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Mid-term Reactive Power Market: Voltage Technical Requirements and Specification

DRAFT FOR CONSULTATION

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Version Control

Version	Date	Notes
V0	9 January 2026	DRAFT and INDICATIVE version of the Technical Specification document as part of the Pre-Market Consultation, for market feedback.

Introduction

This document contains the technical service requirements and specification for the Mid-term Reactive Power Market. It is made up of the following parts:

- Part 1 – Reactive Power Requirements and Locations of Need
- Part 2 – Eligibility Criteria
- Part 3 – Specifications
- Part 4 – Definitions

Part 1 – Reactive Power Requirements and Locations of Need

At the market qualification stage, bidders do not have to be located or connected in a specific location.

However, future reactive power requirements that are procured through the Mid-term Reactive Power Market will be locational specific.

This is because NESO reactive power requirements are identified based on regional locations of need. These locations of need will be selected based on the network topology considering both pre- and post-fault voltage analysis.

To be considered for future Mid-term Reactive Power Market requirements, qualified bidders will need to be connected to an acceptable substation that falls within a location of need.

Acceptable substations will be defined on a case-by-case basis for each future Mid-term Reactive Power Market requirement. NESO will publish information about the locations of need and where required the corresponding substations and busbars.

Solutions connected to other substations (adjacent substations), can be considered to provide the necessary service subject to them being acceptable substation towards the location of need in line with NESO's effectiveness analysis results.

Part 2 –Eligibility Criteria

This section presents the eligibility criteria for the Mid-term Reactive Power Market. Each proposed solution must fulfil the described criteria to qualify for the Mid-term Reactive Power Market.

- The solution must fulfil the overarching Mid-term Market Eligibility Criteria, covered in the document "Mid-term Reactive Power_Eligibility Criteria"
- Solutions can be new, existing or providing additional capability through incremental investment such that they meet the Eligibility Criteria.

Part 3 - Specifications

3.1 Availability and Utilisation Profile

Availability

Specific availability requirements will be confirmed on a case-by-case basis for each future Mid-term Reactive Power Market requirement. Provided below is an indication of likely availability requirements:

- Requirements procured through any year-ahead mini-tender process will typically seek 90% availability.
- Requirements procured through any within-year mini-tender process will likely seek 100% availability.

Utilisation

While there is no defined utilisation requirement at the Market Qualification stage, an indicative utilisation profile for a typical 12-month period is provided for transparency in Table 1 below. Please note that there is no contractual utilisation cap under the Mid-term Reactive Power Market. The usage of each solution will depend on system conditions.

For any absorption static services, it is expected that usage will primarily be overnight and during weekends. For any injection static services, it is expected that usage will primarily occur during high flow and high demand periods. Although static solutions may still be instructed at other times when they are available dependant on the needs of the network.

For the dynamic services, higher utilisation is anticipated, with reactive power output varying according to NESO instructions and system conditions.

Table 1 – indicative utilisation for a typical 12-month period

Service Requirement	Settlement Periods (SP)
Absorption Static Services	11,000
Injection Static Services	3,500
Dynamic Services	15,768

The data provided in Table 1 is indicative only and is provided in good faith, NESO make no guarantee that actual usage within the Mid-term Reactive Power Market will align with the values presented in Table 1 of this technical specification. Further to this, NESO reserves the right to utilise assets in every settlement period for which they are available according to system requirements.

3.2 Sizing and Number of Solutions

Fixed-rating static service solutions should adhere to the sizing limits as detailed in Table 2, or alternatively the capacity allowed by their connection agreement. The maximum values indicated in Table 2 correspond to the typical sizing that can be switched in and out of service by a single circuit breaker without violating voltage step change limits at different voltage levels[1]. However, viable solutions may exist that exceed these maximum values shown in Table 2. This is because the relevant Transmission Owner (TO), as part of the connections application process, conducts technical assessments to verify whether connections are compliant with voltage step change limits. These assessments may vary to the values set out in Table 2 and should be what providers ultimately abide by in any tender submissions.

Table 2 – Fixed rating static service sizing limits

Limit	Connection Voltage (kV)	Total Reactive Power Absorption (Mvar)[2]	Total Reactive Power Injection (Mvar)[2]
Minimum	400	15	15
	275	15	15
Maximum	400	200	230
	275	100	150

There are no specified sizing limits for dynamic-type assets. However, these providers should still abide by any sizing limitations set out in the connection agreement. A solution may consist of smaller units with individual switching capability connected through the

[1] Section 6 of the SQSS defines the limits for step changes
[2] The presented values reflect the maximum reactive power output corresponding to a voltage of 1.0 p.u.

same connection point, which can be beneficial for compliance with voltage step change limits.

3.3 Reactive Power Capability

Unless otherwise stated, the reactive power capability should refer to the Grid Entry Point (GEP). This is defined as the point where the solution connects directly to the transmission system.

Any equipment between the solution and the GEP that may impact the solution's performance must be considered when determining the reactive power capability. This equipment may include transformers, cables, circuits, and other components.

The Mid-term Reactive Power Market seeks technologies that provide reactive power support services based on a technology-agnostic specification. Solutions are classified as either static or dynamic.

In specific locations, where NESO require a dynamic service, only dynamic solutions will be accepted. However, where a static service is specified, solutions based on either static or dynamic assets may be proposed. These solutions may include but are not limited to a Mechanically Switched Reactor (MSR) or a Mechanically Switched Capacitor (MSC).

In all cases the solution must comply with the requirement for the reactive power service to be provided at 0MW and if applicable independent of the MW output of the plant.

For each proposed solution, Providers should declare the reactive power range at the GEP for both Mvar absorption and injection conditions, as follows:

- **Absorption capability** – Mvar at GEP (-ve) when the voltage at the GEP is equal to 1.0 p.u.
- **Injection capability** – Mvar at GEP (+ve) when the voltage at the GEP equal to 1.0 p.u.

The proposed solution must be compliant with all applicable Grid Code sections, including but not limited to:

1. The reactive power capability of Power Generating Modules, including Grid Forming Plant, should be in accordance with the applicable sections of ECC.6.3.2.

2. Plant for which there are no explicit reactive power provisions in the Grid Code, e.g., those that do not export MW, should meet the requirement as defined in Figure 1 and Figure 2 for synchronous and inverter-based plant, respectively.

3. Any excitation and voltage control systems must be in accordance with the applicable sections of the Grid Code (e.g., ECC.6.3.8) and as specified in their Bilateral Connection Agreement. For the avoidance of doubt, Plant not explicitly catered for in the Grid Code should meet the requirements of ECC.6.3.8.3 or ECC.6.3.8.4 depending on their technology type. The performance requirements expected of the control system are detailed in the relevant parts of Appendix E of the Grid Code. Where performance requirements are considered in the Grid Code, the capability of the plant must be taken as the actual capability of the plant rather than the Grid Code Minimum.

4. Providers are required to consider and account for transient and temporary voltage issues for any installation at all sites considering the obligations to be placed on Providers through their Bilateral Connection Agreement (BCA). All requirements regarding AC System Voltage Variations, covering TOV (Grid Code ECC.6.1.4, and TGN(E) 288 requirements) and Electromagnetic Transients, Voltage Fluctuations and Transformer Energisation, covering inrush (Grid Code ECC.6.1.7) must be met. Standard BCA templates can be found on the NESO website at: https://www.neso.energy/document/33976/download. TGN(E) 288 can be found at the following location:

https://www.nationalgrid.com/sites/default/files/documents/TGN%28E%29_288_0.pdf.

Any proposed solution based on technologies not covered by the Grid Code must have the requirements agreed with NESO.

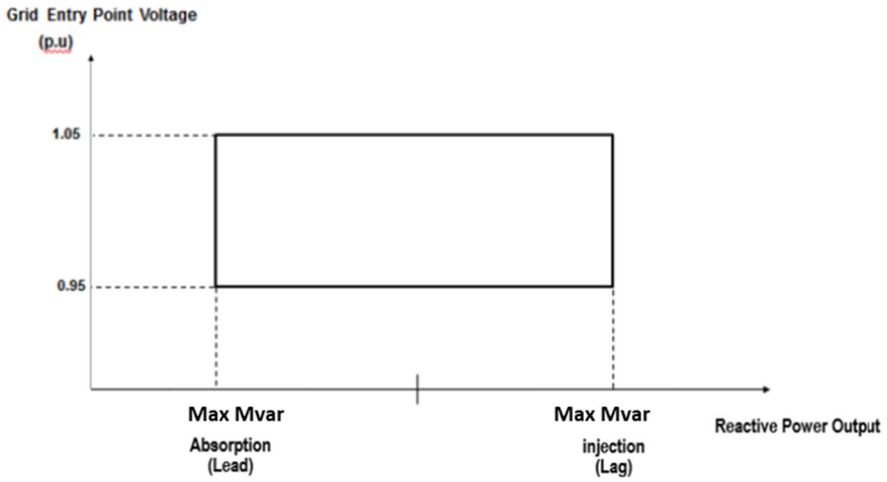

Figure 1: Reactive Capability requirement for Synchronous Plants not specified in the Grid Code

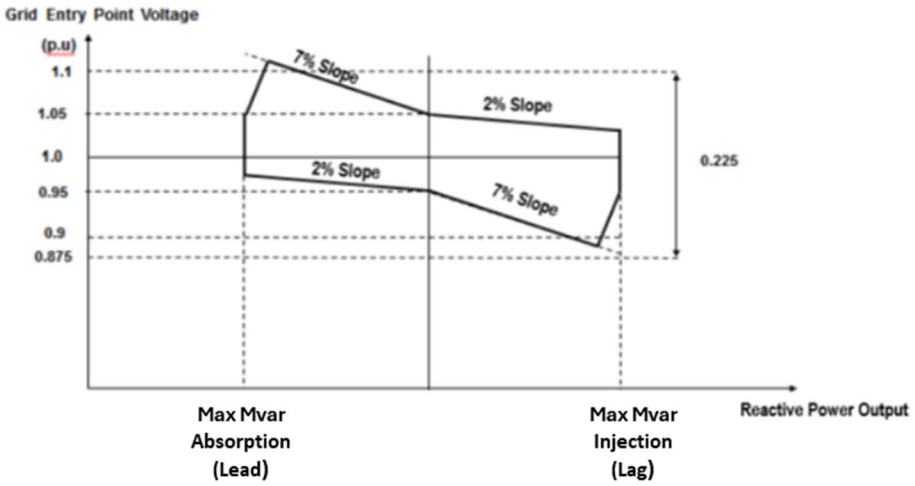

Figure 2: Reactive Capability requirement for Inverter Based Plant not specified in the Grid Code

5. For solutions with dynamic reactive support capability, the solution must be able to operate in Voltage Control Mode. All Plant must the meet Voltage Control requirements within their connection agreements and the relevant Grid Code sections.

6. All plant must have demonstrated compliance with the Grid Code to provide the reactive power service. For the avoidance of doubt this includes, but is not limited to Voltage Control Testing, Reactive Power Capability Testing and Frequency Response Testing.

3.4 Fault Ride Through (FRT) Requirements

1. Solutions must meet the applicable sections of ECC.6.3.15 for their technology type. For solutions based upon Power Electronic Technology, e.g., STATCOM, must meet the requirements of a Power Park Module in the Grid Code.

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

3.5 Oscillation Damping Capability

1. For dynamic solutions, the Facility shall be capable of active and/or reactive power oscillation damping 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, inverter based plant 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 synchronous based plant are required to provide damping as described in future guidance.

   1.7. For co-located solutions providing the dynamic service, providers should agree with NESO a methodology for the demonstration of Oscillation Damping performance.

   1.8. For the avoidance of doubt active power damping requirement is only required for non-0MW solutions.

2. If the Facility is to operate with a Power Systems Stabiliser (PSS) capability as specified through its Bilateral Connection Agreement and GB Grid Code, then this PSS mode shall be used instead of the Power Oscillation Damping specified in 4.6.1. If at any time during the length of the contract, the Facility is not operating with a PSS, then the Facility will need to meet the requirements specified in 4.6.1.

3.6 Dispatch

1. There must be a single point of dispatch.
2. Providers to be dispatched via EDL/EDT or signals over a VPN via IEC104 server connection, unless otherwise agreed.
3. Providers must acknowledge receipt of instruction within 2 minutes.
4. The minimum notice period to deliver the contracted reactive power service is 2 minutes.
5. The maximum notice period required to deliver the contracted reactive power service must not exceed 30 minutes.
6. Providers must have capability of receiving and responding to instructions 24/7 for the duration of the contract period in line with the Mid-term Reactive Power Market terms and conditions.
7. Providers must inform NESO of planned outages/periods of unavailability in line with the Mid-term Reactive Power Market terms and conditions.

3.7 Control and Indication Facilities

1. Where applicable, the transformer tap position shall be provided for by the provider at the NESO 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/reactive power control to the NESO instructions shall be provided by the provider at a staffed control point:

    2.1 Start-up of the solution.

    2.2 Target voltage setting for Voltage Control Mode

    2.3 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 instruction within 24 hours of notice. Adjustments including 3.1 shall not be made unless instructed by the 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%.

4. Providers must provide, at the point of connection, operational and settlement metering for real time visibility and service settlement purposes. In cases where the solution is a part of a wider installation, an alternative metering arrangement may be required.

3.8 Model Provision

1. For Solutions without dynamic reactive power capability, where required by a Tender Acceptance Form under the Mid-term Reactive Power Market terms and conditions, the Provider must submit a Root Mean Square - RMS model with all relevant electrical parameters, including saturation characteristics where applicable. Where the Provider has already submitted a suitable RMS model to NESO, and NESO has accepted the model, it is at NESO's sole discretion if this model needs to be resubmitted.

2. For Solutions with dynamic reactive power capability, where required by a Tender Acceptance Form under the Mid-term Reactive Power Market terms and conditions, the Provider must 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. Where the Provider has already submitted a suitable RMS and EMT model to NESO, and NESO has accepted the model, it is at NESO's sole discretion if this model needs to be resubmitted.

3. 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 at least 3 months before the Scheduled Commercial Operations date, unless otherwise stated by NESO in any given mini-tender or non-competed process.

4. The provider must submit an EMT model in a software version that is agreeable between NESO and the provider at least 3 months before the Scheduled Commercial Operations date, unless otherwise stated by NESO in any given mini-

tender or non-competed process. 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 equivalent documentation at time of connection.

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

3.9 Compliance Requirements

1. Prior to service provision, the Provider may be required to complete a full set of Proving Tests in line with any mini-tender process (or non-competed process) requirements, and the associated contractual terms and conditions.
    a. Where Proving Tests are required to be completed as a post tender milestone, NESO shall provide a full set of test requirements no later than one year before the Scheduled Commercial Operations Date, unless otherwise stated by NESO in any given mini-tender process or non-competed process.
2. 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.

3. 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.

4. 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.

5. 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, at NESO's discretion, may not be paid under any Mid-term Reactive Power Contract until all the obligations identified as a part of this process has been discharged.

Part 4 – Definitions

Term / Acronym	Definition
MSC	Mechanically Switched Capacitor
MSR	Mechanically Switched Reactor
EDT	Electronic Data Transfer
EDL	Electronic Dispatch Logger
NESO	National Energy System Operator
TO	Transmission Owner
Acceptable Substations	Substation on the transmission network where the reactive power service can be provided with reference to the Reference Substation
Reactive Power	The product of voltage and current and the sine of the phase angle between them measured in units of voltamperes reactive.
Solution	Any one asset or group of assets connected through one connection point/bay being proposed as a solution
Provider	Used to refer to whichever company is successful and contracted for provision of the reactive power service when referring to their obligations within the technical specification or the contract.
Static Asset	An asset which delivers the Reactive Power Service by absorbing or injecting an approximately constant level of reactive power level during normal operation.
Dynamic Asset	An asset which delivers the Reactive Power Service according to the characteristics of its control mode. In this mode the reactive power output of the asset changes in

	proportional to changes in the system voltage. This includes but not limited to Synchronous Compensators, Static Var Compensators (SVC), or STATCOM devices.
Grid Entry Point	The point at which the solution connects to the transmission system (typically 275kV or above, or otherwise directly connected).
Zero-MW Solution	A solution which can provide reactive power, without the capability of injecting or absorbing active power in steady-state condition, excluding any intrinsic operational losses, e.g., reactors, synchronous compensators, SVCs, and STATCOMs.
Non-Zero-MW Solution	A solution which can provide reactive power, with the capability of injecting or absorbing active power in steady-state condition beyond any intrinsic operational losses, e.g., generators, batteries, and wind farms.
GB Grid Forming Inverter or GBGF-I Plant	Any Power Park Module, HVDC System, DC Converter, OTSDUW Plant and Apparatus, Non-Synchronous Electricity Storage Module, Dynamic Reactive Compensation Equipment or any Plant and Apparatus (including a smart load) which is connected or partly connected to the Total System via an Electronic Power Converter which has a Grid Forming Capability.
GB Grid Forming Synchronous Plant or GBGF-S Plant	A Synchronous Power Generating Module, Synchronous Electricity Storage Module or Synchronous Generating Unit with a Grid Forming Capability.

Dynamic Reactive Power Capability	Capability of injecting or absorbing Reactive Power in a controlled manner which could be performed by diverse technologies, including but not limited to Synchronous Compensators, SVCs, STATCOMs, or Batteries.
Voltage Control Mode	The unit reactive current shall be directly proportional to the deviation of the system voltage from the preselected setpoint and inversely proportional to the slope setting.
Setpoint	Preselect voltage or Mvar target value as instructed by the NESO.
Slope	The slope setting is equivalent to the percentage voltage change, based on nominal, that results in a change in reactive power from zero to the maximum absorption or injection.