Grid Code Modification Proposal Form	At what stage is this document in the process?
# GC0142: ## Mod Title: Adding Non-Standard Voltages to the Grid Code	01 Proposal Form 02 Workgroup Consultation 03 Workgroup Report 04 Code Administrator Consultation 05 Draft Grid Code Modification Report 06 Final Grid Code Modification Report

Purpose of Modification: Following the rejection of modification GSR0021[1] to the System Quality and Standards of Supply (SQSS) by Ofgem, this modification is being raised to seek modifications to the Grid Code. A separate modification will be raised to modify the SQSS. The modifications are looking to incorporate equipment at nominal voltages other than those that are currently used within the Codes.

	**The Proposer recommends that this modification should:** • Proceed to Code Administrator Consultation This modification was raised on 03 April 2020 and was presented by the Proposer to the Panel on 22 April 2020**.** There were some comments that required review which the Proposer has resolved. This was represented to the Panel on 25 June 2020. The Panel will consider the Proposer's recommendation and determine the appropriate route.
	**High Impact**: None.
	**Medium Impact:** Any users subject to requirements of the Grid Code installing equipment at novel voltages, who will gain clarity.
	**Low Impact** Users subject to requirements of the Grid Code of equipment at standard voltages who will see no change.

Guidance on the use of this Template: *Please complete all sections unless specifically marked for the Code* ***Administrator.*** *Green italic text is provided as guidance and should be removed before submission. Contact us:* ***The Code Administrator is available to help and support the drafting of any modifications, including guidance on completion of this template and the wider modification process. If you require any advice on how to fill in this form please contact the Panel Secretary e-mail:*** grid.code@nationalgrid.com

[1] https://www.nationalgrideso.com/codes/security-and-quality-supply-standards/modifications/gsr021-operational-and-planning-criteria

Contents

Timetable

The Code Administrator will update the timetable.

The Code Administrator recommends the following timetable: *(To be updated following first Workgroup Meeting)*

Initial consideration by Workgroup	22 April 2020
Workgroup Consultation issued to the Industry	dd month year
Modification concluded by Workgroup	dd month year
Workgroup Report presented to Panel	dd month year
Code Administration Consultation Report issued to the Industry	dd month year
Draft Final Modification Report presented to Panel	dd month year
Modification Panel decision	dd month year
Final Modification Report issued the Authority	dd month year
Decision implemented in Grid Code	dd month year

Any questions?

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Proposer Details

Details of Proposer: (Organisation Name)	National Grid ESO
Capacity in which the Grid Code Modification Proposal is being proposed: (e.g. CUSC Party)	The Company
Details of Proposer's Representative:	
Name:	Louise Trodden
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Details of Representative's Alternate:	
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Email Address:	Robert.wilson2@nationalgrideso.com
Attachments (Yes): **Ofgem decision letter GSR021\;** https://www.nationalgrideso.com/document/15301/download	

Impact on Core Industry Documentation.

Please mark the relevant boxes with an "x" and provide any supporting information

BSC	
CUSC	
STC	
Other	X

This modification proposal endeavours to apply consistency to the SQSS alongside Grid Code changes by incorporating changes to both codes concurrently. There is a

separate modification for the SQSS (GSR026) which follows the same principles as this modification. This was raised at the April SQSS panel.

1 Summary

Defect

A previous modification, (GSR0021) to include 220kV assets into the SQSS was rejected by Ofgem in July 2016. This was for the following reasons:

- There were concerns regarding the original proposal having only considered the addition of 220kV as a nominal voltage and did not cover future technological advancements or subsequent new voltages.
- The original proposal was also not detailed enough to differentiate how both on and offshore voltages were reported in chapter 6 and chapter 10 of the SQSS.

Assets operating at 220kV are currently deployed at the Kintyre-Hunerston subsea AC link with two subsea cables between Crossaig on the Kintyre peninsula and Hunterston. The connection to the Onshore transmission system is via two 400/220kV supergrid transformers at Hunterston and via two 220/132kV transformers at Crossaig. Whilst there is currently no user equipment directly connected to the 220kV assets, 220kV assets are not currently specified within the Grid Code.

This defect remains however, this modification now seeks to expand the Grid Code to clarify the requirements that will be placed on equipment operating at non standard voltages. For reference, currently 400kV, 275kV and 132kV are the nominal design voltage levels which have historically been used in the development of high voltage equipment and hence referred within the Grid Code. This means that the specification and requirements for assets operating at any other nominal voltages are not defined in the code.

What

The proposer suggests that by removing specific nominal voltages from the relevant clauses of the Grid Code, this will align better with the treatment given in the European Network Codes and cover any subsequent introduction of new voltages in the future. (It is worth noting that other standard EU voltages are 110kV, 220kV and 380kV.) The proposer is raising a separate modification to support alignment with the SQSS.

Why

The proposed changes to the Grid Code should ensure that current and future nominal voltage levels within the transmission network have clear specification and performance requirements. This proposed change should also ensure the assets operating at such nominal voltages are appropriately specified within the codes, with the aim to include specifications for voltages in such a way that will enable consistency for both the Grid Code and the SQSS. In addition, this proposal also enables greater flexibility, should other nominal voltages (other than 400kV, 275kV and 132kV) be used for the design of

HV equipment in the future and the operational range associated with the designed nominal voltage.

How

The legal text to embody this modification relies on the use of voltage ranges for equipment to ensure that all future possibilities are captured and so better aligning the Grid Code and SQSS with an approach followed in the EU codes using a table of voltages and specifications to suit.

2 Governance

Although the proposed changes are not material, the proposer contends that this modification should follow the standard governance process. This modification is running alongside GSR026 to amend the SQSS. There is no self-governance process for the SQSS, and given this modification is being raised in response to a previously rejected modification, we will also send this to Ofgem for review.

Requested Next Steps

This modification should:

- be assessed by a Workgroup, if the panel deems necessary to discuss the change proposed, or
- proceed straight to Code Administrator Consultation

As the legal text for this proposal is complete and straightforward, in the Proposer's view, a workgroup may not be necessary.

3 Why Change?

Following the rejection of GSR0021, and the request to reassess the consistency of approach to defining voltage limits, this proposal seeks to change the way both nominal and operational and planning voltages are categorised within both the Grid Code and SQSS. By aligning with the SQSS in the process, this shows consistency across the codes, and using similar formats to that of the EU codes, this should support the request by Ofgem to avoid changes to the codes should further nominal voltages be introduced to the system.

4 Code Specific Matters

Technical Skillsets

Understanding the previously rejected SQSS modification for GSR0021 and the structure of the relevant sections of the Grid Code would be helpful but not essential – the principles of this change are straightforward.

Reference Documents

Decision Letter from Ofgem – GSR021. This decision letter from Ofgem outlines the reason for this proposal.

5 Solution

The modification will update the Grid Code with the changes outlined in Section 9- ''Legal Text'' to ensure that nominal voltages other than those used as standard in GB (132kV, 275kV, 400kV) can be accommodated for equipment connecting to the system.

6 Impacts & Other Considerations

Current and future parties are subject to the requirements of the Grid Code when connected to the transmission system and installing equipment of non standard GB nominal voltages. This is not explicitly specified within in the Grid Code at present, hence the requirement for this modification.

These changes aim to make it clearer for those connecting to the transmission system what performance and specification should be followed at nominal voltage that are not currently specified in the Grid Code. Additionally, this modification allows for consistency with the changes being proposed to the SQSS and ensures consistency with EU Codes.

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

None expected

Consumer Impacts

None expected

7 Relevant Objectives

Impact of the modification on the Applicable Grid Code Objectives:

Relevant Objective	Identified impact
(a) To permit the development, maintenance and operation of an efficient, coordinated and economical system for the transmission of electricity	Positive
(b) Facilitating effective competition in the generation and supply of electricity (and without limiting the foregoing, to facilitate the national electricity transmission system being made available to persons authorised to supply or generate electricity on terms which neither prevent nor	Positive

restrict competition in the supply or generation of electricity);	
(c) Subject to sub-paragraphs (i) and (ii), to promote the security and efficiency of the electricity generation, transmission and distribution systems in the national electricity transmission system operator area taken as a whole;	Positive
(d) To efficiently discharge the obligations imposed upon the licensee by this license and to comply with the Electricity Regulation and any relevant legally binding decisions of the European Commission and/or the Agency; and	Positive
(e) To promote efficiency in the implementation and administration of the Grid Code arrangements	Neutral

To support the alignment of the EU codes and facilitate the future of the system.

8 Implementation

Implementation of this modification will only require minor amendments to the legal text of the Grid Code and with alignment to a similar change being taken forwards in the SQSS.

Given that the SQSS modification was initially rejected in 2016 with the request to further review, we should move forward with the proposal, however, given there are no customer connections at this voltage as quoted in Ofgem's decision letter, this was not a high priority.

Implementation should occur as standard on completion of the modification and approval by Ofgem. The application should apply to all new equipment, so no changes in costs for specifications or system changes are envisaged. SSE has confirmed that the equipment currently installed (for example Kintyre-Hunterston) can comply with the operational limits specified.

9 Legal Text

When drafting the legal text, consideration was given to whether there should be modifications to the Connection Conditions (CC) section of the Grid Code and European Connection Conditions (ECC). Changing the CC sections of the Grid Code could aid readers of the code to see the consistency in the texts. However, on reflection those users who have existing connections may see the existing requirements presented differently, causing confusion. Therefore, it is the view of the proposer that we only make the modification applicable to the European Connection Conditions (ECC).

Reviewing the current version of the Grid Code, it became apparent that there were two Electrical Standards which could require a change, these have been highlighted to the TOs for their review. These are indicated below:

The Electrical Standards are as follows: ANNEX TO THE GENERAL CONDITIONS	Current Transformers for Protection and General Use on the 132kV, 275kV and 400kV Systems
The Electrical Standards are as follows: (d) Scottish Electrical Standards for SHETL's Transmission System.	6. NGTS 3.2.3: Metal-Oxide surge arresters for use on 132, 275 and 400kV systems. Issue 2 May 1994. 7. NGTS 3.2.4: Current Transformers for protection and General use on the 132, 275 and 400kV systems. Issue 1 September 1992. 8. NGTS 3.2.5: Voltage Transformers for use on the 132, 275 and 400 kV systems. Issue 2 March 1994. 9. NGTS 3.2.6: Current and Voltage Measurement Transformers for Settlement Metering of 33, 66, 132, 275 and 400kV systems. Issue 1 September 1992.

It is important to note that in ECC6.1.7 Table ECC.6.7.1(b) — Planning levels for flicker, the requirements for systems operating at a nominal voltage between 33kV and 66kV is not clear.. The requirements and specification for railway voltages at 25kV (note this is a phase to neutral voltage which would be equivalent to 43kV phase to phase voltage) could be impacted by this. This lack of clarity exists in the present format of the table, and in the revised table for this modification. Given that addressing this would be out of scope of this modifications defect, and that there is currently work ongoing for P24, the view of the proposer is to review this in the P24 working group for resolution.

It is also of note that, the term 'Supergrid Voltage' has been retained as a defined Grid Code term in the revisions to the legal text for Schedule 5. This is a historic term used in the Grid Code for any voltage greater than 200kV. Irrespective of a User being either a GB Code User or an EU Code User, the term "Supergrid Voltage" still refers to voltages greater than 200kV and therefore reference to this term would make no difference to User's submitting data relating to equipment which operates at a nominal voltage other than 132kV, 275kV or 400kV. The ESO believes that it would not be appropriate to remove the term 'Supergrid Voltage' on the basis of i) the potential for unintended consequences which could result from this change ii) its impact on the wider GB codes and iii) its removal has no materiality on the data that Users are required to provide irrespective of the nominal voltage that the equipment is operating at.

Please see below legal text for this modification:

Section Title	Current Text	Proposed Text
Station Transformer Pg 53	A transformer supplying electrical power to the **Auxiliaries** of (a) a **Power Station**, which is not directly connected to the **Generating Unit** terminals (typical voltage ratios being 132/11kV or 275/11kV), or (b) a **DC Converter Station** or **HDVC Converter**	No Change- as text states 'typical'
Single Point of Connection PC.A.8.1	For **a Single Point of Connection** to a **User's System** (and **OTSUA**), as an equivalent 400kV or 275kV source and also in Scotland and **Offshore** as an	For a **Single Point of Connection** to a **User's System** (and **OTSUA**), as a Transmission System voltage source ~~an equivalent 400kV or 275kV source and also in Scotland and Offshore as~~

	equivalent 132kV source, the data (as at the HV side of the **Point of Connection** (and in the case of **OTSUA**, each **Interface Point** and **Connection Point**) reflecting data given to **The Company** by **Users**) will be given to a **User** as follows: The data items listed under the following parts of PC.A.8.3: (a) (i), (ii), (iii), (iv), (v) and (vi) and the data items shall be provided in accordance with the detailed provisions of PC.A.8.3 (b) - (e)	~~an equivalent 132kV source~~, the data (as at the HV side of the **Point of Connection** (and in the case of **OTSUA**, each **Interface Point** and **Connection Point**) reflecting data given to **The Company** by **Users**) will be given to a **User** as follows: The data items listed under the following parts of PC.A.8.3: (a) (i), (ii), (iii), (iv), (v) and (vi) and the data items shall be provided in accordance with the detailed provisions of PC.A.8.3 (b) - (e)
Data Items PC.A.8.3	(d) Since the equivalent will be produced for the 400kV or 275kV and also in Scotland and **Offshore**132kV parts of the **National Electricity Transmission System The Company** will provide the appropriate supergrid transformer data	(d) ~~Since the equivalent will be produced for the 400kV or275kV and also in Scotland and **Offshore**132kV parts of the **National Electricity Transmission System** **The Company**~~ will provide the appropriate supergrid transformer data for the National Electricity Transmission System associated with equivalent voltage source data.
Grid Voltage Variations for **Users** excluding **DC Connected Power Park Modules** and **Remote End HVDC Converters** ECC.6.1.4.1	Subject as provided below, the voltage on the 400kV part of the **National Electricity Transmission System** at each **Connection Site** with a **User** (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point**, excluding **DC Connected Power Park Modules** and **Remote End HVDC Converters**) 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 **National Electricity Transmission System** at each Connection Point (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point**) will normally remain within the limits ±10% of the nominal value unless abnormal conditions prevail. At nominal **System** voltages below 110kV the voltage of the **National Electricity Transmission System** at each **Connection Site** with a **User** (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point**), excluding **Connection Sites** for **DC Connected Power Park Modules** and **Remote End HVDC Converters**) will normally remain within the limits ±6% of the nominal value unless abnormal conditions prevail. Under fault conditions,	~~Subject as provided below~~ The voltage on ~~the 400kV~~ parts of the **National Electricity Transmission System** operating at nominal voltages of greater than 300kV at each **Connection Site** with a **User** (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point**, excluding **DC Connected Power Park Modules** and **Remote End HVDC Converters**) 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. For nominal voltages of 110kV and up to and including 300kV voltages on the ~~275kV and 132kV~~ parts of the **National Electricity Transmission System** at each Connection Point (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point)** will normally remain within the limits ±10% of the nominal value unless abnormal conditions prevail. At nominal **System** voltages below 110kV the voltage of the **National Electricity Transmission System** at each **Connection Site** with a **User** (and in the case of **OTSDUW Plant and Apparatus**, a **Transmission Interface Point**), excluding **Connection Sites** for **DC Connected Power Park Modules** and **Remote End HVDC Converters**) will normally remain within the limits ±6% of the nominal value unless abnormal conditions prevail. Under fault conditions, the voltage may collapse transiently to zero at the point of fault until the fault is cleared. The normal operating ranges of the **National Electricity Transmission System** are summarised below:

<table>
<tr><td></td><td>the voltage may collapse transiently to zero at the point of fault until the fault is cleared. The normal operating ranges of the National Electricity Transmission System are summarised below:</td><td></td></tr>
<tr><td></td><td>
<table>
<tr><th>National Electricity Transmission System Nominal Voltage</th><th>Normal Operating Range</th><th>Time period for Operation</th></tr>
<tr><td>400kV</td><td>400kV -10% to +5%
400kV +5% to +10%</td><td>Unlimited
15 minutes</td></tr>
<tr><td>275kV</td><td>275kV ±10%</td><td>Unlimited</td></tr>
<tr><td>132kV</td><td>132kV ±10%</td><td>Unlimited</td></tr>
<tr><td>110kV</td><td>110kV ±10%</td><td>Unlimited</td></tr>
<tr><td>Below 110kV</td><td>Below 110kV ±6%</td><td>Unlimited</td></tr>
</table>
The Company and a User may agree greater variations or longer minimum time periods of operation in voltage to those set out above in relation to a particular Connection Site, and insofar as a greater variation is agreed, the relevant figure set out above shall, in relation to that User at the particular Connection Site, be replaced by the figure agreed.
</td><td>
<table>
<tr><th rowspan="2">National Electricity Transmission System Nominal Voltage</th><th colspan="2">Normal Operating Range</th><th rowspan="2">Time Period for Operation</th></tr>
<tr><th>Voltage (percentage of Nominal Voltage)</th><th>PU (1pu relates to the Nominal Voltage)</th></tr>
<tr><td>~~400kV~~ Greater than 300kV</td><td>~~400kV~~ -10% to +5%
~~400kV~~ +5% to +10%</td><td>0.90pu-1.05pu
1.05pu-1.10pu</td><td>Unlimited
15 minutes</td></tr>
<tr><td>~~275kV~~ 110kV up to 300kV</td><td>~~275kV~~ ± 10%</td><td>0.90pu-1.10pu</td><td></td></tr>
<tr><td>~~132kV~~</td><td>~~132kV ± 10%~~</td><td></td><td>~~Unlimited~~</td></tr>
<tr><td>~~110kV~~</td><td>~~110kV ± 10%~~</td><td></td><td>~~Unlimited~~</td></tr>
<tr><td>Below 110kV</td><td>~~Below 110kV~~ ± 6%</td><td>0.94pu-1.06pu</td><td>Unlimited</td></tr>
</table>
The Company and a User may agree greater variations or longer minimum time periods of operation in voltage to those set out above in relation to a particular Connection Site, and insofar as a greater variation is agreed, the relevant figure set out above shall, in relation to that User at the particular Connection Site, be replaced by the figure agreed.
</td></tr>
<tr><td>Fault Clearance Times ECC.6.2.2.2.2</td><td>(a) The required fault clearance time for faults on the Generator's (including DC Connected Power Park Modules) or HVDC System Owner's equipment directly connected to the National Electricity Transmission System or OTSDUW Plant and Apparatus and for faults on the National Electricity Transmission System directly connected to the EU Generator (including DC Connected Power Park Modules) or HVDC System Owner's equipment or OTSDUW Plant and Apparatus, from fault inception to the circuit breaker arc extinction, shall be set out in the Bilateral Agreement. The fault clearance time specified in the Bilateral Agreement shall not be shorter than the durations specified below: (i) 80ms at 400kV, (ii) 100ms at 275kV, (iii) 120ms at 132kV and below but this shall not prevent the User or The Company or the Relevant Transmission Licensee or the EU Generator (including in respect of OTSDUW Plant and Apparatus and DC Connected Power Park Modules) from selecting a shorter fault clearance time on their own Plant and Apparatus provided Discrimination is achieved. A longer fault clearance time may be specified in the Bilateral Agreement for faults on the National Electricity Transmission System. A longer fault clearance time for faults on the EU Generator or HVDC System Owner's equipment or OTSDUW Plant and Apparatus may be agreed with The Company in accordance with the terms of the Bilateral Agreement but only if</td><td>(a) The required fault clearance time for faults on the Generator's (including DC Connected Power Park Modules) or HVDC System Owner's equipment directly connected to the National Electricity Transmission System or OTSDUW Plant and Apparatus and for faults on the National Electricity Transmission System directly connected to the EU Generator (including DC Connected Power Park Modules) or HVDC System Owner's equipment or OTSDUW Plant and Apparatus, from fault inception to the circuit breaker arc extinction, shall be set out in the Bilateral Agreement. The fault clearance time specified in the Bilateral Agreement shall not be shorter than the durations specified below:
(i) 80ms ~~at 400kV~~ for connections operating at a nominal voltage of greater than 300kV
(ii) 100ms ~~at 275kV~~ for connections operating at a nominal voltage of greater than 132kV and up to 300kV
(iii) 120ms ~~at~~ for connections operating at a nominal voltage of 132kV and below
but this shall not prevent the User or The Company or the Relevant Transmission Licensee or the EU Generator (including in respect of OTSDUW Plant and Apparatus and DC Connected Power Park Modules) from selecting a shorter fault clearance time on their own Plant and Apparatus provided Discrimination is achieved. A longer fault clearance time may be specified in the Bilateral Agreement for faults on the National Electricity Transmission System. A longer fault clearance time for faults on the EU Generator or HVDC System Owner's equipment or OTSDUW Plant and Apparatus may be agreed with The Company in accordance with the terms of the Bilateral Agreement but only if System requirements, in The Company's view, permit. The probability that the fault clearance time stated in the Bilateral Agreement will be exceeded by any given</td></tr>
</table>

	System requirements, in **The Company's** view, permit. The probability that the fault clearance time stated in the **Bilateral Agreement** will be exceeded by any given fault, must be less than 2%	fault, must be less than 2%
	(b) In the event that the required fault clearance time is not met as a result of failure to operate on the **Main Protection System(s)** provided, the **Generators** or **HVDC System Owners** or **Generators** in the case of **OTSDUW Plant and Apparatus** shall, except as specified below provide **Independent Back-Up Protection**. **The Relevant Transmission Licensee** will also provide **Back-Up Protection** and the **Relevant Transmission Licensee's** and the **User's Back-Up Protections** will be co-ordinated so as to provide **Discrimination**. On a **Power Generating Module** (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus** and connected to the **National Electricity Transmission System** at 400kV or 275kV and where two **Independent Main Protections** are provided to clear faults on the **HV Connections** within the required fault clearance time, the **Back-Up Protection** provided by **EU Generators** (including in respect of **OTSDUW Plant and Apparatus** and **DC Connected Power Park Modules**) and **HVDC System Owners** shall operate to give a fault clearance time of no longer than 300ms at the minimum infeed for normal operation for faults on the HV Connections. Where two **Independent Main Protections** are installed the **Back-Up Protection** may be integrated into one (or both) of the **Independent Main Protection** relays. On a **Power Generating Module** (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus** and connected to the **National Electricity Transmission System** at 132 kV and where only one **Main Protection** is provided to clear faults on the **HV Connections** within the required fault clearance time, the **Independent Back-Up Protection** provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus** and **DC Connected Power Park Modules**) and the **HVDC System Owner** shall operate to give a fault clearance time of no longer than 300ms at the minimum infeed for normal operation for faults on the **HV Connections**. **A Power Generating Module** (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus**) with **Back-Up Protection** or **Independent Back-Up Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail Protection at	(b) In the event that the required fault clearance time is not met as a result of failure to operate on the **Main Protection System(s)** provided, the **Generators** or **HVDC System Owners** or **Generators** in the case of **OTSDUW Plant and Apparatus** shall, except as specified below provide **Independent Back-Up Protection**. **The Relevant Transmission Licensee** will also provide **Back-Up Protection** and the **Relevant Transmission Licensee's** and the **User's Back-Up Protections** will be co-ordinated so as to provide **Discrimination**. On a **Power Generating Module** (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus** and connected to the **National Electricity Transmission System** operating at a nominal voltage of greater than 132kV ~~400kV or 275kV~~ and where two **Independent Main Protections** are provided to clear faults on the **HV Connections** within the required fault clearance time, the **Back-Up Protection provided** by **EU Generators** (including in respect of **OTSDUW Plant and Apparatus** and **DC Connected Power Park Modules**) and **HVDC System Owners** shall operate to give a fault clearance time of no longer than 300ms at the minimum infeed for normal operation for faults on the HV Connections. Where two **Independent Main Protections** are installed the **Back-Up Protection** may be integrated into one (or both) of the **Independent Main Protection** relays. On a Power Generating Module (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus** and connected to the **National Electricity Transmission System** at 132 kV and below where only one **Main Protection** is provided to clear faults on the **HV Connections** within the required fault clearance time, the **Independent Back-Up Protection** provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus** and **DC Connected Power Park Modules**) and the **HVDC System Owner** shall operate to give a fault clearance time of no longer than 300ms at the minimum infeed for normal operation for faults on the **HV Connections.** **A Power Generating Module** (other than a **Power Park Unit**), **HVDC Equipment** or **OTSDUW Plant and Apparatus**) with **Back-Up Protection** or **Independent Back-Up Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail Protection at a nominal voltage of greater than 132kV ~~400kV or 275kV~~

	400kV or 275kV or of a fault cleared by **Back-Up Protection** where the **EU Generator** (including in the case of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Module**) or **HVDC System** is connected at 132kV and below. This will permit **Discrimination** between the **Generator** in respect of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Modules** or **HVDC System Owners' Back-Up Protection** or **Independent Back-Up Protection** and the **Back-Up Protection** provided on the **National Electricity Transmission System** and other **Users' Systems**	or of a fault cleared by **Back-Up Protection** where the **EU Generator** (including in the case of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Module**) or **HVDC System** is connected at 132kV and below. This will permit **Discrimination** between the **Generator** in respect of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Modules** or **HVDC System Owners' Back-Up Protection** or **Independent Back-Up Protection** and the **Back-Up Protection** provided on the **National Electricity Transmission System** and other **Users' Systems**
	(c) When the **Power Generating Module** (other than **Power Park Units**), or the **HVDC Equipment** or **OTSDUW Plant and Apparatus** is connected to the **National Electricity Transmission System** at 400kV or 275kV, and in Scotland and **Offshore** also at 132kV, and a circuit breaker is provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Modules**) or the **HVDC System** owner, or the **Relevant Transmission Licensee**, as the case may be, to interrupt fault current interchange with the **National Electricity Transmission System**, or **Generator's System**, or **HVDC System Owner's System**, as the case may be, circuit breaker fail Protection shall be provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Modules**) or **HVDC System** Owner, or the **Relevant Transmission Licensee**, as the case may be, on this circuit breaker. In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within the **Fault Current Interruption Time**, the circuit breaker fail Protection is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200ms	(c) When the **Power Generating Module** (other than **Power Park Units**), or the **HVDC Equipment** or **OTSDUW Plant and Apparatus** is connected to the **National Electricity Transmission System** operating at a nominal voltage of greater than 132kV ~~400kV or 275kV~~, and in Scotland and **Offshore** also at 132kV, and a circuit breaker is provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus** or **DC Connected Power Park Modules**) or the **HVDC System** owner, or the **Relevant Transmission Licensee**, as the case may be, to interrupt fault current interchange with the **National Electricity Transmission System**, or **Generator's System**, or **HVDC System Owner's System**, as the case may be, circuit breaker fail Protection shall be provided by the **Generator** (including in respect of **OTSDUW Plant and Apparatus or DC Connected Power Park Modules**) or **HVDC System** Owner, or the **Relevant Transmission Licensee**, as the case may be, on this circuit breaker. In the event, following operation of a **Protection** system, of a failure to interrupt fault current by these circuit-breakers within **the Fault Current Interruption Time**, the circuit breaker fail Protection is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200ms.
Protection arrangements for **EU Code Users** in respect of **Network Operators and NonEmbedded Customers User Systems** directly connected to the **National Electricity Transmission System**, shall	(a) The required fault clearance time for faults on **Network Operator** and **Non-Embedded Customer** equipment directly connected to the **National Electricity Transmission System**, and for faults on the **National Electricity Transmission System** directly connected to the **Network Operator's** or **Non-Embedded Customer's** equipment, from fault inception to the circuit breaker arc extinction, shall be set out in each **Bilateral Agreement**. The fault clearance time specified in the **Bilateral Agreement** shall not be shorter than the durations specified below: (i) 80ms at 400kV (ii) 100ms at 275kV (iii) 120ms at 132kV and below but this shall not prevent the **User** or **The Company** or	(a) The required fault clearance time for faults on **Network Operator** and **Non-Embedded Customer** equipment directly connected to the **National Electricity Transmission System**, and for faults on the **National Electricity Transmission System** directly connected to the **Network Operator's** or **Non-Embedded Customer's equipment**, from fault inception to the circuit breaker arc extinction, shall be set out in each **Bilateral Agreement**. The fault clearance time specified in the **Bilateral Agreement** shall not be shorter than the durations specified below: (i) 80ms ~~at 400kV~~ for connections operating at a nominal voltage of greater than 300kV (ii) 100ms ~~at 275kV~~ for connections operating at a nominal voltage of greater than 132kV

meet the requirements given below: ECC.6.2.3.1.1	**Relevant Transmission Licensee** from selecting a shorter fault clearance time on its own **Plant** and **Apparatus** provided **Discrimination** is achieved. For the purpose of establishing the **Protection** requirements in accordance with ECC.6.2.3.1.1 only, the point of connection of the **Network Operator** or **Non-Embedded Customer equipment** to the **National Electricity Transmission System** shall be deemed to be the low voltage busbars at an **EU Grid Supply Point**, irrespective of the ownership of the equipment at the **EU Grid Supply Point**.	and up to 300kV (iii) 120ms ~~at~~ for connections operating at a nominal voltage of 132kV and below but this shall not prevent the **User** or **The Company** or **Relevant Transmission Licensee** from selecting a shorter fault clearance time on its own **Plant** and **Apparatus** provided **Discrimination** is achieved. For the purpose of establishing the Protection requirements in accordance with ECC.6.2.3.1.1 only, the point of connection of the **Network Operator** or **Non-Embedded Customer** equipment to the **National Electricity Transmission System** shall be deemed to be the low voltage busbars at an **EU Grid Supply Point**, irrespective of the ownership of the equipment at the **EU Grid Supply Point.**
ECC.6.2.3.1.1	(b) (i) For the event of failure of the **Protection** systems provided to meet the above fault clearance time requirements, **Back-Up Protection** shall be provided by the **Network Operator** or **Non-Embedded Customer** as the case may be. (ii) The **Relevant Transmission Licensee** will also provide **Back-Up Protection**, which will result in a fault clearance time longer than that specified for the **Network** **Operator** or **Non-Embedded Customer Back-Up Protection** so as to provide **Discrimination**. (iii) For connections with the **National Electricity Transmission System** at 132kV and below, it is normally required that the **Back-Up Protection** on the **National Electricity Transmission System** shall discriminate with the **Network Operator** or **Non-Embedded Customer's Back-Up Protection**. (iv) For connections with the **National Electricity Transmission System** at 400kV or 275kV, the **Back-Up Protection** will be provided by the **Network Operator** or **Non-Embedded Customer**, as the case may be, with a fault clearance time not longer than 300ms for faults on the **Network Operator's** or **Non-Embedded Customer's Apparatus**.	(b) (i) For the event of failure of the **Protection** systems provided to meet the above fault clearance time requirements, **Back-Up Protection** shall be provided by the **Network Operator** or **Non-Embedded Customer** as the case may be. (ii) The **Relevant Transmission Licensee** will also provide **Back-Up Protection**, which will result in a fault clearance time longer than that specified for the **Network Operator** or **Non-Embedded Customer** Back-**Up Protection** so as to provide **Discrimination**. (iii) For connections with the **National Electricity Transmission System** at 132kV and below, it is normally required that the **Back-Up Protection** on the **National Electricity Transmission System** shall discriminate with the **Network Operator** or **Non-Embedded Customer's Back-Up Protection.** (iv) For connections with the **National Electricity Transmission System** operating at a nominal voltage greater than 132kV ~~400kV or 275kV~~, the **Back-Up Protection** will be provided by the **Network Operator** or **Non-Embedded Customer**, as the case may be, with a fault clearance time not longer than 300ms for faults on the **Network Operator's** or **Non-Embedded Customer's Apparatus**.
ECC.6.2.3.1.1	(v) Such **Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail **Protection** at 400kV or 275kV. This will permit **Discrimination** between **Network Operator's Back-Up Protection** or **Non-Embedded Customer's Back-Up Protection**, as the case may be, and **Back-Up Protection** provided on the **National Electricity Transmission System** and other **User Systems**. The requirement for and level of **Discrimination** required will be	(v) Such **Protection** will also be required to withstand, without tripping, the loading incurred during the clearance of a fault on the **National Electricity Transmission System** by breaker fail **Protection** operating at a nominal voltage of greater than 132kV ~~400kV or 275kV~~. This will permit **discrimination** between **Network Operator's Back-Up Protection** or **Non-Embedded Customer's Back-Up Protection**, as the case may be, and **Back-Up Protection** provided on **the National Electricity Transmission System** and other **User Systems.** The requirement for and level of **Discrimination** required will be specified in the **Bilateral Agreement.**

<table>
<tr>
<td></td>
<td>specified in the Bilateral Agreement.
(c) (i) Where the Network Operator or Non-Embedded Customer is connected to the National Electricity Transmission System at 400kV or 275kV, and in Scotland also at 132kV, and a circuit breaker is provided by the Network Operator or Non-Embedded Customer, or the Relevant Transmission Licensee, as the case may be, to interrupt the interchange of fault current with the National Electricity Transmission System or the System of the Network Operator or Non-Embedded Customer, as the case may be, circuit breaker fail Protection will be provided by the Network Operator or Non-Embedded Customer, or the Relevant Transmission Licensee, as the case may be, on this circuit breaker.

(ii) In the event, following operation of a Protection system, of a failure to interrupt fault current by these circuit-breakers within the Fault Current Interruption Time, the circuit breaker fail Protection is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200ms.</td>
<td>(c) (i) Where the Network Operator or Non-Embedded Customer is connected to part of the National Electricity Transmission System operating at a nominal voltage greater than 132kV and in ~~at 400kV or 275kV, and in~~ Scotland also at 132kV, and a circuit breaker is provided by the Network Operator or Non-Embedded Customer, or the Relevant Transmission Licensee, as the case may be, to interrupt the interchange of fault current with the National Electricity Transmission System or the System of the Network Operator or Non-Embedded Customer, as the case may be, circuit breaker fail Protection will be provided by the Network Operator or Non-Embedded Customer, or the Relevant Transmission Licensee, as the case may be, on this circuit breaker.

(ii) In the event, following operation of a Protection system, of a failure to interrupt fault current by these circuit-breakers within the Fault Current Interruption Time, the circuit breaker fail Protection is required to initiate tripping of all the necessary electrically adjacent circuit-breakers so as to interrupt the fault current within the next 200ms.</td>
</tr>
<tr>
<td>Voltage Fluctuations ECC.6.1.7</td>
<td>
<table>
<tr><th>Supply system Nominal voltage</th><th colspan="2">Planning level</th></tr>
<tr><th></th><th>Flicker Severity Short Term (Pst)</th><th>Flicker Severity Long Term (Plt)</th></tr>
<tr><td>3.3 kV, 6.6 kV, 11 kV, 20 kV, 33 kV</td><td>0.9</td><td>0.7</td></tr>
<tr><td>66 kV, 110 kV, 132 kV, 150 kV, 200 kV, 220 kV, 275 kV, 400 kV</td><td>0.8</td><td>0.6</td></tr>
<tr><td colspan="3">NOTE 1: The magnitude of P_{st} is linear with respect to the magnitude of the voltage changes giving rise to it.
NOTE 2: Extreme caution is advised in allowing any excursions of P_{st} and P_{lt} above the planning level.</td></tr>
</table>
Table ECC.6.7.1(b) — Planning levels for flicker</td>
<td>
<table>
<tr><td>Supply System Nominal Voltage</td><td>Planning Level
Flicker Severity Short Term (Pst)</td><td>
Flicker Severity Long Term (Plt)</td></tr>
<tr><td>~~3.3kV, 6.6kV, 11kV, 20kV,~~ Up to and including 33kV</td><td>0.9</td><td>0.7</td></tr>
<tr><td>66kV and greater, ~~100kV, 132kV, 150kV, 00kV, 220kV, 275kV, 400kV~~</td><td>0.8</td><td>0.6</td></tr>
<tr><td colspan="3">NOTE 1: The magnitude of Pst is linear with respect to the magnitude of the voltage changes giving rise to it.
NOTE 2: Extreme caution is advised in allowing any excursions of Pst and Plt above the planning level.</td></tr>
</table>
Table ECC.6.7.1(b) — Planning levels for flicker</td>
</tr>
<tr>
<td>Schedule 5-Users System Data
Page 1 of 11</td>
<td>(a) all parts of the User's System, whether existing or proposed, operating at Supergrid Voltage, and in Scotland and Offshore, also all parts of the User System operating at 132kV,

(b) all parts of the User's System operating at a voltage of 50kV, and in Scotland and Offshore greater than 30kV, or higher which can interconnect Connection Points, or split bus-bars at a single Connection Point,

This Single Line Diagram shall depict the arrangement(s) of all of the existing and proposed load current carrying Apparatus relating to both existing and proposed Connection Points, showing electrical circuitry (ie. overhead lines, underground cables, power transformers</td>
<td>(a) all parts of the User's System, whether existing or proposed, operating at Supergrid Voltage, and in Scotland and Offshore, also all parts of the User System operating at greater than 110kV ~~132kV~~,

(b) all parts of the User's System operating at a voltage of greater than 50kV, and in Scotland and Offshore greater than 30kV, or higher which can interconnect Connection Points, or split bus-bars at a single Connection Point,

This Single Line Diagram shall depict the arrangement(s) of all of the existing and proposed load current carrying Apparatus relating to both existing and proposed Connection Points, showing electrical circuitry (ie. overhead lines, underground cables, power transformers and similar equipment),</td>
</tr>
</table>

	and similar equipment), operating voltages. In addition, for equipment operating at a **Supergrid Voltage**, and in Scotland and **Offshore** also at 132kV, circuit breakers and phasing arrangements shall be shown.	operating voltages. In addition, for equipment operating at a **Supergrid Voltage**, and in Scotland and **Offshore** also at 110kV and above ~~132kV~~, circuit breakers and phasing arrangements shall be shown.
Schedule 5- Users System Data Page 8 of 11	(f) The following data is required on all transformers operating at **Supergrid Voltage** throughout **Great Britain** and, in Scotland and **Offshore**, also at 132kV: three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage.	(f) The following data is required on all transformers operating at **Supergrid Voltage** throughout **Great Britain** and, in Scotland and **Offshore**, also at greater than 110kV~~132kV~~: three or five limb cores or single phase units to be specified, and operating peak flux density at nominal voltage.

10 Recommendations

Proposer's Recommendation to Panel

Panel is asked to:

- Agree that standard governance procedures should apply
- Agree that this modification can proceed to Code Administrator Consultation
- Refer this proposal to a Workgroup for assessment, only if deemed necessary by panel.

