO 140MS IN DURATION

For short circuit faults at **Supergrid Voltage** up to 140ms in duration, the fault ride through requirement is defined in 3.1 (a) (i). Figures A.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.



Typical fault cleared in less than 140ms: 2 ended circuit

Figure A.1.1 (a)



Typical fault cleared in 140ms:- 3 ended circuit

Figure A.1.1 (b)

A.1.3 **SUPERGRID VOLTAGE** DIPS GREATER THAN 140MS IN DURATION

For balanced **Supergrid voltage** dips having durations greater than 140ms and up to 3 minutes the fault ride through requirement is defined in 3.1 (b) (i) and Figure 1 which is reproduced in this Appendix as Figure A.1.2 and termed the voltage–duration profile.

This profile is not a voltage-time response curve that would be obtained by plotting the transient voltage response at a point on the **GB Transmission System** or **Distribution 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.

Figures A.1.3 (c), (d) and (e) illustrate the meaning of the voltage-duration profile for voltage dips having durations greater than 140ms.

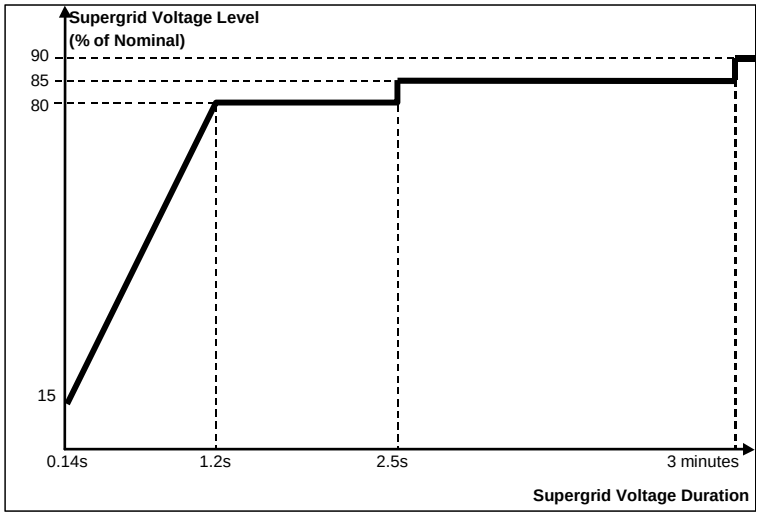
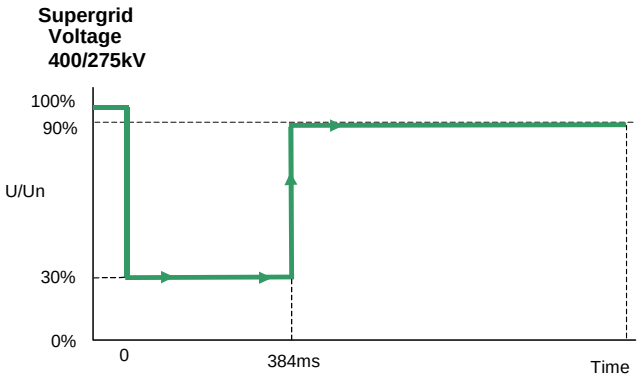
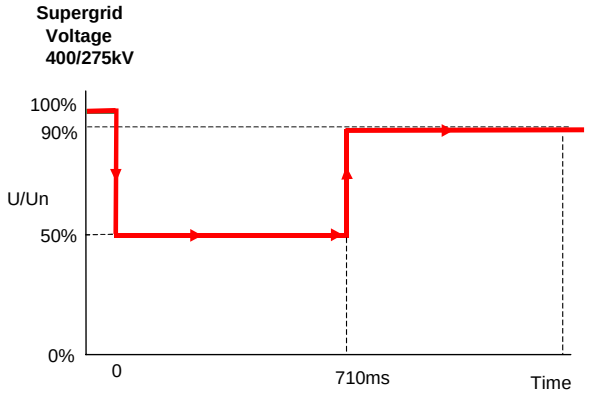


Figure A.1.2



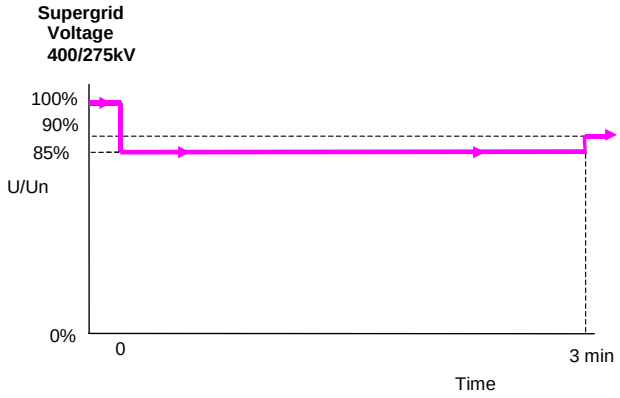
30% retained voltage, 384ms duration

Figure A.1.3(a)



50% retained voltage, 710ms duration

Figure A.1.3(b)



85% retained voltage, 3 minutes duration

Figure A.1.3(c)

New STC Definitions

"**Active Power**"	As defined in the Grid Code
"**DC Converter**"	As defined in the Grid Code
"**Distribution System Entry Point**"	The electrical point of connection between an ***Offshore Transmission System*** and an ***Onshore Distribution System***
"**Interface Point Capacity**"	The maximum amount of Active Power transferable at the ***Interface Point*** as declared by an Offshore Transmission Owner, expressed in whole MW. Each Offshore Transmission Owner shall ensure that the ***Interface Point Capacity*** it declares to NGET is such that it is not less than the sum of the declared Transmission Entry Capacities of each Power Station connected to that Offshore Transmission Owner's ***Offshore Transmission System*** when all such Offshore Transmission Plant and Apparatus is in service.
"**Interface Point**"	The electrical point of connection between an Offshore Transmission System and an Onshore Transmission System
"**Intermittent Power Source**"	As defined in the Grid Code
"**Normal Operating Range**"	Subject as provided below, the voltage on the 400kV part of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within ±5% of the nominal value unless abnormal conditions prevail. The minimum voltage is -10% and the maximum voltage is +10% unless abnormal conditions prevail, but voltages between +5% and +10% will not last longer than 15 minutes unless abnormal conditions prevail. Voltages on the 275kV and 132kV parts of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within the limits ±10% of the nominal value

Comment [M35]: Query Embedded Transmission?

Comment [M36]: This is essentially a back off of Grid Code CC.6.1.4, which is between NGET and Users at the Connection Site, whereas this has been redrafted to be between NGET and OFTOs at the Interface Point

	unless abnormal conditions prevail. At nominal **System** voltages below 132kV the voltage of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within the limits ±6% of the nominal value unless abnormal conditions prevail. Under fault conditions, voltage may collapse transiently to zero at the point of fault until the fault is cleared. **NGET** and an **Offshore Transmission Owner** may agree greater or lesser variations in voltage to those set out above in relation to a particular **Interface Point**, and insofar as a greater or lesser variation is agreed, the relevant figure set out above shall, in relation to that **Offshore Transmission System** at the particular **Interface Point**, be replaced by the figure agreed
"**Offshore Transmission System**"	As defined in the Grid Code
"**Offshore**"	As defined in the Grid Code
"**Onshore**"	As defined in the Grid Code
"**Onshore Transmission System**"	As defined in the Grid Code
"**Power Factor**"	As defined in the Grid Code
"**Reactive Power**"	As defined in the Grid Code
"**Supergrid Voltage**"	As defined in the Grid Code
"**System Back-Up Protection**"	As defined in the Grid Code

Note that this drafting incorporates the changes to the Grid Code currently being proposed as part of the National Grid report to the Authority on Grid Code Consultation G/06. These changes add to the reactive and voltage control requirements that an OFTO will be required to discharge.

SECTION K: OBLIGATIONS UNIQUE TO OFFSHORE TRANSMISSION NETWORKS

PART ONE: TRANSMISSION SERVICES

1. INTRODUCTION

1.1 This Section K, Part One deals with the provision of certain services by ***Offshore Transmission Owners*** to NGET, and sets out:

1.1.1 the process for each ***Offshore Transmission Owner*** to provide a reactive capability and a voltage control capability at the ***Interface Point***;

1.1.2 the obligation on each ***Offshore Transmission Owner*** to ensure that its ***Offshore Transmission System*** has a Fault Ride Through Capability,

1.1.3 the obligation on each ***Offshore Transmission Owner*** who owns an ***Offshore Transmission System*** which includes a DC Converter to provide additional damping facilities for DC Converters forming part of that ***Offshore Transmission System***,

1.1.4 the process for each ***Offshore Transmission Owner*** who owns an ***Offshore Transmission System*** which includes a DC Converter to provide a signal indicating the Frequency of the ***Onshore Transmission System*** to each User who owns a ***Offshore Power Station*** connected to that ***Offshore Transmission System*** and to ensure that the ***Offshore Transmission System*** can operate robustly under a range of System Frequencies, and;

1.1.5 the obligation on each ***Offshore Transmission Owner*** to ensure that any transformers forming pat of that Offshore Transmission System are capable of being neutrally earthed.

2. REACTIVE CAPABILITY AND VOLTAGE CONTROL

2.1 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*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an onshore Distribution System). With all plant in service, the Reactive Power limits defined at the ***Interface Point Capacity***

Comment [M1]: Section backs off the requirements of CC.6.3.2 (c) (part).
CC.6.3.2 (b) back-off not required as (b) is the default should the capability of CC.6.3.2 (c) not be required.

(a) 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 and / or,

(b) 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 / or,

With all Plant in service the Reactive Power limits 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 Service Capability Specification.

2.2 Each ***Offshore Transmission System*** shall be capable of contribution to voltage control by continuous changes to the Reactive Power supplied at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an onshore Distribution System).

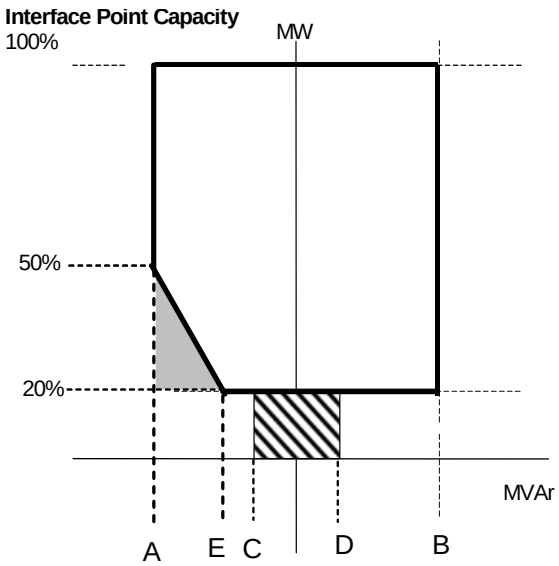
2.3 In the case of an Offshore Transmission System a continuously acting automatic control system is required to provide control of the voltage at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an Onshore Distribution System) without instability over the entire operating range of the ***Offshore Transmission System***. When transferring Active Power equivalent to less than 20% of the Interface point Capacity the automatic control system may continue to provide voltage control utilising any available reactive capability. If voltage control is not being provided, the automatic control system shall be designed to ensure a smooth transition between the shaded area bounded by CD and the non-shaded area bound by AB in Figure K1 below.

Comment [M2]: Assumption that the SCS will be the appropriate place to place any variations to the standard reactive requirements. May be superseded by any contractual agreement between the OFTO and the GBSO developed through the Offshore Transmission Project (STC Working Group)

Comment [M3]: Back off of CC.6.3.6 (b)

Comment [M4]: Back off of CC.6.3.8 (c) and also remainder of CC.6.3.2 (c)

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***.

2.4 The performance requirements for an ***Offshore Transmission System's*** continuously acting automatic voltage control system are specified in Appendix B.

Comment [M5]: Back off of CC.6.3.8 (d).

2.5 The requirement for 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 Services Capability Specification.

Comment [M6]: Back off of CC.6.3.8 (b).

Comment [M7]: Could be replaced by any contractual agreement between the GBSO and OFTO

2.6 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 the Services Capability Specification records otherwise. Operation of such facilities will only be in accordance with instructions to direct the configuration of the GB Transmission System as given by NGET.

Comment [M8]: CC.6.3.8 (e) back-off.

Comment [M9]: Could be replaced by any contractual agreement between the GBSO and OFTO

2.7 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.

Comment [M10]: This drafting is dependent on the switching model adopted in the STC for Offshore Transmission Systems; an issue discussed at the STC Working Group meetings

Comment [M11]: Back off of CC.6.3.4

3 FAULT RIDE THROUGH CAPABILITY

3.1 Fault Ride Through

Comment [M12]: Back off of CC.6.3.15

(a) Short circuit faults at Supergrid Voltage up to 140ms in duration

(i) Each ***Offshore Transmission System*** shall remain transiently stable and connected to the remainder of the Total System at the ***Interface Point*** (or ***Distribution System Entry Point*** where such ***Offshore Transmission System*** is directly connected to an Onshore Distribution System) 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 Services Capability Specification. Following fault clearance, recovery of the Supergrid Voltage to 90% may take longer than 140ms as illustrated in Appendix A Figures A.1.1 (a) and (b).

Comment [M13]: NB. Includes Embedded Transmission by default

Comment [M14]: Interface Point not currently defined to include Embedded Transmission.

Comment [M15]: Query over treatment of Embedded Transmission

Comment [M16]: Could be replaced by any contractual agreement between the GBSO and OFTO

(ii) Each ***Offshore Transmission System*** shall be designed such that upon both clearance of the fault on the GB Transmission System as detailed in 3.1 (a) (i) and within 0.5 seconds of the restoration of the voltage at the ***Interface Point*** to be within the ***Normal Operating Range*** (or within 0.5 seconds of restoration of the voltage at the ***Distribution System Entry Point*** to 90% of nominal or greater if Embedded), Active Power transfer 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 (a) (i) each ***Offshore Transmission System*** shall generate maximum reactive current without exceeding the transient rating limit at the ***Interface Point***.

Comment [M17]: May need to be reworded in line with any future Embedded transmission recommendations

(iii) Each DC Converter forming part of an ***Offshore Transmission System*** shall be designed to meet the Active Power recovery characteristics as specified in the Services Capability Specification upon clearance of the fault on the GB Transmission System as detailed in 3.1 (a) (i).

Comment [M18]: Query wording appropriate for HVDC Offshore systems?

Comment [M19]: May be superseded by any contractual agreement between the GBSO and OFTO

(b) Supergrid Voltage dips greater than 140ms in duration

In addition to the requirements of 3.1 (a) each ***Offshore Transmission System*** shall:

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

Comment [M20]: Again covers Embedded Transmission

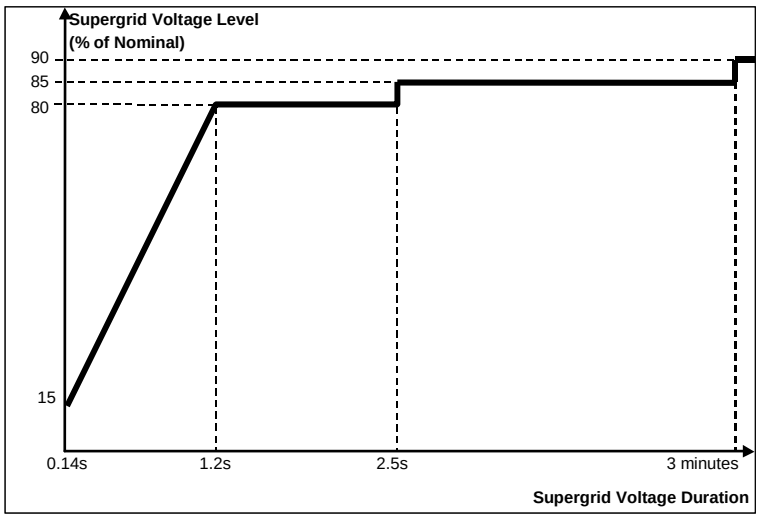


Figure K2

(ii) provide Active Power transfer, during Supergrid Voltage dips as described in Figure K2, at least in proportion to the retained balanced voltage at the ***Interface Point*** (or the retained balanced voltage at the ***Distribution System Entry Point*** if Embedded) 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 that restricts the Active Power transfer below this level. In addition during the voltage dip each Offshore Transmission System shall generate maximum reactive current at the ***Interface Point*** (or the ***Distribution System Entry Point*** if Embedded) without exceeding the transient rating limit of the ***Offshore Transmission System***; and,

Comment [M21]: Query treatment for Embedded transmission

Comment [M22]: Query treatment for Embedded transmission

(iii) restore Active Power transfer, following Supergrid Voltage dips as described in Figure K2, within 1 second of restoration of the voltage at the ***Interface Point*** to be within the ***Normal Operating Range*** (or within 1 second of restoration of the voltage at the Distribution System Entry Point to 90% of nominal or greater if Embedded), to at least 90% of the level available immediately before the occurrence of the dip except in the case of ***Offshore Transmission System*** where there has been a reduction in the Active Power transfer of the ***Offshore Transmission System*** in the time range in Figure K2 that restricts the Active Power transfer below this level.

Comment [M23]: Query for Embedded Transmission

(c) Other Requirements

(i) 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.

(ii) To avoid unwanted island operation, ***Offshore Transmission Systems*** connected to ***Onshore Systems*** in Scotland shall be tripped for the following conditions:-

(1) Frequency above 52Hz for more than 2 seconds

(2) Frequency below 47Hz for more than 2 seconds

(3) Voltage as measured at the ***Interface Point*** or ***Distribution System Entry Point*** below 80% for more than 2 seconds

Comment [M24]: Query over treatment of Embedded Transmission

(4) Voltage as measured at the ***Interface Point*** or ***Distribution System Entry Point*** above 120% (115% for 275kV) for more than 1 second.

Comment [M25]: Query over treatment of Embedded Transmission

The times in sections (1) and (2) are maximum trip times. Shorter times may be used to protect the integrity of an ***Offshore Transmission System*** or Power Stations connected to it.

Comment [M26]: Back off of CC.6.3.16

4 ADDITIONAL DAMPING CONTROL FACILITIES FOR DC CONVERTERS

4.1 ***Offshore Transmission Owners*** who own ***Offshore Transmission Systems*** that contain DC Converters must ensure that any of their DC Converters will not cause a sub-synchronous resonance problem on the Total System. Each DC Converter is required to be provided with sub-synchronous resonance damping control facilities.

4.2 Where specified in the Services Capability Specification, each 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.

Comment [M27]: May be superseded by the contractual agreement between the GBSO and OFTO

5. FREQUENCY CAPABILITES AND SIGNALS

Comment [M28]: Back off of Frequency Signal recommendations

5.1 Each ***Offshore Transmission Owner*** in respect of each of its ***Offshore Transmission Systems*** which include a DC Converter 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 at which the ***Onshore Transmission System*** is operating.

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 Services Capability Specification.

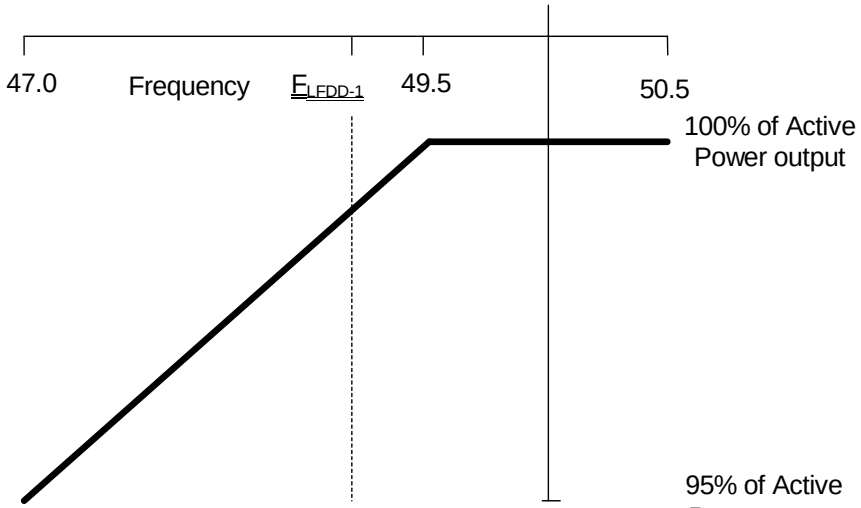
Comment [M29]: May be superseded by any contractual agreement between the GBSO and each OFTO

5.3 Each ***Offshore Transmission Owner*** in respect of each of its ***Offshore Transmission Systems*** which include a DC Converter must be capable of

Comment [M30]: Back off of CC.6.3.3

(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 2

(c) For the avoidance of doubt in the case of a ***Offshore Transmission Systems*** that contains DC Converters to which Generating Units using an Intermittent Power Source are connected where the mechanical power input will not be constant over time, the requirement is that the Active Power transfer shall be independent of System Frequency under (a) above and should not drop with System Frequency by greater than the amount specified in (b) above.

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*** which includes a DC Converter or any constituent element must continue to operate within this Frequency range for at least the periods of time given in Grid Code CC.6.1.3 unless NGET has agreed to any Frequency-level relays and/or rate-of-change-of-Frequency relays which will trip such ***Offshore Transmission System*** which includes a DC Converter and any constituent element within this Frequency range, under the Services Capability Specification.

Comment [M31]: Back off of CC.6.3.12

Comment [M32]: May be superseded by any contractual agreement between the GBSO and OFTO

5.5 ***Offshore Transmission Owners*** who own ***Offshore Transmission Systems*** which include a DC Converter will be responsible for protecting all their 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.

Comment [M33]: Back off of CC.6.3.13

6. NEUTRAL EARTHING

6.1 At nominal System voltages of 132kV and above the higher voltage windings of a transformer(s) 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 GB Transmission System at nominal System voltages of 132kV and above.

Comment [M34]: Back off of CC.6.3.11

APPENDIX A

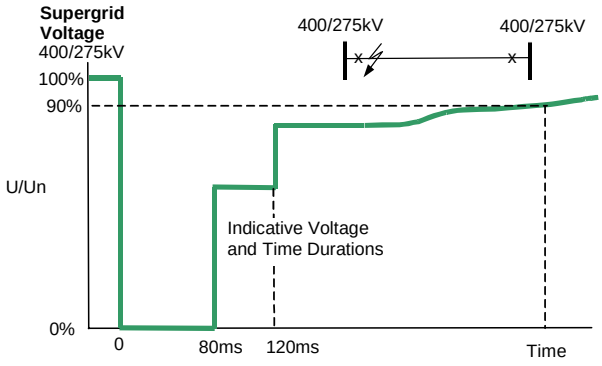
FAULT RIDE THROUGH REQUIREMENT FOR OFFSHORE TRANSMISSION SYSTEMS

A.1.1 SCOPE

The fault ride through requirement is defined in 3.1 (a), (b) and (c). This Appendix provides illustrations by way of examples only of 3.1 (a) (i) and further background and illustrations to 3.1 (b) (i) and is not intended to show all possible permutations.

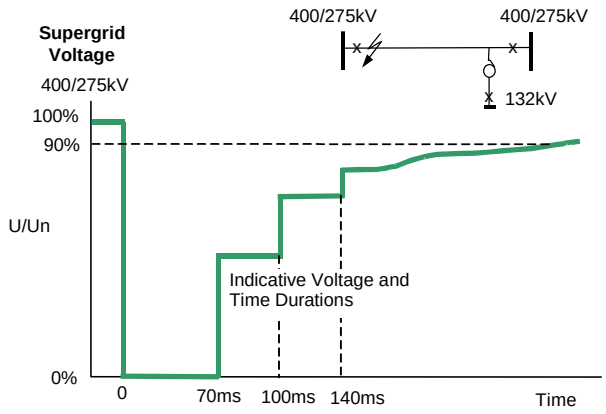
A.1.2 SHORT CIRCUIT FAULTS AT **SUPERGRID VOLTAGE** UP TO 140MS IN DURATION

For short circuit faults at **Supergrid Voltage** up to 140ms in duration, the fault ride through requirement is defined in 3.1 (a) (i). Figures A.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. The short circuit fault could occur at the Interface Point



Typical fault cleared in less than 140ms: 2 ended circuit

Figure A.1.1 (a)



Typical fault cleared in 140ms:- 3 ended circuit

Figure A.1.1 (b)

A.1.3 **SUPERGRID VOLTAGE** DIPS GREATER THAN 140MS IN DURATION

For balanced **Supergrid voltage** dips having durations greater than 140ms and up to 3 minutes the fault ride through requirement is defined in 3.1 (b) (i) and Figure 1 which is reproduced in this Appendix as Figure A.1.2 and termed the voltage–duration profile.

This profile is not a voltage-time response curve that would be obtained by plotting the transient voltage response at a point on the **GB Transmission System** or **Distribution 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.

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

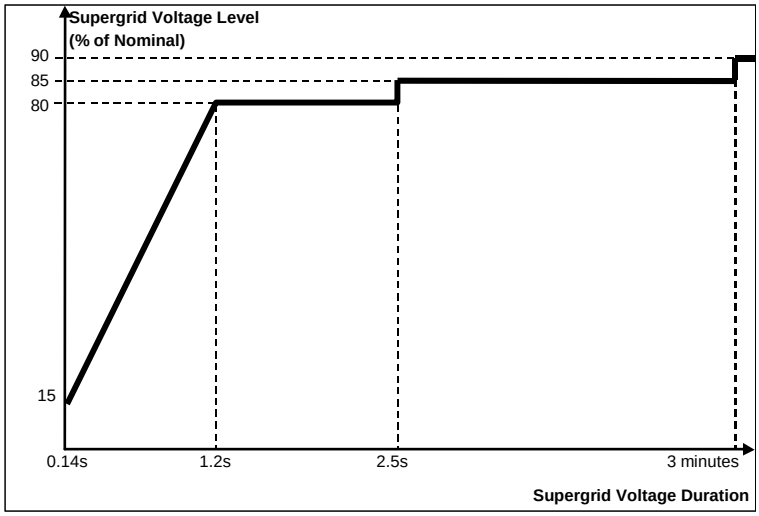
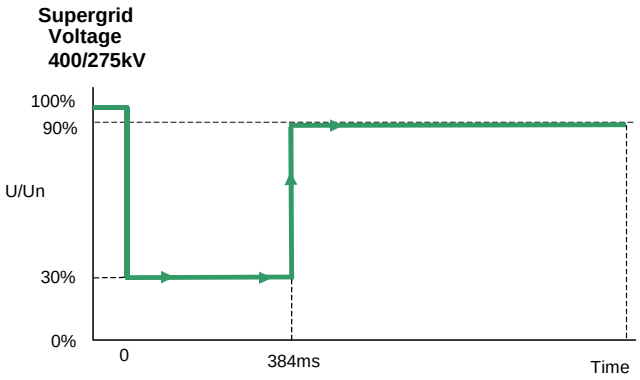
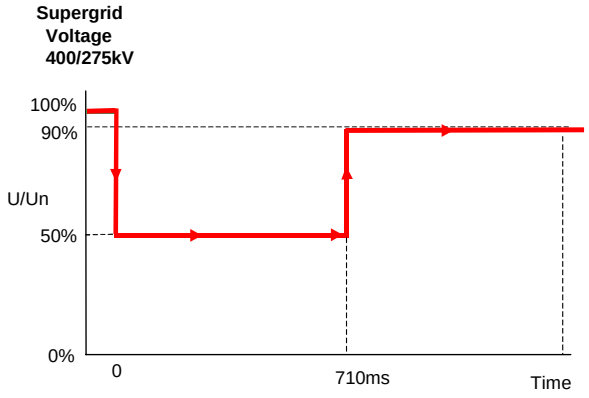


Figure A.1.2



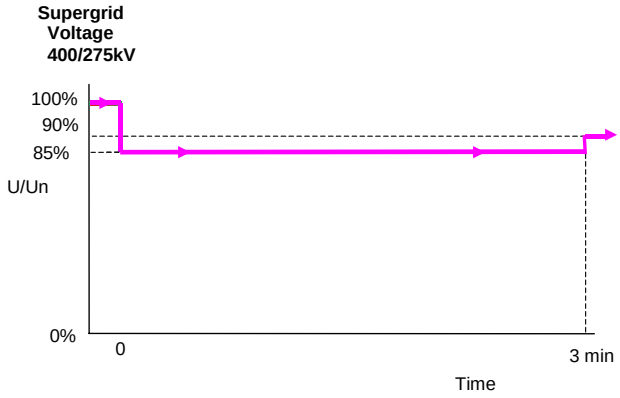
30% retained voltage, 384ms duration

Figure A.1.3(a)



50% retained voltage, 710ms duration

Figure A.1.3(b)



85% retained voltage, 3 minutes duration

Figure A.1.3(c)

APPENDIX B

PERFORMANCE REQUIREMENTS FOR CONTINUOUSLY ACTING AUTOMATIC VOLTAGE CONTROL SYSTEMS FOR **OFSHORE TRANSMISSION SYSTEMS**

B.7.1 SCOPE

B.7.1.1 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 a Services Capability Specification where in NGET's reasonable opinion these facilities are necessary for system reasons.

Comment [M35]: Query whether the SCS is the appropriate place for site specific variations

B.7.1.2 Proposals by owners of ***Offshore Transmission Systems*** to make a change to the voltage control systems are required to be notified to NGET as soon as the owner of the ***Offshore Transmission System*** anticipates making the change. The change may require a revision to the Services Capability Specification.

B.7.2 Requirements

B.7.2.1 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 (B.7.2.2) cannot be utilised, NGET may specify in the Services Capability Specification 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 an amendment to the Services Capability Specification (in accordance with the STC, section C, Part 1, paragraph 3.3) 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.

Comment [M36]: Query whether the SCS is the appropriate place for site specific variations

B.7.2.2 Steady State Voltage Control

B.7.2.2.1 The ***Offshore Transmission System*** shall provide continuous steady state control of the voltage at the Interface Point (or Distribution System Entry Point if the ***Offshore Transmission System*** is connected to an onshore Distribution System) with a Setpoint Voltage and Slope characteristic as illustrated in Figure B.7.2.2a.

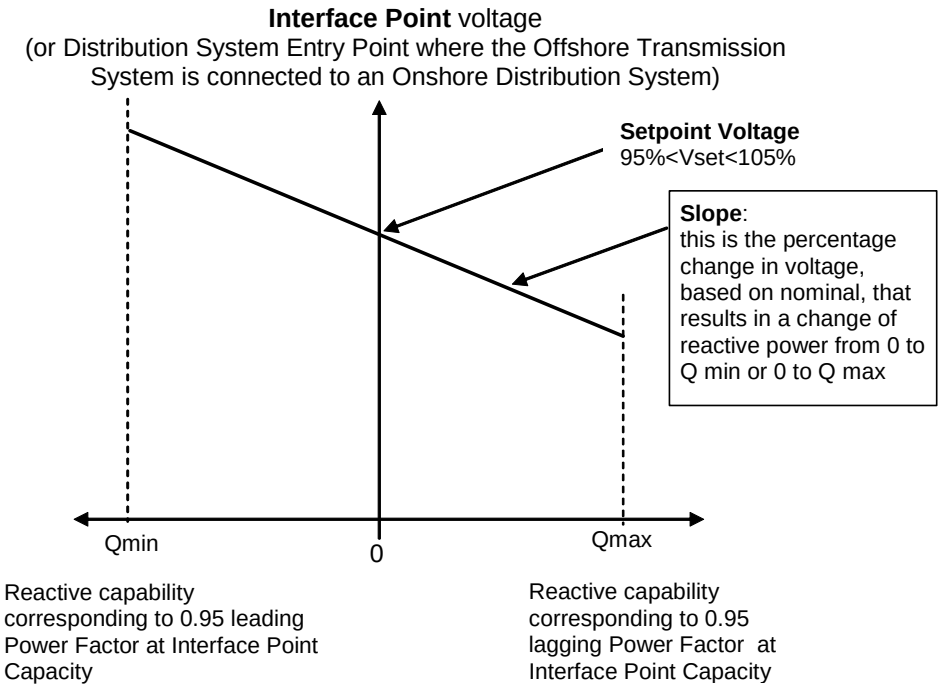


Figure B.7.2.2a

B.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% 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.

B.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% 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.

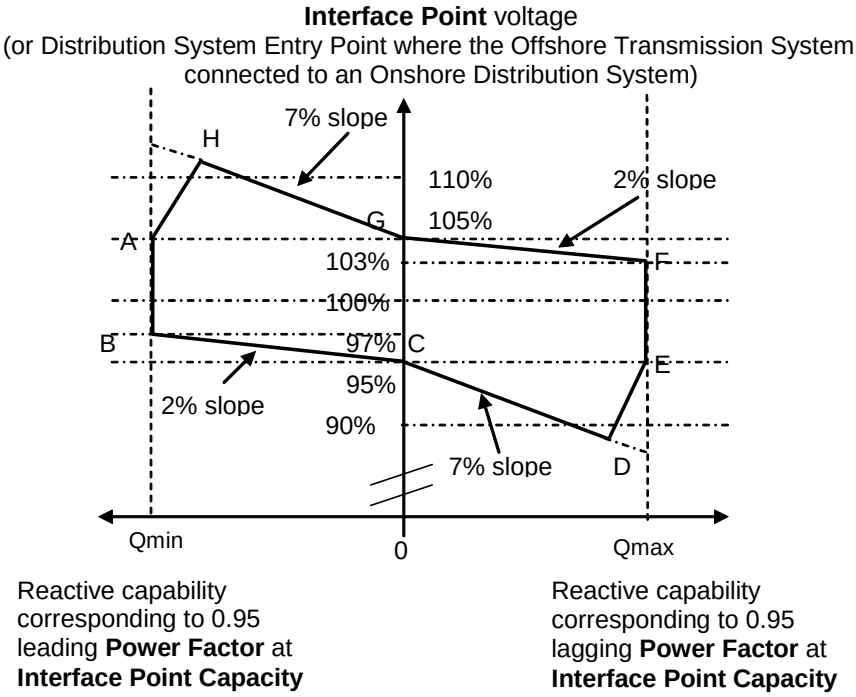


Figure B.7.2.2b

B.7.2.2.4 Figure B.7.2.2b 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.

B.7.2.2.5 Should the operating point of the ***Offshore Transmission System*** deviate so that it is no longer a point on the operating characteristic (figure B.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.

B.7.2.2.6 Should the Reactive Power output of the ***Offshore Transmission System*** reach its maximum lagging limit at an Interface Point voltage (or Distribution System Entry Point voltage if connected to an onshore distribution system) 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 B.7.2.2b. Should the Reactive Power output of the ***Offshore Transmission System*** reach its maximum leading limit at an ***Interface Point*** voltage (or Distribution System Entry Point voltage if connected to an onshore Distribution System) 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 B.7.2.2b.

B.7.2.2.7 For Interface Point voltages (or Distribution System Entry Point voltage if connected to an onshore Distribution System) 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 B.7.2.2b. For Interface Point voltages (or Distribution System Entry Point voltage if connected to an onshore Distribution System) 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 B.7.2.2b. Should the Reactive Power output of the Offshore Transmission System reach its maximum lagging limit at an Interface Point voltage (or Distribution System Entry Point voltage if connected to an onshore Distribution System) 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 (or Distribution System Entry Point voltage if connected to an onshore Distribution System) above 105%, the ***Offshore***

Transmission System shall maintain maximum leading Reactive Power output for further voltage increases.

B.7.2.3 Transient Voltage Control

B.7.2.3.1 For an on-load step change in ***Interface Point*** or Distribution System Entry Point voltage, the continuously acting automatic control system shall respond according to the following minimum criteria

(i) 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 B.7.2.3.1a.

(ii) 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, B.7.2.2.6 or B.7.2.2.7), will be produced within 1 second

(iii) the magnitude of the Reactive Power output response produced within 1 second shall vary linearly in proportion to the magnitude of the step change

(iv) 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.

(v) following the transient response, the conditions of B.7.2.2 apply.

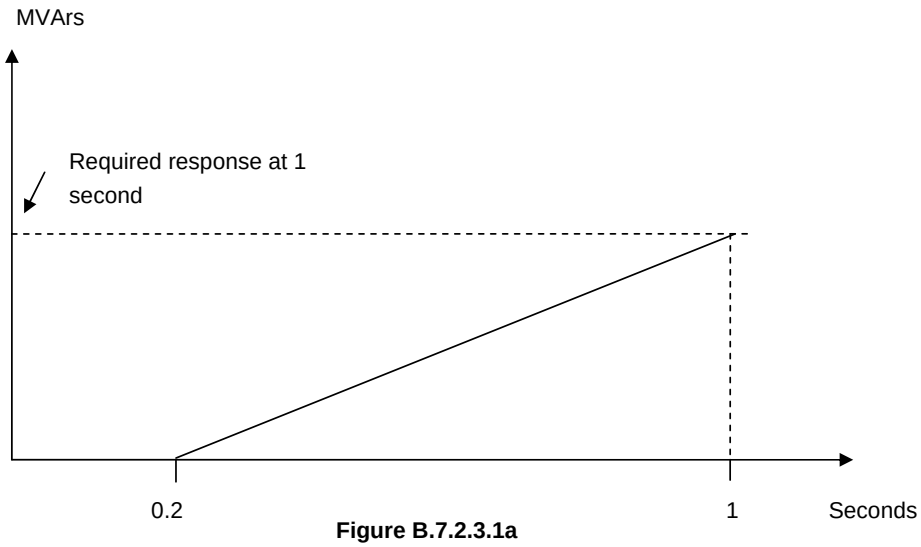


Figure B.7.2.3.1a

B.7.2.4 Power Oscillation Damping

B.7.2.4.1 The requirement for the continuously acting voltage control system to be fitted with a Power System Stabiliser (PSS) shall be specified in the Services Capability 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.

Comment [M37]: Query whether the SCS is the appropriate place for site specific variations

Comment [M38]: Query if this STCP is the appropriate means of commissioning

B.7.2.5 Overall Voltage Control System Characteristics

B.7.2.5.1 The continuously acting automatic voltage control system is required to respond to minor variations, steps, gradual changes or major variations in ***Interface Point*** voltage (or Distribution System Entry Point voltage if connected to an onshore Distribution System).

B.7.2.5.2 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

B.7.2.5.3 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.

New STC Definitions

"**Active Power**"	As defined in the Grid Code
"**DC Converter**"	As defined in the Grid Code
"**Distribution System Entry Point**"	The electrical point of connection between an ***Offshore Transmission System*** and an ***Onshore Distribution System***
"**Interface Point Capacity**"	The maximum amount of Active Power transferable at the ***Interface Point*** as declared by an Offshore Transmission Owner, expressed in whole MW. Each ***Offshore Transmission Owner*** shall ensure that the ***Interface Point Capacity*** it declares to NGET is such that it is not less than the sum of the declared Transmission Entry Capacities of each Power Station connected to that Offshore Transmission Owner's ***Offshore Transmission System*** when all such Offshore Transmission Plant and Apparatus is in service.
"**Interface Point**"	The electrical point of connection between an ***Offshore Transmission System*** and an ***Onshore Transmission System***
"**Intermittent Power Source**"	As defined in the Grid Code
"**Normal Operating Range**"	Subject as provided below, the voltage on the 400kV part of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within ±5% of the nominal value unless abnormal conditions prevail. The minimum voltage is -10% and the maximum voltage is +10% unless abnormal conditions prevail, but voltages between +5% and +10% will not last longer than 15 minutes unless abnormal conditions prevail. Voltages on the 275kV and 132kV parts of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within the limits ±10% of the nominal value

Comment [M39]: Query Embedded Transmission?

Comment [M40]: This is essentially a back off of Grid Code CC.6.1.4, which is between NGET and Users at the Connection Site, whereas this has been redrafted to be between NGET and OFTOs at the Interface Point

	unless abnormal conditions prevail. At nominal **System** voltages below 132kV the voltage of the **Onshore Transmission System** at each **Interface Point** with an **Offshore Transmission System** will normally remain within the limits ±6% of the nominal value unless abnormal conditions prevail. Under fault conditions, voltage may collapse transiently to zero at the point of fault until the fault is cleared. **NGET** and an **Offshore Transmission Owner** may agree greater or lesser variations in voltage to those set out above in relation to a particular **Interface Point**, and insofar as a greater or lesser variation is agreed, the relevant figure set out above shall, in relation to that **Offshore Transmission System** at the particular **Interface Point**, be replaced by the figure agreed
"**Offshore Transmission System**"	As defined in the Grid Code
"**Offshore**"	As defined in the Grid Code
"**Onshore**"	As defined in the Grid Code
"**Onshore Transmission System**"	As defined in the Grid Code
"**Power Factor**"	As defined in the Grid Code
"**Reactive Power**"	As defined in the Grid Code
"**Setpoint Voltage**"	As defined in the Grid Code
"**Slope**"	As defined in the Grid Code
"**Supergrid Voltage**"	As defined in the Grid Code
"**System Back-Up Protection**"	As defined in the Grid Code