

# **EUROPEAN COMPLIANCE PROCESSES**

(ECP)

**GC0096 STORAGE – 30 JULY 2019**

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(This contents page does not form part of the Grid Code)

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## EUROPEAN COMPLIANCE PROCESSES

### ECP.1 INTRODUCTION

ECP.1.1 The **European Compliance Processes** ("ECP") specifies the compliance process in relation to directly connected and **Embedded Power Stations** (subject to a **Bilateral Agreement**), **HVDC Systems**, and **Network Operator's** or **Non-Embedded Customer's Plant and Apparatus**. For the avoidance of doubt, the requirements of the **European Compliance Processes** do not apply to **Demand Response Providers** unless they are also an **EU Code User** and have entered into a **CUSC Contract** with **NGET**. Generators in respect of Electricity Storage Modules are required to meet the requirements of this ECC but are not required to satisfy the requirements of European Regulation (EU) 2016/631, European Regulation 2016/1388 or European Regulation 2016/1485. Any derogation in respect of Electricity Storage Modules would therefore be against the GB Grid Code as the requirements applicable to Electricity Storage Modules are not enforceable by EU Law:

(i) **Type A Power Generating Modules:**

the process for issuing and receiving an **Installation Document** which must be followed by **The Company** and any **User** with a **Type A Power Generating Module** to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus** prior to the relevant **Plant** and **Apparatus** being energised.

(ii) **Type B, Type C or Type D Power Generating Modules and HVDC Systems:**

the process (leading to an **Energisation Operational Notification**) which must be followed by **The Company** and any **User** with a **Type B, Type C or Type D Power Generating Module or HVDC System** to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus** (including **OTSUA**) prior to the relevant **Plant** and **Apparatus** (including any **OTSUA**) being energised.

the process (leading to an **Interim Operational Notification** and **Final Operational Notification**) which must be followed by **The Company** and any **User** with a **Type B, Type C or Type D Power Generating Module or HVDC System or HVDC System Owner** to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus** (including and dynamically controlled **OTSUA**). This process shall be followed prior to and during the course of the relevant **Plant** and **Apparatus** (including **OTSUA**) being energised and **Synchronised**.

the process (leading to a **Limited Operational Notification**) which must be followed by **The Company** and each **User** with a **Type B, Type C or Type D Power Generating Module or HVDC System** where any of its **Plant** and/or **Apparatus** (including any **OTSUA**) becomes unable to comply with relevant provisions of the **Grid Code**, and where applicable with Appendices F1 to F5 of the **Bilateral Agreement** (and in the case of **OTSUA** Appendices OF1 to OF5 of the **Bilateral Agreement**). This process also includes when changes or **Modifications** are made to **Plant** and/or **Apparatus** (including **OTSUA**). This process applies to such **Plant** and/or **Apparatus** after the **Plant** and/or **Apparatus** has become **Operational** and until **Disconnected** from the **Total System**, (or until, in the case of

**OTSUA**, the **OTSUA Transfer Time**) when changes or **Modifications** are made.

(iii) **Network Operator's or Non-Embedded Customer's Plant and Apparatus:**

the process (leading to an **Energisation Operational Notification**) which must be followed by **NGET** and any **Network Operator** or **Non-Embedded Customer** to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus** prior to the relevant **Plant** and **Apparatus** being energised.

the process (leading to an **Interim Operational Notification** and **Final Operational Notification**) which must be followed by **NGET** and any **Network Operator** or **Non-Embedded Customer** to demonstrate its compliance with the **Grid Code** in relation to its **Plant** and **Apparatus**. This process shall be followed prior to and during the course of the relevant **Plant** and **Apparatus** being energised and operated by using the grid connection.

the process (leading to a **Limited Operational Notification**) which must be followed by **NGET** and each **Network Operator** or **Non-Embedded Customer** where any of its **Plant** and/or **Apparatus** becomes unable to comply with relevant provisions of the **Grid Code**, and where applicable with Appendices F1 to F5 of the **Bilateral Agreement**. This process also includes changes or **Modifications** made to the **Plant** and/or **Apparatus**. This process applies to such **Plant** and/or **Apparatus** after the **Plant** and/or **Apparatus** has become operational and until **Disconnected** from the **Transmission System**.

ECP.1.2 As used in the **ECP** references to **OTSUA** means **OTSUA** to be connected or connected to the **National Electricity Transmission System** prior to the **OTSUA Transfer Time**.

ECP.1.3 Where a **Generator** or **HVDC System Owner** and/or **The Company** are required to apply for a derogation to the **Authority**, this is not in respect of **OTSUA**.

ECP.1.4 In the case of an **Electricity Storage Plant** comprising of separate generating units and demand taking plant (eg a pump) then compliance would be assessed individually on the generating units and the demand taking elements.

ECP.2 OBJECTIVE

ECP.2.1 The objective of the **ECP** is to ensure that there is a clear and consistent process for demonstration of compliance by **Users** with the **European Connection Conditions** and **Bilateral Agreement** and will enable **The Company** to comply with its statutory and **Transmission Licence** obligations. For the avoidance of doubt, the requirements of the **European Compliance Processes** do not apply to **Demand Response Providers** unless they are also an **EU Code User** and have entered into a **CUSC Contract** with **NGET**.

ECP.2.2 Provisions of the **ECP** which apply in relation to **OTSDUW** and **OTSUA** shall (in any particular case) apply up to the **OTSUA Transfer Time**, whereupon

- (c) **The Company** receives a submission of data, or a statement from a **Generator, HVDC System Owner** (including **OTSUA** if applicable), **Network Operator** or **Non-Embedded Customer** indicating a change in **Plant** or **Apparatus** or settings (including but not limited to governor and excitation control systems) that may in **The Company's** reasonable opinion, acting in accordance with **Good Industry Practice** be expected to result in a material change of performance.

In the case of an **Embedded Generator** or **Embedded HVDC System Owner**, **The Company** will issue a copy of the **Limited Operational Notification** to the **Network Operator**.

- ECP.8.5.2 The **Limited Operational Notification** will be time limited (in the case of **Type D, HVDC Systems, Network Operator's** or **Non-Embedded Customer's Plant** and **Apparatus** to expire no later than 12 months from the start of the non-compliance or restriction or from reconnection following a change). **The Company** may agree a longer duration in the case of a **Limited Operational Notification** following a **Modification** or whilst the **Authority** is considering the application for a derogation in accordance with ECP.9.1.
- ECP.8.5.3 The **Limited Operational Notification** will notify the **Generator, HVDC System Owner, Network Operator** or **Non-Embedded Customer** of any restrictions on the operation of the **Synchronous Power Generating Module(s), CCGT Module(s), Power Park Module(s)**, **OTSUA** if applicable, **HVDC Equipment** or **Plant** and **Apparatus** and will specify the **Unresolved Issues**. The **Generator, HVDC System Owner, Network Operator** or **Non-Embedded Customer** must operate in accordance with any notified restrictions and must resolve the **Unresolved Issues**.
- ECP.8.5.4 The **User** and **The Company** will be deemed compliant with all the relevant provisions of the **Grid Code** provided operation is in accordance with the **Limited Operational Notification**, whilst it is in force, and that the provisions of and referred to in ECP.8 are complied with.
- ECP.8.5.5 The **Unresolved Issues** included in a **Limited Operational Notification** will show the extent that the provisions of ECP.7.2 (testing) and ECP.7.3 (final data submission) or ECP.7.8 (d) - (e) (testing) and ECP.7.8 (a) – (c) (data submission, As applicable, shall apply. In respect of selecting the extent of any tests which may in **The Company's** view reasonably be needed to demonstrate the restored capability and in agreeing the time period in which the tests will be scheduled, **The Company** shall, where reasonably practicable, take account of the **Generator** or **HVDC System Owner's** input to contain its costs associated with the testing.
- ECP.8.5.6 In the case of a change or **Modification** the **Limited Operational Notification** may specify that the affected **Plant** and **Apparatus** (including **OTSUA** if applicable) or associated **Synchronous Power Generating Module(s)** or **Power Park Unit(s)** must not be **Synchronised** or, in the case of **Network Operator's** or **Non-Embedded Customer's Plant** and **Apparatus**, operated until all of the following items, that in **The Company's** reasonable opinion are relevant, have been submitted to **The Company** to **The Company's** satisfaction:
- (a) updated **Planning Code** data (both **Standard Planning Data** and **Detailed Planning Data**);
  - (b) details of any relevant special **Power Station, Synchronous Power Generating Module(s), Power Park Module(s), OTSUA** (if applicable), **HVDC Equipment Station(s)** or **Network Operator's** or

**Non-Embedded Customer's Plant and Apparatus** protection as applicable. This may include Pole Slipping protection and islanding protection schemes; and

- (c) simulation study provisions of Appendix ECP.A.3 or Appendix ECP.A.8 as appropriate and the results demonstrating compliance with **Grid Code** requirements relevant to the change or **Modification** as agreed by **The Company**; and
- (d) a detailed schedule of the tests and the procedures for the tests required to be carried out by the **Generator, HVDC Equipment Station, Network Operator** or **Non-Embedded Customer** to demonstrate compliance with relevant **Grid Code** requirements as agreed by **The Company**. The schedule of tests shall be consistent with Appendix ECP.A.5, Appendix ECP.A.6 or Appendix ECP.A.8 as appropriate; and
- (e) an interim **Compliance Statement** and a **User Self Certification of Compliance** completed by the **User** (including any **Unresolved Issues**) against the relevant **Grid Code** requirements including details of any requirements that the **Generator, HVDC System Owner, Network Operator** or **Non-Embedded Customer** has identified that will not or may not be met or demonstrated; and
- (f) any other items specified in the **LON**.

ECP.8.5.7 The items referred to in ECP.8.5.6 shall be submitted by the **Generator** (including in respect of any **OTSUA** if applicable) or **HVDC System Owner** using the **User Data File Structure** or **Power Generation Module Document** as applicable.

ECP.8.5.8 In the case of **Synchronous Power Generating Module(s)** only, the **Unresolved Issues** of the **LON** may require that the **Generator** must complete the following tests to **The Company's** satisfaction to demonstrate compliance with the relevant provisions of the **CCs** prior to the **Synchronous Power Generating Module** being **Synchronised** to the **Total System**:

- (a) those tests required to establish the open and short circuit saturation characteristics of the **Synchronous Power Generating Module** (as detailed in Appendix ECP.A.5.3) to enable assessment of the short circuit ratio in accordance with ECC.6.3.2.3.4 or ECC.6.3.2.5. Such tests may be carried out at a location other than the **Power Station** site; and
- (b) open circuit step response tests (as detailed in Appendix ECP.A.5.2) to demonstrate compliance with ECC.A.6.2.4.1.

ECP.8.6 In the case of a change or **Modification**, not less than 28 days, or such shorter period as may be acceptable in **The Company's** reasonable opinion:

- (a) prior to the **Generator** or **HVDC System Owner (including OTSUA if applicable)** wishing to **Synchronise** its **Plant and Apparatus** for the first time following the change or **Modification**, the **Generator** or **HVDC System Owner** will:
  - (i) submit a **Notification of User's Intention to Synchronise**; and
  - (ii) submit to **The Company** the items referred to at ECP.8.5.6.

(b) prior to the **Network Operator** or **Non-Embedded Customer** wishing to operate its **Plant** and **Apparatus** for the first time following the change or **Modification**, the **Network Operator** or **Non-Embedded Customer** will;

(i) submit a **Notification of User's intention to operate**; and

(ii) submit to **NGET** the items referred to at ECP.8.5.6

ECP.8.7 Other than **Unresolved Issues** that are subject to tests to be witnessed by **The Company**, the **Generator**, **HVDC System Owner**, **Network Operator** or **Non-Embedded Customer** must resolve any **Unresolved Issues** prior to the commencement of the tests, unless **The Company** agrees to a later resolution. The **Generator**, **HVDC System Owner**, **Network Operator** or **Non-Embedded Customer** must liaise with **The Company** in respect of such resolution. The tests that may be witnessed by **The Company** are specified in ECP.7.2.2.

ECP.8.8 Not less than 28 days, or such shorter period as may be acceptable in **The Company's** reasonable opinion, prior to the **Generator** or **HVDC System Owner** wishing to commence tests listed as **Unresolved Issues** to be witnessed by **The Company**, the **Generator** or **HVDC System Owner** will notify **The Company** that the **Synchronous Power Generating Module(s)**, **CCGT Module(s)**, **Power Park Module(s)**, **OTSUA** if applicable or **HVDC Equipment** as applicable is ready to commence such tests.

ECP.8.9 The items referred to at ECP.7.3 or ECP.7.8 as applicable and listed as **Unresolved Issues** shall be submitted by the **Generator**, **HVDC System Owner**, **Network Operator** or **Embedded Customer** after successful completion of the tests.

ECP.8.10 Where the **Unresolved Issues** have been resolved a **Final Operational Notification** will be issued to the **User**.

ECP.8.11 If a **Final Operational Notification** has not been issued by **The Company** as referred to at ECP.8.5.2 (or where agreed following a **Modification** by the expiry time of the **LON**) then the **Generator**, **HVDC System Owner**, **Network Operator** or **Non-Embedded Customer** (where licensed in respect of its activities) and **The Company** shall apply to the **Authority** for a derogation.

## ECP.9 PROCESSES RELATING TO DEROGATIONS

ECP.9.1 Whilst the **Authority** is considering the application for a derogation, the **Interim Operational Notification** or **Limited Operational Notification** will be extended to remain in force until the **Authority** has notified **The Company** and the **Generator**, **HVDC System Owner**, **Network Operator** or **Non-Embedded Customer** of its decision. Where the **Generator** or **HVDC System Owner** is not licensed **The Company** may propose any necessary changes to the **Bilateral Agreement** with such unlicensed **Generator** or **HVDC System Owner**.

ECP.9.2 If the **Authority**:

- (a) grants a derogation in respect of the **Plant** and/or **Apparatus**, then **The Company** shall issue **Final Operational Notification** once all other **Unresolved Issues** are resolved; or
- (b) decides a derogation is not required in respect of the **Plant** and/or **Apparatus** then **The Company** will reconsider the relevant **Unresolved Issues** and may issue a **Final Operational Notification** once all other **Unresolved Issues** are resolved; or

- (c) decides not to grant any derogation in respect of the **Plant** and/or **Apparatus**, then there will be no **Operational Notification** in place and **The Company** and the **User** shall consider its rights pursuant to the **CUSC**.

ECP.9.3 Where a **Interim Operational Notification** or **Limited Operational Notification** is so conditional upon a derogation and such derogation includes any conditions (including any time limit to such derogation) the **Generator, HVDC System Owner, Network Operator** or **Non-Embedded Customer** will progress the resolution of any **Unresolved Issues** and / or progress and / or comply with any conditions upon such derogation and the provisions of ECP.6 to ECP.7.11 shall apply and shall be followed.

## ECP.10 MANUFACTURER'S DATA & PERFORMANCE REPORT

ECP.10.1.1 Data and performance characteristics in respect of certain **Grid Code** requirements may be registered with **The Company** by **Power Park Unit** manufacturers in respect of specific models of **Power Park Units** by submitting information in the form of a **Manufacturer's Data and Performance Report** to **The Company**.

ECP.10.1.2 A **Generator** planning to construct a new **Power Station** containing the appropriate version of **Power Park Units** in respect of which a **Manufacturer's Data & Performance Report** has been submitted to **The Company** may reference the **Manufacturer's Data & Performance Report** in its submissions to **The Company**. Any **Generator** considering referring to a **Manufacturer's Data & Performance Report** for any aspect of its **Plant** and **Apparatus** may contact **The Company** to discuss the suitability of the relevant **Manufacturer's Data & Performance Report** to its project to determine if, and to what extent, the data included in the **Manufacturer's Data & Performance Report** contributes towards demonstrating compliance with those aspects of the **Grid Code** applicable to the **Generator**. **The Company** will inform the **Generator** if the reference to the **Manufacturer's Data & Performance Report** is not appropriate or not sufficient for its project.

ECP.10.1.3 The process to be followed by **Power Park Unit** manufacturers submitting a **Manufacturer's Data & Performance Report** is agreed by **The Company**. ECP.10.2 indicates the specific **Grid Code** requirement areas in respect of which a **Manufacturer's Data & Performance Report** may be submitted.

ECP.10.1.4 **The Company** will maintain and publish a register of those **Manufacturer's Data & Performance Reports** which **The Company** has received and accepted as being an accurate representation of the performance of the relevant **Plant** and / or **Apparatus**. Such register will identify the manufacturer, the model(s) of **Power Park Unit(s)** to which the report applies and the provisions of the **Grid Code** in respect of which the report contributes towards the demonstration of compliance. The inclusion of any report in the register does not in any way confirm that any **Power Park Modules** which utilise any **Power Park Unit(s)** covered by a report is or will be compliant with the **Grid Code**.

ECP.10.2 A **Manufacturer's Data & Performance Report** in respect of **Power Park Units** may cover one (or part of one) or more of the following provisions of the **Grid Code**:

- (a) Fault Ride Through capability ECC.6.3.15, ECC.6.3.16.
- (b) Power Park Module mathematical model PC.A.5.4.2.



- ECP.10.3 Reference to a **Manufacturer's Data & Performance Report** in a **EU Code User's** submissions does not by itself constitute compliance with the **Grid Code**.
- ECP.10.4 A **Generator** referencing a **Manufacturer's Data & Performance Report** should insert the relevant **Manufacturer's Data & Performance Report** reference in the appropriate place in the **DRC** data submission, **Power Generating Module Document** and / or in the **User Data File Structure**. **The Company** will consider the suitability of a **Manufacturer's Data & Performance Report**:
- (a) in place of **DRC** data submissions a mathematical model suitable for representation of the entire **Power Park Module** as per ECP.A.3.4.4. For the avoidance of doubt only the relevant sections as specified in PC.A.2.5.5.7 apply. Site specific parameters will still need to be submitted by the **Generator**.
  - (b) in place of Fault simulation studies as follows;
 

**The Company** will not require Fault Ride Through simulation studies to be conducted as per ECP.A.3.5.1 and qualified in ECP.A.3.5.2 provided that;

    - (i) Adequate and relevant **Power Park Unit** data is included in respect of Fault Ride Through testing covered in ECP.A.6.7 in the relevant **Manufacturer's Data & Performance Report** , and
    - (ii) For each type and duration of fault as detailed in ECP.A.3.5.1, the expected minimum retained voltage is greater than the corresponding minimum voltage achieved and successfully ridden through in the fault ride through tests covered by the **Manufacturer's Data & Performance Report**.
  - (c) to reduce the scope of compliance site tests as follows;
    - (i) Where there is a **Manufacturer's Data & Performance Report** in respect of a **Power Park Unit** which covers Fault Ride Through, **The Company** may agree that no Fault Ride Through testing is required.
- ECP.10.5 It is the responsibility of the **EU Code User** to ensure that the correct reference for the **Manufacturer's Data & Performance Report** is used and the **EU Code User** by using that reference accepts responsibility for the accuracy of the information. The **EU Code User** shall ensure that the manufacturer has kept **The Company** informed of any relevant variations in plant specification since the submission of the relevant **Manufacturer's Data & Performance Report** which could impact on the validity of the information.
- ECP.10.6 **The Company** may contact the **Power Park Unit** manufacturer directly to verify the relevance of the use of such **Manufacturer's Data & Performance Report**. If **The Company** believe the use some or all of such **Manufacturer's Data & Performance Report** information is incorrect or the referenced data is inappropriate then the reference to the **Manufacturer's Data & Performance Report** may be declared invalid by **The Company**. Where, and to the extent possible, the data included in the **Manufacturer's Data & Performance Report** is appropriate, the compliance assessment process will be continued using the data included in the **Manufacturer's Data & Performance Report**.

ECP.10.7 In the case of a co-located site, for example **Electricity Storage Modules** connected within a new or existing **Power Station**, **The Company** will accept demonstration of compliance at the **Grid Entry Point** or **User System Entry Point** (if **Embedded**) through a combination of the capabilities of the **Power Generating Modules** and **Electricity Storage Modules** or **Electricity Storage Modules** and **Generating Units** or **Power Park Modules**. **Generators** should however be aware that for the purposes of compliance, full Grid Code compliance should be demonstrated when, for example, the **Electricity Storage Module** is out of service and the remaining **Power Generating Module** is in service or the **Electricity Storage Module** is in service and the **Power Generating Module** is out of service. Equally, **The Company** will accept **Manufacturer's Data & Performance Reports** for the purposes of proving compliance at co-located sites.

APPENDIX 1  
NOT USED

## APPENDIX 2

### USER SELF CERTIFICATION OF COMPLIANCE (Interim/Final)

|  |  |              |                  |  |  |
|--|--|--------------|------------------|--|--|
| <b>Power Station/<br/>HVDC<br/>Equipment<br/>Station</b> | [Name of<br>Connection Site/site<br>of connection] | <b>User:</b> | [Full User name] | <b>Maximum<br/>Capacity (MW)<br/>of Plant:</b> |  |
|--|--|--------------|------------------|--|--|

This **User Self Certification of Compliance** records the compliance by the **EU Code User** in respect of [NAME] **Power Station/HVDC Equipment Station** with the **Grid Code** and the requirements of the **Bilateral Agreement** and **Construction Agreement** dated [ ] with reference number [ ]. It is completed by the **Power Station/HVDC System Owner** in the case of **Plant** and/or **Apparatus** connected to the **National Electricity Transmission System** and for **Embedded Plant**.

We have recorded our compliance against each requirement of the **Grid Code** which applies to the **Power Station/HVDC Equipment Station**, together with references to supporting evidence and a commentary where this is appropriate, and have provided this to **The Company**. A copy of the **Compliance Statement** is attached.

Supporting evidence, in the form of simulation results, test results, manufacturer's data and other documentation, is attached in the **User Data File Structure**.

The **EU Code User** hereby certifies that, to the best of its knowledge and acting in accordance with **Good Industry Practice**, the **Power Station** is compliant with the **Grid Code** and the **Bilateral Agreement** in all aspects [with the following **Unresolved Issues\***] [with the following derogation(s)\*\*]:

| Connection Condition | Requirement | Ref: | Issue |
|----------------------|-------------|------|-------|
|                      |             |      |       |
|                      |             |      |       |
|                      |             |      |       |
|                      |             |      |       |
|                      |             |      |       |

|                                     |  |  |
|-------------------------------------|--|--|
| <b>Compliance<br/>certified by:</b> | Name:<br>[PERSON]<br>Signature:<br>[PERSON]<br>Date: | Title:<br>[PERSON DESIGNATION]<br>Of<br>[User details] |
|-------------------------------------|--|--|

\* Include for Interim User Self Certification of Compliance ahead of Interim Operational Notification.

\*\* Include for final User Self Certification of Compliance ahead of Final Operational Notification where derogation(s) have been granted. If no derogation(s) required delete wording and Table.

## APPENDIX 3

### SIMULATION STUDIES

#### ECP.A.3.1 SCOPE

ECP.A.3.1.1 This Appendix sets out the simulation studies required to be submitted to **The Company** to demonstrate compliance with the Connection Conditions unless otherwise agreed with **The Company**. This Appendix should be read in conjunction with ECP.6 with regard to the submission of the reports to **The Company**. Where there is any inconsistency in the technical requirements in respect of which compliance is being demonstrated by simulation in this Appendix and ECC.6.3 and the **Bilateral Agreement**, the provisions of the **Bilateral Agreement** and ECC.6.3 prevail. The studies specified in this Appendix will normally be sufficient to demonstrate compliance. However **The Company** may agree an alternative set of studies proposed by the **Generator** or **HVDC System Owner** provided **The Company** deem the alternative set of studies sufficient to demonstrate compliance with the **Grid Code** and the **Bilateral Agreement**.

ECP.A.3.1.2 The **Generator** or **HVDC System Owner** shall submit simulation studies in the form of a report to demonstrate compliance. In all cases the simulation studies must utilise models applicable to the **Synchronous Power Generating Module**, **HVDC Equipment** or **Power Park Module** with proposed or actual parameter settings. Reports should be submitted in English with all diagrams and graphs plotted clearly with legible axes and scaling provided to ensure any variations in plotted values is clear. In all cases the simulation studies must be presented over a sufficient time period to demonstrate compliance with all applicable requirements.

ECP.A.3.1.3 In the case of an **Offshore Power Station** where **OTSDUW Arrangements** apply simulation studies by the **Generator** should include the action of any relevant **OTSUA** where applicable to demonstrate compliance with the **Grid Code** and the **Bilateral Agreement** at the **Interface Point**.

ECP.A.3.1.4 **The Company** will permit relaxation from the requirement ECP.A.3.2 to ECP.A.3.8 where an **Equipment Certificate** for the **Power Generating Module** or **HVDC Equipment** has been provided which details the characteristics from appropriate simulations on a representative installation with the same equipment and settings and the performance of the **Power Generating Module** or **HVDC Equipment** can, in **The Company's** opinion, reasonably represent that of the installed **Power Generating Module** or **HVDC Equipment**.

ECP.A.3.1.5 For **Type B**, **Type C** and **Type D Power Generating Modules** the relevant **Equipment Certificate** must be supplied in the **Power Generating Module Document** or **Users Data File structure** as applicable. For **HVDC Equipment** the relevant **Equipment Certificates** must be supplied in the **Users Data File structure**.

ECP.A.3.1.6 In the case of a co-located site, for example **Electricity Storage Modules** connected within a new or existing **Power Station**, **The Company** will accept simulation studies to demonstrate compliance at the **Grid Entry Point** or **User System Entry Point** (if **Embedded**) through a combination of the capabilities of the **Power Generating Modules** and **Electricity Storage Modules** or **Electricity Storage Modules** and **Generating Units** or **Power Park Modules**. **Generators** should however be aware that for the purposes of simulations, full **Grid Code** compliance should be demonstrated when, for example, the **Electricity Storage Module** is out of service and the remaining **Power**

Generating Module is in service or the Electricity Storage Module is in service and the Power Generating Module is out of service.

ECP.A.3.2 Power System Stabiliser Tuning

ECP.A.3.2.1 In the case of a **Synchronous Power Generating Module** with an **Excitation System Power System Stabiliser** the **Power System Stabiliser** tuning simulation study report required by ECC.A.6.2.5.6 or required by the **Bilateral Agreement** shall contain:

- (i) the **Excitation System** model including the **Power System Stabiliser** with settings as required under the **Planning Code** (PC.A.5.3.2(c))
- (ii) open circuit time series simulation study of the response of the **Excitation System** to a +10% step change from 90% to 100% terminal voltage.
- (iii) on load time series dynamic simulation studies of the response of the **Excitation System** with and without the **Power System Stabiliser** to 2% and 10% steps in the reference voltage and a three phase short circuit fault applied to the higher voltage side of the **Synchronous Power Generating Module** transformer for 100ms. The simulation studies should be carried out with the **Synchronous Power Generating Module** operating at full **Active Power** and maximum leading **Reactive Power** import with the fault level at the **Supergrid** HV connection point at minimum or as otherwise agreed with **The Company**. The results should show the **Synchronous Power Generating Module** field voltage, terminal voltage, **Power System Stabiliser** output, **Active Power** and **Reactive Power** output.
- (iv) gain and phase Bode diagrams for the open loop frequency domain response of the **Synchronous Power Generating Module Excitation System** with and without the **Power System Stabiliser**. These should be in a suitable format to allow assessment of the phase contribution of the **Power System Stabiliser** and the gain and phase margin of the **Excitation System** with and without the **Power System Stabiliser** in service.
- (v) an eigenvalue plot to demonstrate that all modes remain stable when the **Power System Stabiliser** gain is increased by at least a factor of 3 from the designed operating value.
- (vi) gain Bode diagram for the closed loop on load frequency domain response of the **Synchronous Power Generating Module Excitation System** with and without the **Power System Stabiliser**. The **Synchronous Power Generating Module** operating at full load and at unity power factor. These diagrams should be in a suitable format to allow comparison of the **Active Power** damping across the frequency range specified in ECC.A.6.2.6.3 with and without the **Power System Stabiliser** in service.

ECP.A.3.2.2 In the case of **Onshore Non-Synchronous Power Generating Module, Onshore HVDC Equipment and Onshore Power Park Modules and OTSDUW Plant and Apparatus** at the **Interface Point** the **Power System Stabiliser** tuning simulation study report required by ECC.A.7.2.4.1 or ECC.A.8.2.4 or required by the **Bilateral Agreement** shall contain:

## APPENDIX 5

### COMPLIANCE TESTING OF SYNCHRONOUS POWER GENERATING MODULES

#### ECP.A.5.1 SCOPE

ECP.A.5.1.1 This Appendix sets out the tests contained therein to demonstrate compliance with the relevant clauses of the European Connection Conditions of the **Grid Code**. This Appendix shall be read in conjunction with the ECP with regard to the submission of the reports to **The Company**.

ECP.A.5.1.2 The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **The Company** may:

- (i) agree an alternative set of tests provided **The Company** deem the alternative set of tests sufficient to demonstrate compliance with the **Grid Code** and **Bilateral Agreement**; and/or
- (ii) require additional or alternative tests if information supplied to **The Company** during the compliance process suggests that the tests in this Appendix will not fully demonstrate compliance with the relevant section of the **Grid Code** or **Bilateral Agreement**.
- (iii) Agree a reduced set of tests for subsequent **Synchronous Power Generating Module** following successful completion of the first **Synchronous Power Generating Module** tests in the case of a **Power Station** comprised of two or more **Synchronous Power Generating Module** which **The Company** reasonably considers to be identical.

If:

- (a) the tests performed pursuant to ECP.A.5.1.2(iii) in respect of subsequent **Synchronous Power Generating Modules** do not replicate the full tests for the first **Synchronous Power Generating Module** , or
- (b) any of the tests performed pursuant to ECP.A.5.1.2(iii) do not fully demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and / or **Bilateral Agreement**,

then notwithstanding the provisions above, the full testing requirements set out in this Appendix will be applied.

ECP.A.5.1.3 The **Generator** is responsible for carrying out the tests set out in and in accordance with this Appendix and the **Generator** retains the responsibility for the safety of personnel and plant during the test. **The Company** will witness all of the tests outlined or agreed in relation to this Appendix unless **The Company** decides and notifies the **Generator** otherwise. Reactive Capability tests may be witnessed by **The Company** remotely from the **The Company** control centre. For all on site **The Company** witnessed tests the **Generator** should ensure suitable representatives from the **Generator** and manufacturer (if appropriate) are available on site for the entire testing period. In all cases the **Generator** shall provide suitable monitoring equipment to record all relevant test signals as outlined below in ECP.A.6.1.5.

ECP.A.5.1.6 The **Generator** shall submit a schedule of tests to **The Company** in accordance with CP.4.3.1.

ECP.A.5.1.7 Prior to the testing of a **Synchronous Power Generating Module** the

**Generator** shall complete the **Integral Equipment Test** procedure in accordance with OC.7.5.

ECP.A.5.1.8 Full **Synchronous Power Generating Module** testing as required by CP.7.2 is to be completed as defined in ECP.A.5.2 through to ECP.A.5.9.

ECP.A.5.1.9 **The Company** will permit relaxation from the requirement ECP.A.5.2 to ECP.A.5.9 where an **Equipment Certificate** for the **Synchronous Power Generating Module** has been provided which details the characteristics from tests on a representative machine with the same equipment and settings and the performance of the **Synchronous Power Generating Module** can, in **The Company's** opinion, reasonably represent that of the installed **Synchronous Power Generating Module** at that site. For **Type B**, **Type C** and **Type D Power Generating Modules** the relevant **Equipment Certificate** must be supplied in the **Power Generating Module Document** or **Users Data File structure** as applicable.

ECP.A.5.1.10 In the case of a co-located site, for example **Electricity Storage Modules** connected within a new or existing **Power Station**, **The Company** will accept test results to demonstrate compliance at the **Grid Entry Point** or **User System Entry Point (if Embedded)** through a combination of the capabilities of the **Power Generating Modules** and **Electricity Storage Modules** or **Electricity Storage Modules** and **Generating Units** or **Power Park Modules**. **Generators** should however be aware that for the purposes of testing, full Grid Code compliance should be demonstrated when, for example, the **Electricity Storage Module** is out of service and the remaining **Power Generating Module** is in service or the **Electricity Storage Module** is in service and the **Power Generating Module** is out of service. In the case of a **Synchronous Electricity Storage Module**, **The Company** would expect the full set of tests to be completed as detailed in ECP.A.5.2 to ECP.A.5.9.

ECP.A.5.2 Excitation System Open Circuit Step Response Tests

ECP.A.5.2.1 The open circuit step response of the **Excitation System** will be tested by applying a voltage step change from 90% to 100% of the nominal **Synchronous Power Generating Module** terminal voltage, with the **Synchronous Power Generating Module** on open circuit and at rated speed.

ECP.A.5.2.1 The test shall be carried out prior to synchronisation in accordance with CP.6.4. This is not witnessed by **The Company** unless specifically requested by **The Company**. Where **The Company** is not witnessing the tests, the Generator shall supply the recordings of the following signals to **The Company** in an electronic spreadsheet format:

Vt - **Synchronous Generating Unit** terminal voltage  
Efd - **Synchronous Generating Unit** field voltage or main exciter field voltage  
Ifd- **Synchronous Generating Unit** field current (where possible)  
Step injection signal

ECP.A.5.2.3 Results shall be legible, identifiable by labelling, and shall have appropriate scaling.

ECP.A.5.3 Open & Short Circuit Saturation Characteristics

ECP.A.5.3.1 The test shall normally be carried out prior to synchronisation in accordance with ECP.6.2.4 or ECP.6.3.4 **Equipment Certificates** or Manufacturer's Test Certificates may be used where appropriate may be used if agreed by **The**

**Company.**

- ECP.A.5.3.2 This is not witnessed by **The Company**. Graphical and tabular representations of the results in an electronic spreadsheet format showing per unit open circuit terminal voltage and short circuit current versus per unit field current shall be submitted to **The Company**.
- ECP.A.5.3.3 Results shall be legible, identifiable by labelling, and shall have appropriate scaling.
- ECP.A.5.4 **Excitation System On-Load Tests**
- ECP.A.5.4.1 The time domain performance of the **Excitation System** shall be tested by application of voltage step changes corresponding to 1% and 2% of the nominal terminal voltage.
- ECP.A.5.4.2 Where a **Power System Stabiliser** is present:
- (i) The **PSS** must only be commissioned in accordance with BC2.11.2. When a **PSS** is switched on for the first time as part of on-load commissioning or if parameters have been adjusted the **Generator** should consider reducing the **PSS** output gain by at least 50% and should consider reducing the limits on **PSS** output by at least a factor of 5 to prevent unexpected PSS action affecting the stability of the **Synchronous Generating Unit** or the **National Electricity Transmission System**.
  - (ii) The time domain performance of the **Excitation System** shall be tested by application of voltage step changes corresponding to 1% and 2% of the nominal terminal voltage, repeating with and without the **PSS** in service.
  - (iii) The frequency domain tuning of the **PSS** shall also be demonstrated by injecting a 0.2Hz-3Hz band limited random noise signal into the **Automatic Voltage Regulator** Setpoint with the **Synchronous Generating Unit** operating at points specified by **The Company** (up to rated MVA output).
  - (iv) The **PSS** gain margin shall be tested by increasing the **PSS** gain gradually to threefold and observing the **Synchronous Generating Unit** steady state **Active Power** output.
  - (v) The interaction of the **PSS** with changes in **Active Power** shall be tested by application of a +0.5Hz frequency injection to the governor while the **Synchronous Generating Unit** is selected to **Frequency Sensitive Mode**.
  - (vi) If the **Synchronous Power Generating Module** is of the **Pumped Storage** type then the step tests shall be carried out, with and without the **PSS**, in the pumping mode in addition to the generating mode. In the case of a **Synchronous Electricity Storage Module** the tests shall be carried out with and without the **PSS** in both importing and exporting modes of operation.
  - (vii) Where the **Bilateral Agreement** requires that the **PSS** is in service at a specified loading level additional testing witnessed by **The Company** will be required during the commissioning process before the **Synchronous Power Generating Module** may exceed this output level.
  - (viii) Where the **Excitation System** includes a **PSS**, the **Generator** shall



provide a suitable noise source to facilitate noise injection testing.

ECP.A.5.4.3 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **PSS** Tests.

| Test | Injection   | Notes |
|------|---|-------|
|      | Synchronous Generating Unit running at Maximum Capacity, unity pf, PSS Switched Off   |       |
| 1    | <ul style="list-style-type: none"> <li>Record steady state for 10 seconds</li> <li>Inject +1% step to AVR Voltage Setpoint and hold for at least 10 seconds until stabilised</li> <li>Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |
| 2    | <ul style="list-style-type: none"> <li>Record steady state for 10 seconds</li> <li>Inject +2% step to AVR Voltage Setpoint and hold for at least 10 seconds until stabilised</li> <li>Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |
| 3    | <ul style="list-style-type: none"> <li>Inject band limited (0.2-3Hz) random noise signal into voltage Setpoint and measure frequency spectrum of Real Power.</li> <li>Remove noise injection.</li> </ul>  |       |
|      | Switch On Power System Stabiliser   |       |
| 4    | <ul style="list-style-type: none"> <li>Record steady state for 10 seconds</li> <li>Inject +1% step to AVR Voltage Setpoint and hold for at least 10 seconds until stabilised</li> <li>Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |
| 5    | <ul style="list-style-type: none"> <li>Record steady state for 10 seconds</li> <li>Inject +2% step to AVR Voltage Setpoint and hold for at least 10 seconds until stabilised</li> <li>Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |
| 6    | <ul style="list-style-type: none"> <li>Increase PSS gain at 30second intervals. i.e. x1 – x1.5 – x2 – x2.5 – x3</li> <li>Return PSS gain to initial setting</li> </ul>  |       |
| 7    | <ul style="list-style-type: none"> <li>Inject band limited (0.2-3Hz) random noise signal into voltage Setpoint and measure frequency spectrum of Real Power.</li> <li>Remove noise injection.</li> </ul>  |       |
| 8    | <ul style="list-style-type: none"> <li>Select the governor to FSM</li> <li>Inject +0.5 Hz step into governor.</li> <li>Hold until generator MW output is stabilised</li> <li>Remove step</li> </ul>   |       |

ECP.A.5.5 **Under-excitation Limiter Performance Test**

ECP.A.5.5.1 Initially the performance of the **Under-excitation Limiter** should be checked by moving the limit line close to the operating point of the **Synchronous Generating Unit** when operating close to unity power factor. The operating point of the **Synchronous Generating Unit** is then stepped into the limit by applying a 2% decrease in **Automatic Voltage Regulator Setpoint** voltage.

ECP.A.5.5.2 The final performance of the **Under-excitation Limiter** shall be demonstrated by testing its response to a step change corresponding to a 2% decrease in **Automatic Voltage Regulator Setpoint** voltage when the **Synchronous Generating Unit** is operating just off the limit line, at the designed setting as indicated on the **Performance Chart** [P-Q Capability Diagram] submitted to **The Company** under OC2.

ECP.A.5.5.3 Where possible the **Under-excitation Limiter** should also be tested by

operating the tap- changer when the **Synchronous Generating Unit** is operating just off the limit line, as set up.

ECP.A.5.5.4 The **Under-excitation Limiter** will normally be tested at low active power output and at maximum **Active Power** output.

ECP.A.5.5.5 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **Under-excitation Limiter** Tests.

| Test | Injection  | Notes |
|------|--|-------|
|      | <b>Synchronous Generating Unit</b> running at <b>Maximum Capacity</b> and unity power factor. Under-excitation limit temporarily moved close to the operating point of the <b>Synchronous Generating Unit</b> .  |       |
| 1    | <ul style="list-style-type: none"> <li>• PSS on.</li> <li>• Inject -2% voltage step into AVR voltage Setpoint and hold at least for 10 seconds until stabilised</li> <li>• Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |
|      | Under-excitation limit moved to normal position. <b>Synchronous Generating Unit</b> running at <b>Maximum Capacity</b> and at leading <b>Reactive Power</b> close to Under-excitation limit.   |       |
| 2    | <ul style="list-style-type: none"> <li>• PSS on.</li> <li>• Inject -2% voltage step into AVR voltage Setpoint and hold at least for 10 seconds until stabilised</li> <li>• Remove step returning AVR Voltage Setpoint to nominal and hold for at least 10 seconds</li> </ul> |       |

ECP.A.5.6 Over-excitation Limiter Performance Test

ECP.A.5.6.1 The performance of the **Over-excitation Limiter**, where it exists, shall be demonstrated by testing its response to a step increase in the Automatic Voltage Regulator Setpoint voltage that results in operation of the **Over-excitation** Limiter. Prior to application of the step the **Synchronous Generating Unit** shall be generating **Maximum Capacity** and operating within its continuous **Reactive Power** capability. The size of the step will be determined by the minimum value necessary to operate the **Over-excitation** Limiter and will be agreed by **The Company** and the **Generator**. The resulting operation beyond the **Over-excitation Limit** shall be controlled by the **Over-excitation Limiter** without the operation of any protection that could trip the **Synchronous Power Generating Module**. The step shall be removed immediately on completion of the test.

ECP.A.5.6.2 If the **Over-excitation Limiter** has multiple levels to account for heating effects, an explanation of this functionality will be necessary and if appropriate, a description of how this can be tested.

ECP.A.5.6.3 The following typical procedure is provided to assist **Generators** in drawing up their own site specific procedures for the **The Company** witnessed **Under-excitation Limiter** Tests.

| Test | Injection   | Notes |
|------|---|-------|
|      | <b>Synchronous Generating Unit</b> running at <b>Maximum Capacity</b> and maximum lagging <b>Reactive Power</b> . |       |
|      | Over-excitation Limit temporarily set close to this operating point. <b>PSS</b> on.                               |       |

|   |  |  |
|---|--|--|
| 1 | <ul style="list-style-type: none"> <li>Inject positive voltage step into AVR voltage Setpoint and hold</li> <li>Wait till <b>Over-excitation Limiter</b> operates after sufficient time delay to bring back the excitation back to the limit.</li> <li>Remove step returning AVR Voltage Setpoint to nominal.</li> </ul> |  |
|   | Over-excitation Limit restored to its normal operating value.<br><b>PSS</b> on.  |  |

#### ECP.A.5.7 Reactive Capability

ECP.A.5.7.1 The **Reactive Power** capability on each **Synchronous Power Generating Module** will normally be demonstrated by :

(a) operation of the **Synchronous Power Generating Module** at maximum lagging **Reactive Power** and Maximum Capacity for 1 hour

(b) operation of the **Synchronous Power Generating Module** at maximum leading **Reactive Power** and Maximum Capacity for 1 hour.

(c) operation of the **Synchronous Power Generating Module** at maximum lagging **Reactive Power** and **Minimum Stable Operating Level** for 1 hour

(d) operation of the **Synchronous Power Generating Module** at maximum leading **Reactive Power** and **Minimum Stable Operating Level** for 1 hour.

(e) operation of the **Synchronous Power Generating Module** at maximum lagging **Reactive Power** and a power output between **Maximum Capacity** and **Minimum Stable Operating Level**.

(f) operation of the **Synchronous Power Generating Module** at maximum leading **Reactive Power** and a power output between **Maximum Capacity** and **Minimum Stable Operating Level**.

In the case of a **Synchronous Electricity Storage Module**, **The Company** shall have discretion to reduce the durations of the tests set out in ECP.A.5.7.1 (a) – (f), depending upon the capacity of the energy store.

ECP.A.5.7.2 In the case of an **Embedded Synchronous Power Generating Module** where distribution network considerations restrict the **Synchronous Power Generating Module Reactive Power Output** **The Company** will only require demonstration within the acceptable limits of the **Network Operator's System**.

ECP.A.5.7.3 The test procedure, time and date will be agreed with **The Company** and will be to the instruction of **The Company** control centre and shall be monitored and recorded at both **The Company** control centre and by the **Generator**.

ECP.A.5.7.4 Where the **Generator** is recording the voltage, **Active Power** and **Reactive Power** at the HV connection point the voltage for these tests **Active Power** and **Reactive Power** at the **Synchronous Power Generating Module** terminals may also be included. The results shall be supplied in an electronic spreadsheet format. Where applicable the **Synchronous Power Generating Module** transformer tapchanger position should be noted throughout the test period.

#### ECP.A.5.8 Governor and Load Controller Response Performance

ECP.A.5.8.1 The governor and load controller response performance will be tested by injecting simulated frequency deviations into the governor and load controller

## APPENDIX 6

### COMPLIANCE TESTING OF POWER PARK MODULES

#### ECP.A.6.1 SCOPE

ECP.A.6.1.1 This Appendix outlines the general testing requirements for **Power Park Modules** and **OTSDUA** to demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and **Bilateral Agreement**. The tests specified in this Appendix will normally be sufficient to demonstrate compliance however **The Company** may:

- i) agree an alternative set of tests provided **The Company** deem the alternative set of tests sufficient to demonstrate compliance with the **Grid Code**, **Ancillary Services Agreement** and **Bilateral Agreement**; and/or
- ii) require additional or alternative tests if information supplied to **The Company** during the compliance process suggests that the tests in this Appendix will not fully demonstrate compliance with the relevant section of the **Grid Code**, **Ancillary Services Agreement** or **Bilateral Agreement**; and/or
- iii) require additional tests if a **Power System Stabiliser** is fitted; and/or
- iv) agree a reduced set of tests if a relevant **Manufacturer's Data & Performance Report** has been submitted to and deemed to be appropriate by **The Company**; and/or
- v) agree a reduced set of tests for subsequent **Power Park Modules** or **OTSDUA** following successful completion of the first **Power Park Module** or **OTSDUA** tests in the case of a **Power Station** comprised of two or more **Power Park Modules** or **OTSDUA** which **The Company** reasonably considers to be identical.

If:

- (a) the tests performed pursuant to ECP.A.6.1.1(iv) do not replicate the results contained in the **Manufacturer's Data & Performance Report** or
- (b) the tests performed pursuant to ECP.A.6.1.1(v) in respect of subsequent **Power Park Modules** or **OTSDUA** do not replicate the full tests for the first **Power Park Module** or **OTSDUA**, or
- (c) any of the tests performed pursuant to ECP.A.6.1.1(iv) or ECP.A.6.1.1(v) do not fully demonstrate compliance with the relevant aspects of the **Grid Code**, **Ancillary Services Agreement** and / or **Bilateral Agreement**,

then notwithstanding the provisions above, the full testing requirements set out in this Appendix will be applied.

ECP.A.6.1.2 The **Generator** is responsible for carrying out the tests set out in and in accordance with this Appendix and the **Generator** retains the responsibility for the safety of personnel and plant during the test. **The Company** will witness all of the tests outlined or agreed in relation to this Appendix unless **The Company** decides and notifies the **Generator** otherwise. Reactive Capability tests may be witnessed by **The Company** remotely from **The Company** control centre. For all on site **The Company** witnessed tests the **Generator**

must ensure suitable representatives from the **Generator** and / or **Power Park Module** manufacturer (if appropriate) and/or **OTSDUA** manufacturer (if appropriate) are available on site for the entire testing period. In all cases and in addition to any recording of signals conducted by **The Company** the **Generator** shall record all relevant test signals as outlined in ECP.A.4.

ECP.A.6.1.3 In addition to the dynamic signals supplied in ECP.A.4 the **Generator** shall inform **The Company** of the following information prior to the commencement of the tests and any changes to the following, if any values change during the tests:

- (i) All relevant transformer tap numbers; and
- (ii) Number of **Power Park Units** in operation

ECP.A.6.1.4 The **Generator** shall submit a detailed schedule of tests to **The Company** in accordance with CP.6.3.1, and this Appendix.

ECP.A.6.1.5 Prior to the testing of a **Power Park Module** or **OTSDUA** the **Generator** shall complete the **Integral Equipment Tests** procedure in accordance with OC.7.5

ECP.A.6.1.6 Partial **Power Park Module** or **OTSDUA** testing as defined in ECP.A.6.2 and ECP.A.6.3 is to be completed at the appropriate stage in accordance with ECP.6, ECP6.4A, ECP6.4B.

ECP.A.6.1.7 Full **Power Park Module** or **OTSDUA** testing as required by CP.7.2 is to be completed as defined in ECP.A.6.4 through to ECP.A.6.7

ECP.A.6.1.8 Where **OTSDUW Arrangements** apply and prior to the **OTSUA Transfer Time** any relevant **OTSDUW Plant and Apparatus** shall be considered within the scope of testing described in this Appendix. Performance shall be assessed against the relevant Grid Code requirements for **OTSDUW Plant and Apparatus** at the **Interface Point** and other **Generator Plant and Apparatus** at the **Offshore Grid Entry Point**. This Appendix should be read accordingly.

ECP.A.6.1.9 **The Company** will permit relaxation from the requirement ECP.A.6.2 to ECP.A.6.8 where an **Equipment Certificate** for the **Power Park Module** has been provided which details the characteristics from tests on a representative installation with the same equipment and settings and the performance of the **Power Park Module** can, in **The Company's** opinion, reasonably represent that of the installed **Power Park Module** at that site. For **Type B, Type C** and **Type D Power Park Modules** the relevant **Equipment Certificate** must be supplied in the **Power Generating Module Document** or **Users Data File structure** as applicable.

ECP.A.6.1.10 In the case of a co-located site, for example **Electricity Storage Modules** connected within a new or existing **Power Station**, **The Company** will accept test results to demonstrate compliance at the **Grid Entry Point** or **User System Entry Point (if Embedded)** through a combination of the capabilities of the **Power Generating Modules** and **Electricity Storage Modules** or **Electricity Storage Modules** and **Generating Units** or **Power Park Modules**. **Generators** should however be aware that for the purposes of testing, full Grid Code compliance should be demonstrated when, for example, the **Electricity Storage Module** is out of service and the remaining **Power Generating Module** is in service or the **Electricity Storage Module** is in service and the **Power Generating Module** is out of service. In the case of a **Non-Synchronous Electricity Storage Module**, **The Company** would expect the full set of tests to be completed as detailed in ECP.A.6.2 to ECP.A.6.8.

- ECP.A.6.2      Pre 20% (or <50MW) **Synchronised Power Park Module** Basic Voltage Control Tests
- ECP.A.6.2.1    Before 20% of the **Power Park Module** (or 50MW if less) has commissioned, either voltage control test ECP.A.6.5.6(i) or (ii) must be completed in accordance with ECP.6, ECP.6A or ECP.6B. In the case of an **Offshore Power Park Module** the test must be completed by the **Generator** undertaking **OTSDUW** or the **Offshore Transmission Licensee** under STCP19-5.
- ECP.A.6.2.2    In the case of an **Offshore Power Park Module** which provides all or a portion of the **Reactive Power** capability as described in ECC.6.3.2.5.2 or ECP.6.3.2.6.3 and / or voltage control requirements as described in ECC.6.3.8.5 to enable an **Offshore Transmission Licensee** to meet the requirements of **STC** Section K, the **Generator** is required to cooperate with the **Offshore Transmission Licensee** to conduct the 20% voltage control test. The results in relation to the **Offshore Power Park Module** will be assessed against the requirements in the **Bilateral Agreement**.
- ECP.A.6.3      **Power Park Modules with Maximum Capacity  $\geq$ 100MW Pre 70% Power Park Module Tests**
- ECP.A.6.3.1    Before 70% but with at least 50% of the **Power Park Module** commissioned the following **Limited Frequency Sensitive** tests as detailed in ECP.A.6.6.2 must be completed.  
                   (a) BC3  
                   (b) BC4
- ECP.A.6.4      Reactive Capability Test
- ECP.A.6.4.1    This section details the procedure for demonstrating the reactive capability of an **Onshore Power Park Module** or an **Offshore Power Park Module** or **OTSDUA** which provides all or a portion of the **Reactive Power** capability as described in ECC.6.3.2.5.2 or ECP.6.3.2.6.3 as applicable (for the avoidance of doubt, an **Offshore Power Park Module** which does not provide part of the **Offshore Transmission Licensee Reactive Power** capability as described in ECC.6.3.2.5.1 and ECP.6.3.2.6.1 should complete the **Reactive Power** transfer / voltage control tests as per section ECP.A.6.8). These tests should be scheduled at a time where there are at least 95% of the **Power Park Units** within the **Power Park Module** in service. There should be sufficient MW resource forecasted in order to generate at least 85% of **Maximum Capacity** of the **Power Park Module**.
- ECP.A.6.4.2    The tests shall be performed by modifying the voltage set-point of the voltage control scheme of the **Power Park Module** or **OTSDUA** by the amount necessary to demonstrate the required reactive range. This is to be conducted for the operating points and durations specified in ECP.A.6.4.5.
- ECP.A.6.4.3    An **Embedded Generator** or **Embedded Generator** undertaking **OTSDUW** should liaise with the relevant **Network Operator** to ensure the following tests will not have an adverse impact upon the **Network Operator's System** as per OC.7.5. In situations where the tests have an adverse impact upon the **Network Operator's System** The **Company** will only require demonstration within the acceptable limits of the **Network Operator**. For the avoidance of doubt, these tests do not negate the requirement to produce a complete **Power Park Module** or **OTSDUA** performance chart as specified in OC2.4.2.1
- ECP.A.6.4.4    In the case where the **Reactive Power** metering point is not at the same location as the **Reactive Power** capability requirement, then an equivalent **Reactive Power** capability for the metering point shall be agreed between the **Generator**

and **The Company**.

ECP.A.6.4.5 The following tests shall be completed:

- (i) Operation in excess of 60% **Maximum Capacity** and maximum continuous lagging **Reactive Power** for 30 minutes.
- (ii) Operation in excess of 60% **Maximum Capacity** and maximum continuous leading **Reactive Power** for 30 minutes.
- (iii) Operation at 50% **Maximum Capacity** and maximum continuous leading **Reactive Power** for 30 minutes.
- (iv) Operation at 20% **Maximum Capacity** and maximum continuous leading **Reactive Power** for 60 minutes.
- (v) Operation at 20% **Maximum Capacity** and maximum continuous lagging **Reactive Power** for 60 minutes.
- (vi) Operation at less than 20% **Maximum Capacity** and unity **Power Factor** for 5 minutes. This test only applies to systems which do not offer voltage control below 20% of **Maximum Capacity**.
- (vii) Operation at the lower of the **Minimum Stable Operating Level** or 0% **Maximum Capacity** and maximum continuous leading **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.
- (viii) Operation at the lower of the **Minimum Stable Operating Level** or 0% **Maximum Capacity** and maximum continuous lagging **Reactive Power** for 5 minutes. This test only applies to systems which offer voltage control below 20% and hence establishes actual capability rather than required capability.

In the case of a **Non-Synchronous Electricity Storage Module**, **The Company** shall have discretion to reduce the duration of the tests required in ECP.A.6.4.5 (i) – (viii) depending upon the capability of the energy store.

ECP.A.6.4.6 Within this **ECP** lagging **Reactive Power** is the export of **Reactive Power** from the **Power Park Module** to the **Total System** and leading **Reactive Power** is the import of **Reactive Power** from the **Total System** to the **Power Park Module** or **OTSDUA**.

ECP.A.6.5 Voltage Control Tests

ECP.A.6.5.1 This section details the procedure for conducting voltage control tests on **Onshore Power Park Modules** or **OTSDUA** or an **Offshore Power Park Module** which provides all or a portion of the voltage control capability as described in ECC.6.3.8.5 (for the avoidance of doubt, **Offshore Power Park Modules** which do not provide part of the **Offshore Transmission Licensee** voltage control capability as described in CC6.3.8.5 should complete the **Reactive Power** transfer / voltage control tests as per section ECP.A.6.8). These tests should be scheduled at a time when there are at least 95% of the **Power Park Units** within the **Power Park Module** in service. There should be sufficient MW resource forecasted in order to generate at least 65% of **Maximum Capacity** of the **Onshore Power Park Module**. An **Embedded Generator** or **Embedded Generators** undertaking **OTSDUW** should also liaise with the relevant **Network Operator** to ensure all requirements covered