

MODIFICATION RECOMMENDATION FORM



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*RECOMMENDATION TO CER BY EIRGRID OF MODIFICATION TO GRID
CODE.*

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| ABSTRACT / TITLE OF MODIFICATION | | Interconnector | |
| MODIFICATION NUMBER | | MPID 187 | |
| RECOMMENDED AT GCRP MEETING NUMBER | | 27 | |
| CURRENT GRID CODE VERSION : | | V3.5 | |
| GRID CODE SECTION(S) AFFECTED BY PROPOSAL: | <ul style="list-style-type: none"> • PC.3 • GRID CODE - PLANNING CODE APPENDIX • PC.A5 • PC.A6 (Adjustment from PC.A5, New) | | |
| PLANNING CODE | PLANNING CODE – INTRODUCTION | | |
| CONNECTION CONDITIONS : | <ul style="list-style-type: none"> • CC.3 • CC.5.3 • CC.7.2.5.5 (New) • CC.7.2.5.6(New) • CC.7.5 (New) • CC.7.5.1(New) • CC.7.5.1.1(New) • CC.7.5.1.2(New) • CC.7.5.2 (New) • CC.7.5.3(New) • CC.7.5.4(New) • CC.7.5.5(New) • CC.7.5.6(New) • CC.7.5.7(New) • CC.7.5.7.1(New) • CC.7.5.8(New) • CC.7.5.8.1(New) • CC.7.5.8.2(New) • CC.7.5.8.3(New) • CC.7.5.8.4(New) • CC.7.5.9(New) • CC.7.5.9.1(New) • CC.7.5.10(New) • CC.7.5.11(New) • CC.10 • CC.10.12 (New) • CC.10.12.1(New) • CC.10.12.2(New) • CC.10.12.3 (New) • CC.10.13 (Adjustment from CC.10.12) • CC.10.13.1 (Adjustment from CC.10.12.1) • CC.10.13.2 (Adjustment from CC.10.12.2) • CC.10.13.3(New) • CC.10.13.4(New) • CC.12.2 (s, t, u, v - New) • CC.15.6 | | |
| GLOSSARY | <ul style="list-style-type: none"> • Automatic Voltage Regulation (existing) • Block Load for an Interconnector (New) • Current Source Technology (New) • Forbidden Zone (existing) • Frequency Response (existing) • Grid Connection Point • Interconnection Agreement (existing) • Interconnector (existing) • Interconnector Minimum Export Load (New) • Interconnector Minimum Import Load (New) • Interconnector Minimum Load (New) • Interconnector Operating Protocol (New) • Interconnector Operator (New) • Interconnector Owner (existing) • Interconnector 's Plant (New) • Interconnector Ramp-down Capability (New) • Interconnector Ramp-up Capability (New) • Interconnector Ramp Rate (New) • Interconnector Registered Capacity (New) • Interconnector Registered Export Capacity (New) • Interconnector Registered Import Capacity (New) • Interconnector Transformer (New) • Voltage Regulation (existing) | | |

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| <p>MODIFICATION PROPOSAL DESCRIPTION</p> | <p>For the following changes in the Grid Code</p> <ul style="list-style-type: none"> • Rationale will be highlighted in italic formatting. • Text in blue is new text that has been reviewed and agreed by the Grid Code Review Panel. • Text in red and strike-through is text recommended for deletion. |
| <p>PC.3</p> <p><i>Inclusion of the Interconnectors to the scope of the section.</i></p> | <p>(a) Generators and Generator Aggregators with Registered Capacity greater than 10 MW;</p> <p>(b) all Generators connected to the Transmission System;</p> <p>(c) Distribution System Operator;</p> <p>(c) Interconnector Operators;</p> <p>(d) Distribution System Operator;</p> <p>(e) Transmission Asset Owner; and</p> <p>(f) Demand Customers including both Dispatchable Demand Customers and Demand Side Units.</p> |
| <p>GRID CODE - PLANNING CODE APPENDIX</p> <p><i>Inclusion of new section before Dispatchable Demand Customers to maintain consistency of Interconnector position throughout the document.</i></p> <p><i>Amendment of the numbering Scheme, existing PC.A5 will now change to PC.A6.</i></p> | <p>PC.A5: INTERCONNECTOR CHARACTERISTICS AND REGISTERED DATA</p> <p>PC.A56: DISPATCHABLE DEMAND CUSTOMERS</p> |
| <p>PLANNING CODE Appendix – INTRODUCTION</p> <p><i>General Inclusion of Interconnectors for this Section.</i></p> | <p>This appendix specifies data to be submitted to the TSO by Users or prospective Users of the Transmission System. The requirement to provide data is governed by the Planning Code (PC4.2, PC4.3, PC4.4, PC5 and PC6).</p> <p>The specific data requirements depend on whether the User is a Customer or a Generator or both Interconnector or more than one combined. PC.A1 and PC.A2 apply to all Users. PC.A3 applies to demand Users. PC.A4 applies to Generators. PC.A5 applies to Interconnectors and PC.A6 applies to Dispatchable Demand Customers.</p> <p>Any material changes to the data specified in PC.A3 or PC.A4 must be notified to the TSO as soon as practicable.</p> |

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| <p>PC.A5:</p> <p><i>New section inserted before Dispatch demand customers to maintain consistency throughout the Grid Code. This section will deal with the Interconnector Data Requirements.</i></p> | <p>Interconnector Operating Characteristics and Registered Data</p> <p>Minimum technical, design and operational criteria to be met by Interconnectors are specified in the Connection Conditions.</p> <p>For an Interconnector the following information shall be provided for specified temperature conditions:</p> <ul style="list-style-type: none"> (i) Interconnector Registered Capacity <ul style="list-style-type: none"> (a) Interconnector Registered Import Capacity for import to the Transmission System (MW) _____; (b) Interconnector Registered Export Capacity for export from the Transmission System (MW) _____. <p>Interconnector Registered Capacity figures (a) and (b) above shall include transmission power losses for the Interconnector and be considered Registered Data.</p> |
| <p>PC.A56:</p> <p><i>Section has been renumbered; This change is applied to the planning Code Introduction No other influences within the Grid Code.</i></p> | <p>PC.A56: Dispatchable Demand Customers</p> |
| <h2>Connection Conditions</h2> | |
| <p>CC.3</p> <p><i>Insert Interconnectors – all other letters will be updated for each plant.</i></p> | <p>CC.3 SCOPE</p> <p>The Connection Conditions apply to the TSO and to the following Users:</p> <ul style="list-style-type: none"> (a) Generators with Registered Capacity greater than 2MW; (b) The Distribution System Operator; (b) Interconnectors; (c) The Distribution System Operator; (d) Demand Customers; and (e) Dispatchable Demand Customers. |

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| <p>CC.5.3</p> <p><i>Insert Interconnectors into (b) – change all subsequent lettering – This is to ensure easy reading / reference for Interconnectors throughout the Grid Code – to be inserted after Generator reference. No other dependencies / references related to these numbers within the Grid Code.</i></p> | <p>The TSO's standard practice currently requires that, unless otherwise agreed with the TSO, the following standard designations apply:</p> <ul style="list-style-type: none"> (a) Generation Units: for hydro and wind: G1, G2 etc. for thermal: U1, U2 etc. (b) Interconnectors; for : I1, I2 etc. (c) Generator transformers and Interconnector transformers: at 400 kV; T4001, T4002 etc. (i.e. transformers for at 220 kV; T2001, T2002 etc. Generation Unit production) at 110 kV; T101, T102 etc. (d) Power Station transformers: at 400 kV; ST4001, ST4002 etc. (i.e. dedicated transformers at 220 kV; ST2001, ST2002 etc. supplying both the Generation Unit and the Power Station auxiliaries from the HV busbar) (e) Unit transformers: UT1, UT2 etc. (i.e. transformers supplying auxiliaries of a Generation Unit) (f) Load transformers: for 400/110 kV; T4101, T4102 etc. for 220/110 kV; T2101, T2102 etc. for 110/38kV; T141, T142 etc. for 110/20kV; T121, T122 etc. for 110/11kV and below; T101, T102 etc. (g) Bus sections, conventional busbars: single bus; A1, A2 etc. double bus; A1, A2, B1, B2 etc. (h) Bus sections, ring busbars: each section identified by designation of Plant and/or Apparatus item connected to it. (l) Bus Couplers: K1, K2 etc. (j) Lines and cables: each line or cable at a station identified by name of station or stations at the remote end or ends of the line or cable in alphabetical order. (k) Circuit Breakers CB. (l) Main Earth Disconnects DE. (m) Line Disconnect DL. (n) Busbar Disconnects DA, DB, etc. (o) Coupler Disconnects DA, DB, etc. |
| <p>CC.7.2.5.5</p> | <p>An Interconnector Transformer shall be designed such that the Reactive Power capability is possible over the full range of Transmission System Voltages (specified in CC.7.5.1.1 (f)). The TSO and an Interconnector owner will liaise on matters related to the Interconnector Transformer at the design stage.</p> |

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| CC.7.2.5.6 | Interconnector Transformer windings shall be connected in star (with the star point or neutral brought out) on the higher Voltage side and in delta on the lower Voltage side or as agreed with the TSO . |
| CC.7.5 | Interconnector |
| CC.7.5.1 | The conditions specified in this section of the Grid Code apply to all Interconnectors connected to or connecting to the Transmission System . The provision of services affecting the Transmission System shall be in accordance with the Interconnector Operating Protocol as agreed with the TSO and the External System Operator . |

Recommended by GCRP 27

CC.7.5.1.1

Each **Interconnector**, shall have the following minimum capabilities, for the avoidance of doubt, additional performance capabilities are required from **OC4- System Services**:

- (a) operate continuously at **MW Output at Transmission System Frequencies** in the range 49.5Hz to 50.5Hz;
- (b) operate and remain connected to the **Transmission System at Transmission System Frequencies** within the range 47.5Hz to 52.0Hz;
- (c) remain connected to the **Transmission System at Transmission System Frequencies** within the range 47.0Hz to 47.5Hz for a duration of 30 seconds required each time the Frequency is below 47.5Hz;
- (d) remain connected to the **Transmission System** during rate of change of **Transmission System Frequency** of values up to and including 1 Hz per second;
- (e) remain connected to the **Transmission System at MW Output at Transmission System Voltages** within the ranges specified in CC.8.3.2 for step changes in **Transmission System Voltage** of up to 10%;
- (f) sustained operation in accordance with the **Reactive Power** capability referred to in CC.7.5.10 at **Transmission System Voltages** within the ranges specified in CC.8.3.2, unless otherwise specified;
- (g) remain connected during and following **Voltage** dips at the **HV** terminals of the **Interconnector Transformer** of 95% of nominal **Voltage** (5% retained) for duration 0.2 seconds and **Voltage** dips of 50% of nominal **Voltage** (i.e. 50% retained) for duration of 0.6 seconds. Following the fault clearance the **Interconnector** should return to pre-fault conditions subject to normal **Frequency Response** and **Voltage Regulation**;
- (h) operate within all normal operating characteristics at a minimum short circuit level at the **Connection Point** of 1000 MVA;
- (i) remain connected to the **Transmission System** during a negative phase sequence load unbalance in accordance with IEC 60034-1;
- (j) have support triggers to allow the **Interconnector** to provide **System Services** as outlined in OC4;

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| | <p>(k) in Emergency capable of reversing the power flow on the Interconnector at a rate which shall be no less than the Interconnector Registered Capacity within five seconds, up to ten times during the life of the plant and no more than two times in any given twelve months;</p> <p>(l) Interconnector Minimum Load not greater than the lesser of 3% of the Interconnector Registered Capacity or 50 MW;</p> <p>(m) Interconnector Ramp-up Capability not less than the greater of 10% of the Interconnector Registered Capacity per minute or 50 MW per minute, when the Interconnector is in the Normal Dispatch Condition;</p> <p>(n) Interconnector Ramp-down Capability not less than the greater of 10% of the Interconnector Registered Capacity per minute or 50 MW per minute, when the Interconnector is in the Normal Dispatch Condition;</p> <p>(o) Forbidden Zones within the lesser range of between + and - 3% of the Interconnector Registered Capacity or 30 MW in either flow direction and not more than 2 specified zones.</p> <p>(p) Block Load for an Interconnector not greater than the lesser of Interconnector Registered Capacity or 30 MW in either flow direction.</p> |
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| | <p>(q) Time from off-line to Interconnector Minimum Load in either flow direction. Not greater than 30 minutes.</p> <p>(r) Time from Interconnector Minimum Load in either flow direction to off-line. Not greater than 30 minutes.</p> |
| <p>CC.7.5.1.2</p> | <p>Where the TSO approaches an Interconnector Operator, the Interconnector Operator will co-operate with the TSO in the development of procedures and facilities to improve the response of each Interconnector during conditions of system stress. This shall be subject to the agreement of the Interconnector Operator that the procedures are consistent with secure operation of the Interconnector Operator's Plant, such agreement not to be unreasonably withheld.</p> |
| <p>CC.7.5.2</p> | <p>The Interconnector Operator must ensure that the reversal of flow capabilities is provided for such that the average Interconnector Ramp Rate from Interconnector Registered Export Capacity to Interconnector Minimum Import Load or Interconnector Registered Import Capacity to the Interconnector Registered Export Capacity of at least 50 MW per minute. For the avoidance of doubt this aggregate Interconnector Ramp Rate will include any time needed to pass through deadbands or Forbidden Zones of operation.</p> |

Recommendation 101

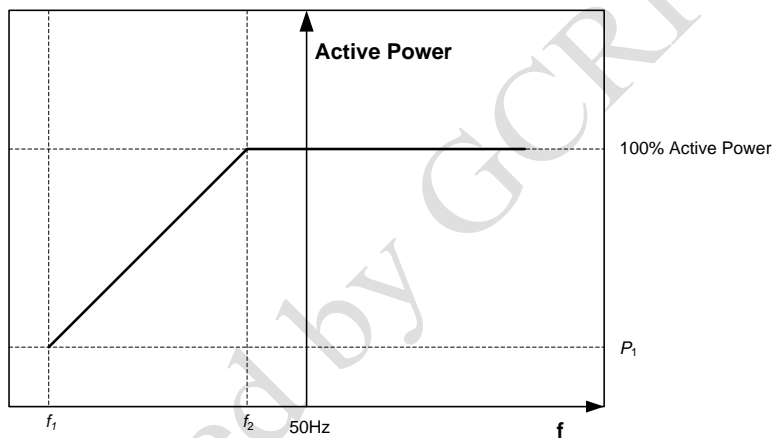
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| <p>CC.7.5.3</p> | <p>The Interconnector will be able to connect to the Transmission System under the following conditions:</p> <ul style="list-style-type: none"> (a) Transmission System Frequency within the limits 48.0 to 52.0 Hz; (b) Transmission System Voltage within the limits as specified in CC.8.3.2, not withstanding CC.7.5.9; (c) Transmission System Short Circuit Level at the point of connection no less than 1000 MVA. <p>Where supply from the Transmission System is temporarily lost, Interconnectors must be able to reconnect to the Transmission System and reach Minimum Load within 30 minutes of the Transmission System supply being restored.</p> |
| <p>CC.7.5.4</p> | <p>Each Interconnector:</p> <ul style="list-style-type: none"> (a) Must ensure that they do not cause any sub synchronous resonance, undamped oscillations or harmful shaft torsional oscillations to Users on the Transmission System. This shall be demonstrated by simulation prior to connection by the Interconnector using best industry practice as agreed by the TSO. (b) Where it is determined by the TSO that the Interconnector does cause such harmful oscillations or resonances the operation of the Interconnector shall cease until a solution is agreed with the TSO; (c) Where further studies are required to examine an oscillation or resonance issue there shall be an exchange of the necessary data between the Interconnector Operator and the TSO, such exchange of data shall not be unreasonably withheld. The Interconnector Operator shall provide a report to show the contribution that the Interconnector control system design will have on the torsional mode frequencies. (d) Input provisions for addition of a future sub synchronous damping controller shall be made by the Interconnector Operator; |

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| CC.7.5.5 | <p>Each Interconnector must be capable of:</p> <ul style="list-style-type: none"> (a) contributing to Frequency Control by continuous modulation of Active Power supplied to the Transmission System; (b) contributing to Voltage Control by continuous changes to the Reactive Power supplied to the Transmission System; |
| CC.7.5.6 | <p>Users shall install Interconnector controllers that comply with OC4 System Services. Users shall not change frequency or load related control settings of the Interconnector controllers without agreement with the TSO.</p> |
| <p>CC.7.5.7 See definition - Frequency Response</p> | <p>Standards for Frequency Response</p> |
| CC.7.5.7.1 | <p>Each Interconnector must be fitted with a fast acting control device to provide Frequency Response under normal operating conditions in accordance with OC4.3. The control device must be designed and operated to the appropriate;</p> <ul style="list-style-type: none"> (a) European Standards; or (b) In the absence of a relevant European Standards, such other standard which is in common use within the European Union; and (c) Interconnection Agreement. |
| CC.7.5.8 | <p>Interconnector Frequency Response</p> |

CC.7.5.8.1

An **Interconnector** must be capable of maintaining its **Active Power** output (i.e. when operating in Import mode) to the **Transmission System** at a level not less than the amount determined by the linear relationship shown in the figure below for **System Frequency** changes within the range f_1 to f_2 Hz, such that if the **System Frequency** drops to f_1 Hz the **Active Power** output shall not decrease by more than $100 - P_1$ where P_1 is the upper active power limit as a percentage of the **Active Power** output before the frequency change event, where;

- (i) $f_2 \geq f_1$
- (ii) $48\text{Hz} \leq f_1 \leq 50\text{Hz}$
- (iii) $48\text{Hz} \leq f_2 \leq 50\text{Hz}$
- (iv) $95\% \leq P_1 \leq 100\%$ Active Power



Settings for each of f_1 , f_2 and P_1 shall be specified by the **TSO** at least 120 **Business Days** prior to the **Interconnector's** scheduled **Operational Date**. The **Interconnector Operator** shall be responsible for implementing the appropriate settings during **Commissioning**.

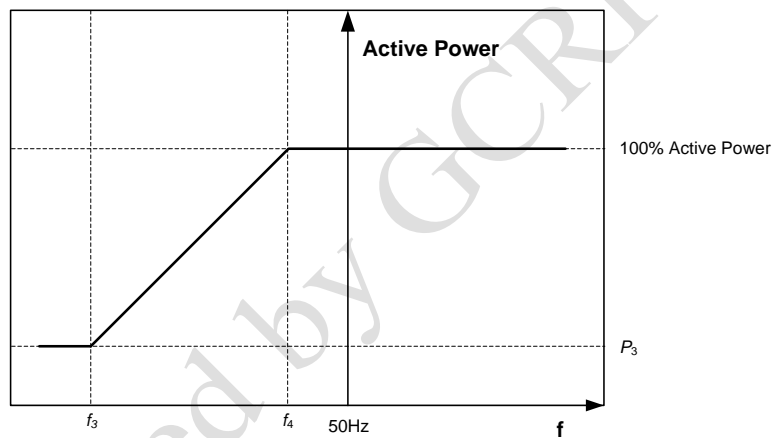
Alterations to these settings may be requested in real-time by the **TSO** and the implementation of the settings shall commence within 10 seconds of receipt of the signal from the **TSO**.

Note: This clause is in addition to any other obligations for **Frequency Performance** that the **Interconnector** may already have.

CC.7.5.8.2

An **Interconnector** must be capable of maintaining its **Active Power** input (i.e. when operating in Export mode) from the **Transmission System** at a level not greater than the amount determined by the linear relationship shown in the figure below for **System Frequency** changes within the range f_3 to f_4 Hz, such that if the **System Frequency** drops to f_3 Hz the **Active Power** input decreases by more than $100 - P_3$ where P_3 is the lower **Active Power** limit as a percentage of the **Active Power** output before the frequency change event, where;

- (i) $f_4 \geq f_3$
- (ii) $48\text{Hz} \leq f_3 \leq 50\text{Hz}$
- (iii) $48\text{Hz} \leq f_4 \leq 50\text{Hz}$
- (iv) $0\% \leq P_3 \leq 100\%$ Active Power



Settings for each of f_3 , f_4 and P_3 shall be specified by the **TSO** at least 120 **Business Days** prior to the **Interconnector's** scheduled **Operational Date**. The **Interconnector Operator** shall be responsible for implementing the appropriate settings during **Commissioning**.

Alterations to these settings may be requested in real-time by the **TSO** and the implementation of the settings shall commence within 10 seconds of receipt of the signal from the **TSO**.

Note: This clause is in addition to any other obligations for **Frequency Performance** that the **Interconnector** may already have.

CC.7.5.8.3

At the **Grid Connection Point** the **Active Power** output under steady state conditions of any **Interconnector** directly connected to the **Transmission System** should not be affected by **Voltage** changes in the normal operating range specified 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 at normal operating range.

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| CC.7.5.8.4 | The Frequency Deadband for all Interconnectors should be no greater than 0.03Hz (for the avoidance of doubt, $\pm 0.015\text{Hz}$); |
| CC.7.5.9 <i>See Definition amendment to Automatic Voltage Regulation.</i> | Automatic Voltage Regulation |
| CC.7.5.9.1 <i>Requirement for Current Source Technology included. See Definition Current Source Technology.</i> | <p>All Interconnectors (excluding Current Source Technology) shall be capable of contributing to control of Transmission System Voltage by continuous modulation of Interconnector Voltage by means of a suitable continuously acting Automatic Voltage Regulation (AVR) which shall be in accordance with European Standards and the characteristics of which have been accepted by the TSO prior to the Connection Date, such acceptance not to be unreasonably withheld.</p> <p>Interconnectors using Current Source Technology shall be capable of meeting the Reactive Power requirements to satisfy unity Power Factor at rated MW import / export at the Connection Point.</p> |

Recommended by CCRP

CC.7.5.10

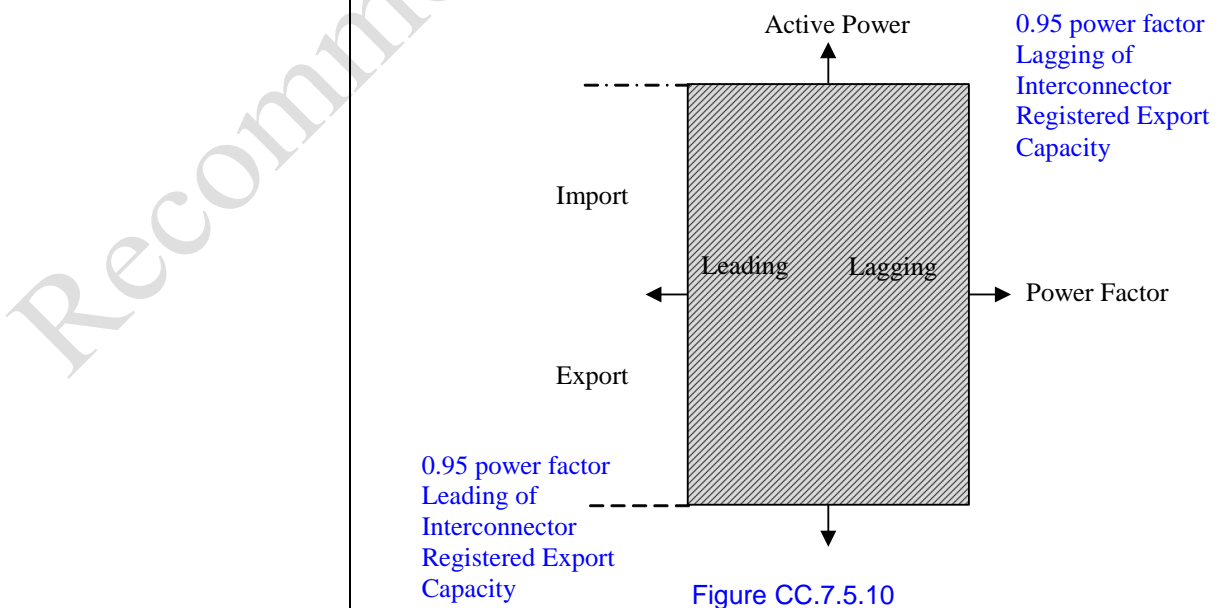
The reactive power graph as previously consulted was as referenced within the GB Grid Code. The new graph shows the same requirements but demonstrates the box graph defined 0.95pf lagging & leading for Registered export capacity. The GB graph was removed.

Interconnector Reactive Power

(a) There is a requirement for a continuously-acting automatic control system to provide control of the **Voltage** (or zero transfer of **Reactive Power** as applicable for **Current Source Technology**) at the **Grid Connection Point** without instability over the entire operating range of the **Interconnector**.

(b) An **Interconnector** must be capable of maintaining zero transfer of **Reactive Power** at the **Grid Connection Point** at all **Active Power** output levels under steady state **Voltage** conditions. The steady state tolerance on **Reactive Power** transfer to and from the **Transmission System** expressed in **Mvar** shall be no greater than 5% of the rated **MW**.

(c) An **Interconnector** (excluding **Current Source Technology**) must be capable of supplying rated **MW** import / export at any point between the limits 0.95 **Power Factor** lagging and 0.95 **Power Factor** leading based on the **Interconnector Registered Export Capacity** at the **Connection Point**. For the avoidance of doubt, **Interconnectors** shall be capable of operating at any point within the shaded section for the **Power Factor** ranges for **Registered Import Capacity** or **Registered Export Capacities** illustrated in Figure CC.7.5.10. The box shape is defined by the higher figure between **Interconnector Registered Import Capacity** and **Interconnector Registered Export Capacity**.



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| <p>CC.7.5.11</p> <p><i>Existing definition within the Grid Code with proposed modification to include option of the Interconnector Operator. As the requirements of External System Operators may differ it is thus difficult to standardise within the Grid Code. This agreement is a mechanism for which the TSO's will be obliged to agree to operation of the Interconnector in coordination with the Interconnector Operator.</i></p> | <p>Interconnection Agreement</p> <p>The Interconnection Agreement shall consist of an Interconnector Operating Protocol between at least, the TSO and the External System Operator but may include the Interconnector Operator. The agreement shall provide operational details; requirements and services affecting the System and the External System. For clarity, this shall not supersede any other agreements and is required to ensure System Security when operating the Interconnector. The Interconnection Agreement shall be agreed not less than 6 months prior to operation.</p> |
| <p>CC.10</p> <p><i>General Inclusion of Interconnectors.</i></p> | <p>USER PROTECTION AND POWER QUALITY</p> <p>CC.10 shall apply to the DSO, Generators, Interconnectors and Demand Customers.</p> |
| <p>CC.10.12</p> <p><i>Existing reference within the Grid Code, however adopted now for Interconnectors to maintain consistency with the other layout requirements. Existing CC.10.12 renumbered CC.12.13</i></p> | <p>Interconnectors</p> |

Recommended by GCRP 27

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| <p>CC.10.12.1</p> | <p>Interconnectors shall provide:</p> <ul style="list-style-type: none"> (a) differential protection on the Interconnector Transformer. The connections between the Grid Connection Point circuit breaker and the HV terminals of the Interconnector Transformer shall be included in the protected zone of this differential protection, or in the event that other plant such as filter banks or reactors are connected to these connections they shall be protected by a suitable buszone or differential protection scheme. (b) primary and backup protection for any plant (e.g. filter banks, reactors, damping resistors) which may be connected between the Grid Connection Point circuit breaker and the Interconnector Transformer. (c) backup protection (to the Transmission System) on Interconnectors. The TSO acting reasonably shall require one or more of the following to be installed: Interconnector overcurrent protection, Voltage controlled Interconnector overcurrent protection or Interconnector distance protection; (d) over/ under Frequency protection; and (e) over/under-voltage protection |
| <p>CC.10.12.2</p> | <p>The TSO may require an individual Interconnector Operator, to install additional protection and/or control schemes, where the TSO can reasonably show that it is prudent or necessary to do so. These schemes may include but are not limited to the following:</p> <ul style="list-style-type: none"> (a) Power System Stabiliser; (b) Ability to accept set points and commands (e.g. to ramp up or ramp down or reverse MW and or Mvar flows) from external System Integrity Protection schemes. |
| <p>CC.10.12.3</p> | <p>Distance protection shall be provided by the TSO on the Grid Connection Point circuit breaker of Interconnector Transformers.</p> |
| <p>CC.10.1213 <i>Consequence of renumbering of CC.10.12 for Interconnectors. No other dependences within the Grid Code.</i></p> | <p>CC.10.1213 Power Quality</p> |

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| <p>CC.10.12.13.1 <i>Consequence of renumbering of CC.10.12 for Interconnectors. No other dependences within the Grid Code.</i></p> | <p>The aggregate power factor for a Demand Customer is calculated in accordance with the following formula:</p> |
| <p>CC.10.12.13.2 <i>Consequence of renumbering of CC.10.12 for Interconnectors. No other dependences within the Grid Code.</i></p> | <p>A Demand Customer shall ensure that at any load above 50% of Maximum Import Capacity the aggregate power factor as determined at the Connection Point in any half-hour period shall be within the range 0.90 lagging to unity.</p> |
| <p>CC.10.13.3 <i>New section.</i></p> | <p>Interconnector Operators shall ensure that their connection to the Transmission System does not result in the level of distortion or fluctuation of the supply Voltage on the Transmission System, at the Connection Point, exceeding that allocated to them. These limits will be determined by the TSO during discussions with the Interconnector, where the necessary data will be exchanged between both parties, the exchange of data shall not be unreasonably withheld. This data may consist of impedance loci at the Connection Point and the Interconnector harmonic current emissions. Distortion and fluctuation limits are outlined in IEC/TR3 61000-3-6 (Harmonics) and IEC/TR3 61000-3-7 (Voltage fluctuation). Interconnectors shall also operate their Plant in a manner which will not cause the requirements in CENELEC Standard EN 50160 to be breached.</p> <p>The Interconnector cannot be connected to the Transmission System until:</p> <ul style="list-style-type: none"> (a) the required harmonic studies have been completed by the Interconnector Owner and or Interconnector Operator to show compliance with the standards outlined above and reviewed by the TSO; (b) any appropriate remedies to enable the Interconnector to operate with harmonic distortion levels within agreed limits have been identified and implemented with the TSO. |
| <p>CC.10.13.4 <i>New Section</i></p> | <p>For Interconnectors the harmonic voltage distortion emission limits and any special conditions pertaining to the quality of supply must be included in the Connection Agreement, and are subject to verification of compliance by the TSO through an ongoing approved monitoring programme to be implemented by the Interconnector Operator, or as agreed with the TSO.</p> |

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| <p>CC.12.2 <i>Additional signal requirements for Interconnectors.</i></p> | <p>(s), (t),(u) & (v) are applicable to Interconnectors only: (s) +/-MW and +/-Mvar at the high Voltage terminals of the Interconnector Transformer; (t) kV at Interconnector Transformer high Voltage terminals; (u) Interconnector Transformer tap position; (v) Interconnector status.</p> |
| <p>CC.15.6 <i>Inclusion of Interconnectors.</i></p> | <p>Generators and Interconnectors will be subject to SDC1 and SDC2 a minimum of seven (7) days prior to the Operational Date and the Generation Unit or Interconnector will be available for Dispatch from the Operational Date.</p> |
| <h1>Glossary</h1> | |
| <p>Automatic Voltage Regulation</p> | <p>Automatic maintenance of a Generation Unit's terminal voltage or Interconnector's Reactive Power output at a desired setpoint</p> |
| <p>Block Load for an Interconnector</p> | <p>The level of output, in either flow direction, that an Interconnector immediately produces following energisation. For avoidance of doubt, Block Load can equal 0 MW and can be different in either flow direction.</p> |
| <p>Current Source Technology</p> | <p>Current source inverters include all static devices generating an AC current from a rectified DC current source. The intermediate DC current is kept constant with a controlled rectifier and high inductance reactors, while the AC output is of variable Frequency and Voltage.</p> |
| <p>Forbidden Zone</p> | <p>A MW range within which a Generator or Interconnector cannot operate in a stable manner due to an inherent technical limitation of the machine.</p> |
| <p>Frequency Response</p> | <p>The automatic adjustment of Active Power output from a Generation Unit(s) or Interconnector in response to Frequency changes</p> |
| <p>Grid Connection Point</p> | <p>The point at which a Generating Unit, Interconnector or a CCGT Installation or a CCGT Unit or a Customer or an External System, is directly connected to the Transmission System.</p> |
| <p>Interconnection Agreement</p> | <p>A bilateralAn agreement between the TSO and an External System Operator, which may include agreement with the Interconnector Owner and or Interconnector Operator.</p> |

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| Interconnector | <p>Electric lines and electric Plant used for conveying electricity or provision of Reserves from outside both of Northern Ireland and the Republic of Ireland directly to or from a substation or converter station in either Northern Ireland or the Republic of Ireland.</p> <p>A HVDC electrical transmission system as a means for the bulk transmission of electrical power to or from the Transmission System or Other Transmission System to or from an External Transmission System.</p> |
| Interconnector Export Load Minimum | Minimum MW output an Interconnector can export continuously to a remote network while maintaining stability. |
| Interconnector Import Load Minimum | Minimum MW output an Interconnector can import continuously from a remote network while maintaining stability. |
| Interconnector Minimum Load | Absolute sum of the Interconnector Minimum Export Load and Interconnector Minimum Import Load representing the minimum range of bi-directional power transfer. |
| Interconnector Operating Protocol | The Interconnector Operating Protocol is a protocol for specific operating conditions of the Interconnector which may exist between the Interconnector Operator , the TSO and the External TSO . The Interconnector Operating Protocol shall be agreed as appropriate by all parties before operation of the Interconnector . The Interconnector Operating Protocol shall include but is not limited by the following; planned outage coordination, Operating Procedures, Interconnector Instructions, Interconnector Faults, Emergency Power Functionality, Operational Liaison, System Testing, Operational and Safety Switching. |
| Interconnector Operator | A person who operates an Interconnector and is subject to the Grid Code pursuant to any agreement with the TSO or otherwise. |
| Interconnector Owner | A person who owns an Interconnector . For the avoidance of doubt the Interconnector Owner shall be responsible for all Grid Code requirements concerning the Interconnector Operator in relation to the Interconnector . |

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| Interconnector's Plant | An Interconnector subject to Central Dispatch which will include appropriate control and response of each converter station and Apparatus upon Dispatch Instruction issued by the TSO . It shall consist of all aspects of the technology including, converter station, DC cable filter banks etc. up to the Connection Point . |
| Interconnector Ramp-down Capability | The rate of decrease of an Interconnector . Ramp-down Capabilities apply over the bi-directional range from its Interconnector Registered Import Capacity to its Interconnector Registered Export Capacity . |
| Interconnector Ramp-up Capability | The rate of increase of an Interconnector . Ramp-up Capabilities apply over the bi-directional range from its Interconnector Registered Export Capacity to its Interconnector Registered Import Capacity . |
| Interconnector Ramp Rate | The maximum rate of increase or decrease of the power transferred, in either flow direction, by an Interconnector . |
| Interconnector Registered Capacity | The maximum Capacity , in either flow direction, expressed in whole MW , that an Interconnector can deliver on a sustained basis, without accelerated loss of equipment life, at the Connection Point . This figure shall include transmission power losses for the Interconnector . |
| Interconnector Registered Export Capacity | The maximum Capacity , expressed in whole MW that an Interconnector may export (transfer energy from the Power System to a remote network) on a sustained basis, without accelerated loss of equipment life, as registered with the TSO . |
| Interconnector Registered Import Capacity | The maximum Capacity , expressed in whole MW that an Interconnector may import (transfer energy from a remote network into the Power System) on a sustained basis, without accelerated loss of equipment life, as registered with the TSO . |
| Interconnector Transformer | A transformer whose principal function is to provide the interconnection between the Interconnector and the Network and to transform the Interconnector voltage to the Network voltage. |
| Voltage Regulation | The automatic adjustment of Reactive Power output from a Generation Unit(s) or Interconnector in response to Voltage changes. (e.g. from a Generation Unit). |

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| <p>MODIFICATION DESCRIPTION Overview</p> <p>SUMMARY DESCRIPTION OF:</p> <p>a) THE REASON FOR THE RECOMMENDED MODIFICATION</p> <p>b) HISTORY OF PROGRESSION THROUGH GCRPs, WORKING GROUP AND/OR CONSULTATION</p> <p>c) SUMMARY NOTE OF ANY OBJECTIONS TO THE RECOMMENDED CHANGE FROM GCRP MEMBERS OR CONSULTATION RESPONSES</p> <p>d) OUTCOME OF ANY GCRP MEETING ACTIONS RELATING TO THE RECOMMENDED MODIFICATION</p> | <p>These Grid Code modifications establish minimum technical requirements for current and future Interconnector development to the Power System.</p> <p>This recommendation introduces minimum technical requirements in the PC and CC sections of the Grid Code and subsequent changes to the glossary.</p> <p>The background to these proposed modifications:</p> <p>A working group was established by EirGrid to establish the modifications to the Grid Code to cater for Interconnectors. The working Group looked at the PC and CC sections of the Grid Code.</p> <p>This modification was discussed at GCRP #22, 27th April 2009 and further discussed at GCRP #23, 24th September 2009. At the GCRP #23 it was agreed that EirGrid would submit an agreed position paper to all panel members before submitting the paper and other issues raised by panel members to the CER.</p> <p>In November 2009, EirGrid submitted to CER proposed modifications to the Grid Code to cater for the future connection of Interconnectors to the grid. In December 2009, the CER published for consultation the modifications proposed by EirGrid, as follows:</p> <ul style="list-style-type: none"> • Interconnector Grid Code Modifications <u>CER/09/187</u> • Grid Code Modifications <u>CER/09/189(a)</u> • Grid Code Modifications <u>CER/09/187(b)</u> <p>The CER also requested independent consultation to provide technical advice to CER in relation to the Grid Code modifications proposed by EirGrid. Following independent consultation and the 5 additional responses received by CER and subsequent follow up with EirGrid, the following Grid Code modification proposal, to include Interconnectors, has been accepted by the panel members of GCRP #27.</p> <p>No objections were received to the recommended changes.</p> |
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| <p>IMPLICATION OF NOT IMPLEMENTING THE MODIFICATION</p> | <p>Currently no technical requirements exist in the Grid Code for Interconnectors.</p> <p>The GCRP panel member representing Interconnectors stressed that the East-West Interconnector is at a critical stage of the design phase, financial and timing risks exist while these technical requirements remain unapproved.</p> |
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Recommended by GCRP 27