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Stability Technical Requirements and Specification

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Version Control

Version number	Date	Notes
V1	24 March 2025	Initial version published at EOI. Please note this document may be updated at ITT stage at NESO's discretion, following market feedback and/or learnings in-between EOI and ITT stages of the tender process.
V2	16 July 2025	Updated version at ITT. Updates include minor changes in Eligibility Criteria and Stacking Rules, and changes to FFCI requirements. The requirement at Glenglass 132kV in Scotland has been removed from the requirements.
V3	22 August 2025	Updated version published during the ITT. Updates include clarification on the provision of the Inertia Service and Compliance Requirements. Updates are flagged by a 'V3' indicator.
V4	15 December 2025	Updated version published during the ITT. Updates include a clarification to section 4.6.6 Reactive Power Capability following receipt of a tender query. The update is flagged by a 'V4' indicator.

Introduction

This document sets out the technical requirements and specifications of the Stability Service. It contains the following sections:

- Part 1 – Regions of Needs
- Part 2 – Acceptable Sites within Regions of Need
- Part 3 – Stability Specific Eligibility Criteria
- Part 4 – Technical Specification

Part 1 – Regions of Need and Summary of Stability (Inertia, Short Circuit Level) Requirements

This tender is seeking to procure 10 GVA.s of inertia on a national basis, the Short Circuit level requirements are shown in Table 1 below.

Table 1: Short Circuit Level Requirements

Reference Node	Region	Requirement (MVA)
Lackenby 400kV	North East England	1100
Creyke Beck 400kV	North East England	5400
Minety 400kV	South Wales and West England	250
Seabank 400kV	South Wales and West England	6050
Exeter Main 400kV	South West England	2050
Indian Queens 400kV	South West England	1000
Richborough 400kV	South East England	1100
Tealing 132kV	East Scotland	700
Peterhead 400kV	North East Scotland	7100
Spittal 275kV	North Scotland	2700
Spittal 400kV	North Scotland	3700

Part 2 – Acceptable Sites within Regions of Need

Proposed solutions must be within one of the identified regions of need and connecting through one of the acceptable sites.

The acceptable sites within each region can be found in the 'LT2029 Stability Effectiveness Sheet'. The effectiveness data, system impedance and fault impedance data can also be found in the same document 'LT2029 Stability Effectiveness Sheet'. Please note, that the calculation of the overall Short Circuit Level (SCL) contribution towards the **Reference Node** is a two-part process with the effectiveness factors that will be used to do so (as listed in 'LT2029 Stability Effectiveness Sheet') being the second part of this. Further detail on how the Fault and System impedance will be used for the calculation of the Short Circuit Level Contribution towards the **Reference Node** will be provided at the ITT stage of the tender.

This tender will be procuring SCL on a nodal basis and Inertia on a national basis. For the SCL needs, the network has been divided into regions. Within these regions there are either one or two points of requirement where a requirement for additional SCL has been identified. A solution in a region may be effective to both points of requirement. Furthermore, some sites are effective across regions with different levels of SCL effectiveness, in this case the solution at these sites may be effective across both regions.

Part 3 – Stability Eligibility Criteria

This section presents the stability specific eligibility criteria. As per the Contract Award Criteria, each proposed solution must fulfil all criteria to be considered for the Stability Service being procured in the Long-Term 2029 Tender.

- The solution must fulfil the overarching LT29 Eligibility Criteria, covered in the document "Long-term 2029 Eligibility Criteria"

- New/Additional/Existing Capability: Solutions must be either: new, providing additional capability through incremental investment, or an existing solution that can operate and provide the stability service at 0MW or independently of MW. See definitions of each below.

    - A new solution is:
        - Any solution with a new connection offer or connection agreement received after 30/09/2024 or;
        - Anything registered on the TEC register after 30/09/2024

    - A solution providing additional capability through incremental investment is:
        - Anything with a connection agreement in place prior to 30/09/2024 or on TEC register prior to 30/09/2024 but following 30/09/2024 is:
            - Making a modification to install additional stability capability (E.g.: increase their inertia capability from 100 MVA.s to 200 MVA.s, or increase their SCL capability from 100 MVA to 200 MVA), or,
            - Making a modification to provide the service at 0MW (e.g. an existing generator installing a clutch), or,
            - Making a modification to enable the service to be delivered, such as fitting Grid-Forming equipment.

    - An existing solution that can operate and provide the stability service at 0MW or independently of MW is:
        - An already commissioned and connected asset capable of providing stability at 0MW or independently from MW in line with the Generic Eligibility Criteria, whose capability is not currently under any

other Stability Service contract during the contract term (2029 onwards).

- Solutions must meet the relevant Grid Forming requirements for either GBGF-I or GBGF-S in ECC.6.3.19.
- Solutions must not be fitted with RoCoF protection relays or any other equipment which may impede their ability to supply Active RoCoF Response Power.

If you have any queries about these criteria, please contact **NESO** through the query process set out in the Instructions to Tenderers document.

Part 4 – Specifications

4.1 Availability

This tender is requiring solutions to be available for 90% of Settlement Periods.[1]

NESO reserves the right to utilise assets in every settlement period for which the asset is available.

4.2 Sizing of Solutions

The minimum solution sizing for Inertia is 100 MVA.s and the maximum unit size for Inertia is 5000 MVA.s. Additionally as part of the tender process we will assess solutions such that no more than 12 GVA.s of inertia can be lost for a credible fault. Please refer to the Contract Award Criteria document for more details on how solutions will be assessed.

For Short Circuit Level, all solutions must be in a region of need and bid a level of Short Circuit Level as part of the tender. There is no maximum limit for Short Circuit Level however, providers should be aware of and account for any limitations imposed by their connection offers/agreements or the reserved bay capacity.

[1] Further detail on the availability requirement is covered in the contractual documents

4.3 Inertia Capability

The provider must ensure that the solution will provide an inertial response with an inertia as defined in Equation 1. The inertial response must be provided for frequency changes both above and below 50Hz.

Equation 1: $$\text{Inertia} = \frac{\Delta P\, f_0}{2 \times RoCoF}$$

Where:

ΔP is the **Active Inertia Power** of the **Grid Forming Plant** for a frequency event of 1Hz/s (MW). This must be calculated as the average ΔP over the RoCoF event.

RoCoF is the Rate of Change of Frequency (RoCoF) in Hz/s

f_0 is the pre-fault System Frequency (50Hz)

1. For **GBGF-I Plant,** the inertial response must be such that **Active Inertia Power** is provided without activating current limiting functions for a Rate of Change of System Frequency (RoCoF) whose magnitude is less than or equal to 1Hz/s.

2. For **GBGF-I Plant**, the maximum H constant allowed is 25 MW.s/MVA . This is to be based upon the Inertia Constant (He) as defined in the Grid Code. This H constant shall be based upon the Maximum Continuous Rating of the plant.
3. For **GBGF-I Plant,** the contribution of Inertia must predominantly arise from the H constant of the plant (this would be equivalent to the mass of a conventional synchronous machine), with the damping function of the machine having a minimal impact on the total inertial response. Providers must provide an explanation of the implementation of the damping function on the total inertial response of the plant.

4. When the solution delivers an inertial response, there should be a limited impact upon the reactive power output of the solution. The solution should have the inherent capability to independently control reactive and active power.

5. At NESO's sole discretion, with regards to any Network Owner solutions, and with respect to the relevant Network Owners Transmission License, the provision of Inertia from a solution may not be required.

4.4 Short Circuit Level Capability

The provider must ensure that during a fault the short circuit level contribution from the solution at Grid Entry Point will be provided as defined in Equation 2.

Equation 2: $Short\ Circuit\ Level\ (MVA) = \sqrt{3}\ \times Rated\ Voltage\ (kV) \times Fault\ Current\ (kA)$

Where:

The fault current is defined as the reactive positive sequence RMS fault current seen at 40ms after a 3-phase fault at the Grid Entry Point and the Rated voltage is defined as the nominal voltage at the Grid Entry Point.

Note: In Equation 2 only the reactive short circuit current is considered as contributing towards the Short Circuit Level. As part of the ITT stage of the tender further detail will be given on how to calculate the Short-Circuit Level contribution of the plant.

4.5 Oscillation Damping Capability

1. The Facility shall be capable of active and/or reactive power oscillation damping achieved over a duration of 20s. The Power oscillation damping shall:
   - 1.1. Inherently or through a control system contribute to damping sub-synchronous frequency oscillations in the system's active or reactive power range over a frequency bandwidth of 0.3-2 Hz.
   - 1.2. Inject active or reactive current adequately in antiphase to achieve a reduction in oscillations (as described above) at the **Grid Entry Point.**
   - 1.3. Change the amount of active or reactive current injection proportional to the amplitude of the oscillations.
   - 1.4. Ensure the influence of any subsidiary control functions be no more than 10% of the machine rating.
   - 1.5. In addition, solutions based on **GBGF-I** technology are required to provide damping as described in this Guidance Note. Please note this Guidance Note is a live document on the **NESO** website and it may be updated from time to time.
   - 1.6. Solutions based on GBGF-S technology are required to provide damping as described in any future guidance published by **NESO**.

1.7. For Hybrid solutions, Providers must agree with **NESO** a methodology for the demonstration of Oscillation Damping Performance.[2]

1.8. For all plant any Sub-Synchronous Oscillation Behaviour assessment must consider the actual operation of the plant, including but not limited to the stacking of Active Power Services.

2. If the **Facility** is to operate with a Power Systems Stabiliser (PSS) capability as specified through its Bilateral Connection Agreement and the GB Grid Code then this PSS mode shall be used instead of the Power Oscillation Damping specified in 4.5.1. If at any time during the length of the contract, the **Facility** is not operating with a PSS, then the **Facility** will need to satisfy the requirements specified in 4.5.1

4.6 Reactive Power Capability

1. The Facility shall, following an Instruction, have the capability to provide Reactive Power within the range set out in the following table[3].

Purpose	**GEP/USEP Voltage (pu)**	**Active Power condition (if applicable)**	**MW at GEP/USEP**	**Lead MVAr at GEP/USEP (absorption: -ve)**	**Lag MVAr at GEP/USEP (injection: +ve)**
Required service (for **GBGF- I** and **GBGF-S**)	0.95	Maximum MW export			
		0 MW			
		Maximum MW import			
	1	Maximum MW export			
		0 MW			
		Maximum MW import			
	1.05	Maximum MW export			
		0 MW			
		Maximum MW import			
Required Service for **GBGF-I** only	0.9	Maximum MW export			
		0 MW			

[2] A Hybrid asset is an asset consisting of both GBGF-I and GBGF-S elements.

[3] Reactive generation and absorption values to be as specified by the tenderer in their tender submission. Relevant parts of the table to be filled in as required depending on technology type.

For **GBGF-S** this is only for information		Maximum MW import			
	1.1	Maximum MW export			
		0 MW			
		Maximum MW import			

2. The reactive capability of **Grid Forming Plant** should be in accordance with the applicable sections of ECC.6.3.2. Any plant partaking in the long-term stability market must meet the minimum reactive capability specified for their technology type.

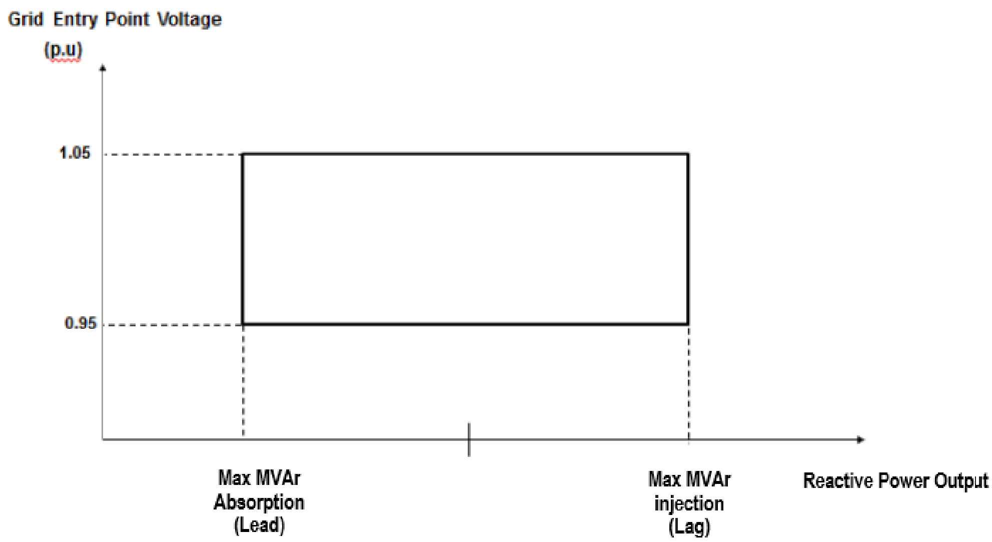

Figure 1: Reactive Capability requirement for GBGF-S Plant not specified in the Grid Code

3. **GBGF-S Plant** for which there are no explicit reactive power provisions in the Grid Code, e.g., **Grid Forming Plant** that do not export MW (e.g., synchronous condensers) should meet the requirement as defined in Figure 1.
4. **GBGF-I Plant** where there are currently no explicit reactive power provisions in the Grid Code (e.g. zero MW connections using static converter plant such as STATCOMs) should meet the reactive power capability requirements defined in Figure 2.

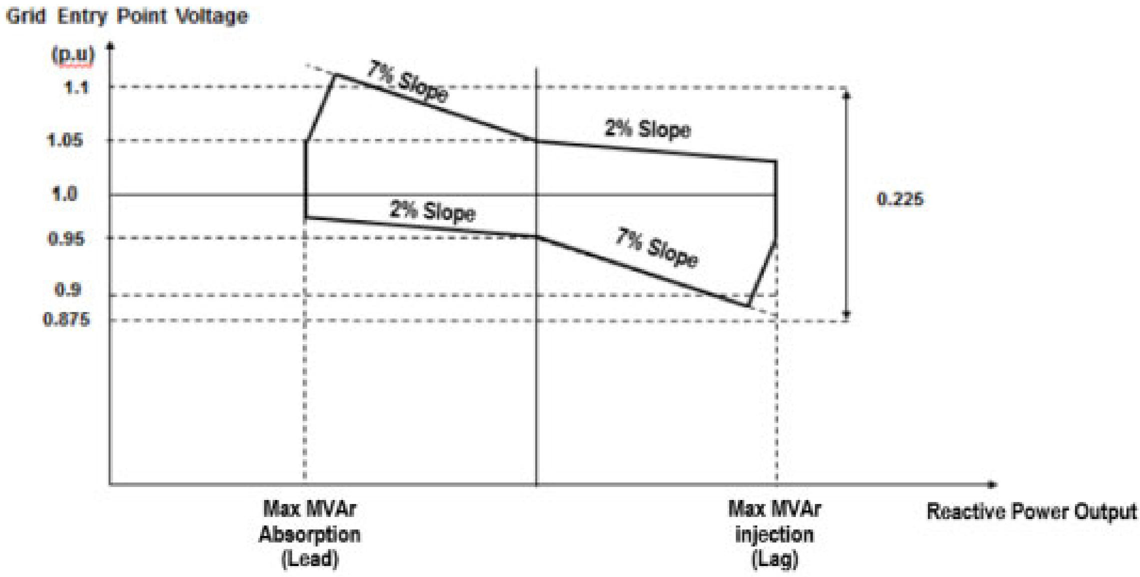

Figure 2: Reactive Capability requirement for GBGF-I Plant not specified in the Grid Code

5. The reactive capability must be fully achievable at the **Grid Entry Point** or the **User System Entry Point** where the voltage at the **Grid Entry Point** or the **User System Entry Point** is between 0.95pu and 1.05pu inclusive. Operating at any point within this reactive range should not limit the ability to provide the contracted inertia or contracted short-circuit level.

6. The reactive capability of **Grid Forming Plant** should be in accordance with the applicable sections of ECC.6.3.2. For all **Grid Forming Plant** where the voltage at the Grid Entry Point is between 0.95pu and 1.05pu inclusive, the values of reactive power injection and absorption at the Grid Entry Point should be no less than ±33MVAr or ±33% of the Maximum Active Power Capacity (Pmax) of the **V4 Grid Forming Plant**, whichever is higher. Please note that the minimum reactive power capability requirements should be available irrespective of the MW output of the **Grid Forming Plant**.

7. The solutions excitation and voltage control shall be in accordance with the applicable sections of the Grid Code (e.g., ECC.6.3.8) and as specified in the Facility's Bilateral Connection Agreement. For the avoidance of doubt, **GBGF-S Plant** and **GBGF-I Plant** not explicitly catered for in ECC.6.3.8 should meet the requirements of ECC.6.3.8.3 and ECC.6.3.8.4 respectively. For **GBGF-I plant** not explicitly covered in the Grid Code the requirements of ECC.A.7.1 must be followed.

8. For GBGF-S solutions without the capability to export active power they shall be required to provide both a 'Target Voltage' and a 'Constant MVAr' mode of operation.

9. For GBGF-I solutions the 'Constant MVAr' mode is not required, however if the provider wishes to offer the 'Constant MVAr' mode the solution must be able to meet all other requirements set out in the technical specification when operating in this mode.

10. The requirements for 'Target Voltage' mode will follow the requirements for the base technology in the Grid Code.

11. For **Grid Forming Plant** operating in Constant MVAr Mode, the MVAr output of the Facility equals the 'Target MVAr' setting. The Facility must still respond rapidly to sudden changes in system voltage, its output returning steadily to the target value over a definable subsequent period. In this mode, the Facility's excitation and voltage control must:

    11.1 Adjust the target voltage so that the MVAr output of the Facility equals the 'Constant MVAr' setting. The Facility will thus still respond rapidly to sudden changes in system voltage, its output returning steadily to within (+/ - 2% of unit MVAr rating) of the target value over the subsequent 5 minute period.

    11.2 Should the voltage on the NETS vary outside adjustable preset limits, the Facility must automatically be switched to Target Voltage Mode to control the abnormal system voltage. This change of operating mode shall be alarmed to alert **NESO** to a possible abnormal system condition. The preset limits shall be adjustable between 0.93 and 1.07 pu, with a resolution of 0.0025 pu.

    11.3 The requirements of the 'Constant MVAr' mode must be achievable for all system short circuit levels including down to the minimum short circuit level of zero MVA. Constant MVAr control must be achievable at any MVAr output and at any system voltage as defined in ECC.6.1.4 and frequencies as defined in ECC.6.1.2.1 of the Grid code.

4.7 Fast Fault Current Requirements

For **GBGF-I plant** in addition to the requirements in ECC.6.3.19.5, the following conditions will apply.

1. Any balanced fault which results in the positive phase sequence voltage falling below the voltage levels specified in CC.6.1.4 or ECC.6.1.4 (as applicable) at the Grid Entry Point, a GBGF-I Plant shall, as a minimum be required to inject a reactive current of at least their Peak Current Rating when the voltage at the Grid Entry Point drops to zero. For intermediate retained voltages at the Grid Entry Point, the injected reactive current shall be on or above the black line drawn from the bottom left-hand corner of the normal voltage control operating zone (shown in the rectangular green shaded area of Figure 3) and the specified Peak Current Rating at a voltage of zero at the Grid Entry Point as shown in Figure 3.

2. The injected reactive current for GBGF-I Plant, shall also be on or below the red line drawn from the point equal to a Grid Entry Point voltage of 1.1pu on the top-right corner of the normal voltage control operating zone (shown in the rectangular green shaded area of Figure 3) and the maximum Peak Current Rating at a voltage of 0.3pu at the Grid Entry Point as shown in Figure 3.

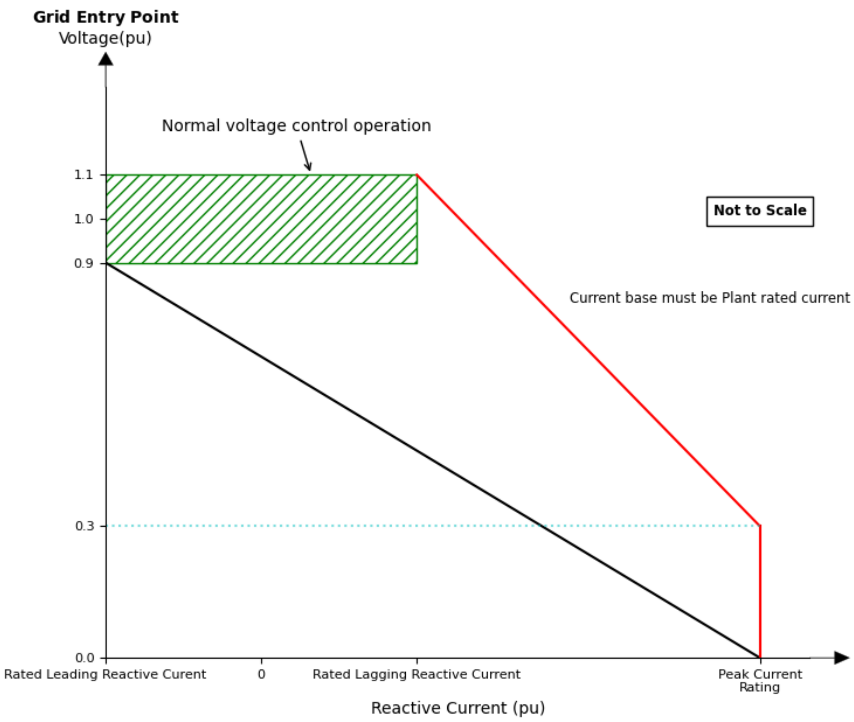

Figure 3: The reactive current to be supplied under a faulted condition

3. When the voltage at the Grid Entry Point is below 0.9p.u. but above 0p.u., GBGF-I Plant should utilise the rest of the inverter's current capability to inject active fault current with pre-fault active current as a target.

For **GBGF-S plant** the following conditions will apply.

4. The Fast Fault Current Injection of GBGF-S Plant should be in line with the behaviour of a directly coupled synchronous generator.

4.8 Fault Ride Through Requirements

1. Solutions must meet the applicable sections of ECC.6.3.15 for their technology type.

2. All Solutions must be able to meet the relevant voltage duration curves for connections at or above 110kV as specified in ECC.6.3.15 according to their relevant technology type. This requirement must be met regardless of the connection voltage of the solution.

4.9 Control and Indication Facilities

1. Where applicable, the transformer tap position shall be provided by the Provider at **NESO's** operational metering system control and data acquisition (SCADA) outstation interface, as specified in the Provider's Bilateral Connection Agreement.

2. Where applicable, the following facilities for voltage control and control of the stability service to **NESO's** instructions shall be provided by the Provider at a manned control point This data shall be provided through a system elected by **NESO**:
   2.1. Start-up of machine and transition to Stability Compensation mode.
   2.2. Shut down of Stability Compensation mode.
   2.3. Availability of Inertia
   2.4. Target voltage setting (resolution 1kV) (for *Target Voltage* control mode).
   2.5. Target MVAr setting (resolution 1MVAr) (for Constant MVAr control mode)
   2.6. Control mode selection (Target Voltage or Constant MVAr).
   2.7. Slope setting (range 2% to 7%, resolution 0.5%.)

3. The following additional facilities for voltage/reactive power control shall be provided by the Provider. The Provider shall use all reasonable endeavours to adjust any of the following specified quantities upon **NESO's** instruction within 24 hours notice. Adjustments including 3.1 and 3.2 shall not be made unless instructed by **NESO**.

3.1. When operating in Voltage Control Mode, the control system shall be capable of operating to a Setpoint Voltage between 95% and 105% with a resolution of 0.25%

3.2.The time for switching between Target Voltage mode and Constant MVAr mode (The value shall be within the range 5 minutes to 30 minutes, with a resolution of 5 minutes).

4. To accurately monitor the performance of a **Grid Forming Plant**, **each Grid Forming Plant** shall be equipped with a dynamic system monitoring (DSM) facility in accordance with the requirements of ECC.6.6.1.2 or an alternative solution as agreed with NESO.

5. For **GBGF-I** in addition to the DSM requirements set out in ECC.6.6.1.2 it is expected that the provider installs additional monitoring equipment for the purpose of performance monitoring, this equipment should be capable of recording frequency, voltage, active and reactive power and current at a sampling rate of no less than 100Hz. This data should be held by the **Provider** for at least 28 days. The accuracy of all Active Power, Reactive Power and their derived quantities should be at least +/- 1%. Further detailed specifications will be specified by **NESO**.

6. The signals which shall be provided by the **Provider** to **NESO** for Physical Testing shall be of the following resolution, unless otherwise agreed by **NESO**:
   6.1. 1 kHz for **Grid Forming Plant** signals including fast fault current measurements.
   6.2. 1 kHz for the other **Grid Forming Plant** tests.

4.10 Model Provision

1. Solutions with dynamic reactive power capability must, prior to commissioning, submit a dynamic (Root Mean Square - RMS) model and an electromagnetic transient (EMT) model in accordance with Grid Code PC.A.5.3 or PC.A.5.4 and PC.A.9 as appropriate. All solutions must also submit models in compliance with PC.A.5.8.

2. The provider must submit an open RMS model (i.e., transfer functions visible with no encryption on any block diagrams, equations or macros and not contain DLL code or requiring set up script to function) produced in DIgSILENT PowerFactory in a software version that is agreeable between **NESO** and the Provider.

3. The provider must submit an EMT model in a software version that is agreeable between the **NESO** and the provider 3 months before the Scheduled Commercial Operations date. Further to this the model must be accepted by **NESO**. Any model submitted should be in line with PC.A.9.4, PC.A.9.6 and PC.A.9.9. The model should be expected to be shared with the relevant TO and, if it applies, the relevant DNO. The model may also be shared with other users as a part of the compliance process. The provider must follow the requirements set out in the Guidance Notes for Electro-Magnetic Transient (EMT) Models or any updated and/or equivalent version of this documentation at time of connection.

4. The provider must submit a Performance Chart in accordance with Grid Code OC2.4.2.1.

4.11 Compliance Requirements

1. Prior to service provision, the Provider must complete a full set of Proving Tests in line with the contractual terms and conditions.
2. To enable this, **NESO** shall provide a full set of test requirements no less than 1 year before the Scheduled Commercial Operations Date.
3. For **Grid Forming Plant Owners,** the Operational Notification Process contained in ECP.5 to ECP.7 shall apply in relation to the type of Plant to which the **Grid Forming Capability** is provided (be it a **GBGF-S Plant** or **GBGF-I Plant**) in order for the provider's Facility to become operational.
4. For GBGF-I solutions all tests covered in ECP.A.9 shall be completed through physical testing. These tests must be completed to a methodology agreed with **NESO**.
5. Any change to the Plant and Apparatus of the Provider required to provide the Solution shall be notified to NESO and the Relevant Transmission Licensees, including the submission of all Planning Data. If NESO or the Relevant Transmission Licensee consider this to have a material impact on the Provider's Construction Agreement and Bilateral Agreement, the Provider is expected to submit a modification application to identify such impacts and modify the agreements accordingly. This should cover, but not limited to, issues like
   a. Change of plant configuration to provide Grid Forming capabilities; and
   b. Interactions that may give rise to Unacceptable Sub-Synchronous Oscillation and Sub-Synchronous Torsional Interactions.

6. Costs arising from these Modification Applications and from discharging any obligations to the User that arise from them are expected to be the responsibility of the Provider. The Provider will not be paid under the Stability Contract until all the obligations identified as a part of this process has been discharged.
7. In the case where The Provider is relying upon a reserved bay, the same requirements will apply. For the avoidance of doubt any costs arising from the use of reserved bays with regards to Sub-Synchronous Torsional Interactions or other Unacceptable Sub-Synchronous Oscillations are expected to be the responsibility of the Provider.

4.12 Service Stacking

1. If successful in the Long-Term 2029 tender, Providers who wish to stack active and reactive power services with the stability contract must demonstrate this capability through physical testing that considers the inertial and short circuit level response of the plant. Providers should refer to the contract terms for more details.