Voltage 2026 EOI Webinar Technical Specification and Connections Approach

We will start at 14:05 to allow time for everyone to connect.
This webinar has been recorded.

ESO

House keeping

- Please remain on mute during the webinar
- Videos have been disabled to maximise quality of bandwidth during this webinar
- To submit a query, please use the Q&A functionality within teams
- If your query is confidential, please email it directly to the tender team: box.voltage2026@nationalgrideso.com
- This webinar has been recorded, a copy of the recording and the slides will be made available

Agenda

- Background
- Technical Requirements and Specification
- Connections Requirements
- Consultation timeline and next steps
- Q&A

Background

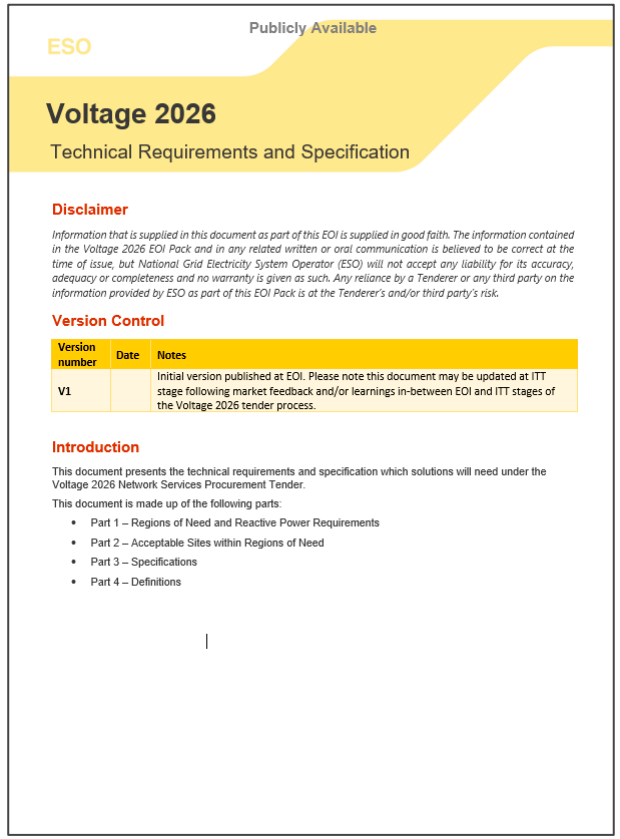
- Following the completion of Mersey and Pennine Voltage Pathfinders ESO have conducted network analysis studies to evaluate future reactive power needs
- This analysis has identified further reactive power absorption requirements in England between 2026 and 2036
- This Voltage 2026 tender is seeking to identify the most cost-effective solutions that meet these reactive power requirements

Technical Requirements and Specification

Document Summary

- Part 1 – Regions of Need and Reactive Power Requirements
- Part 2 – Acceptable Sites within Regions of Need
- Part 3 – Specifications
- Part 4 – Definitions

Initial version published at EOI: it may be updated at ITT stage



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Voltage 2026

Technical Requirements and Specification

Disclaimer

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Version Control

Version number	Date	Notes
V1		Initial version published at EOI. Please note this document may be updated at ITT stage following market feedback and/or learnings in-between EOI and ITT stages of the Voltage 2026 tender process.

Introduction

This document presents the technical requirements and specification which solutions will need under the Voltage 2026 Network Services Procurement Tender.

This document is made up of the following parts:

- Part 1 – Regions of Need and Reactive Power Requirements
- Part 2 – Acceptable Sites within Regions of Need
- Part 3 – Specifications
- Part 4 – Definitions

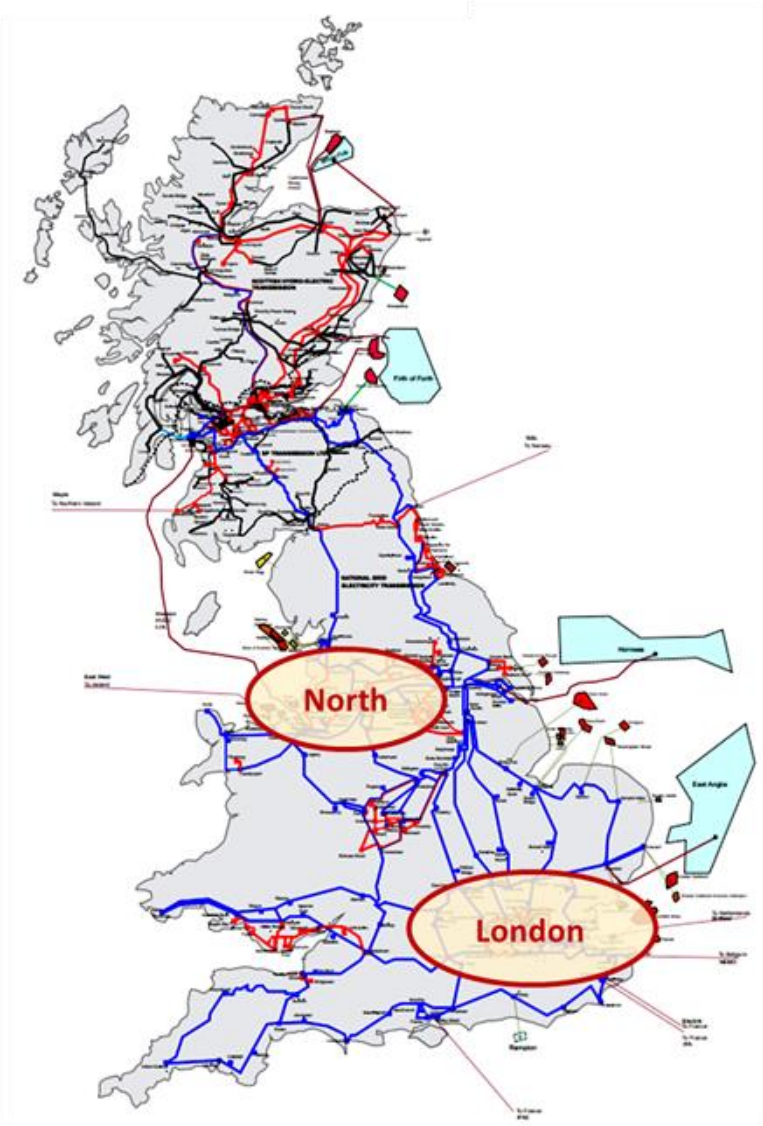
⚠ *In this webinar, key aspects of the document will be covered. Please refer to the document for full details.*

**EOI: Express of Interest*
**ITT: Invitation to Tender*

Regions of Need and Reactive Power Requirements

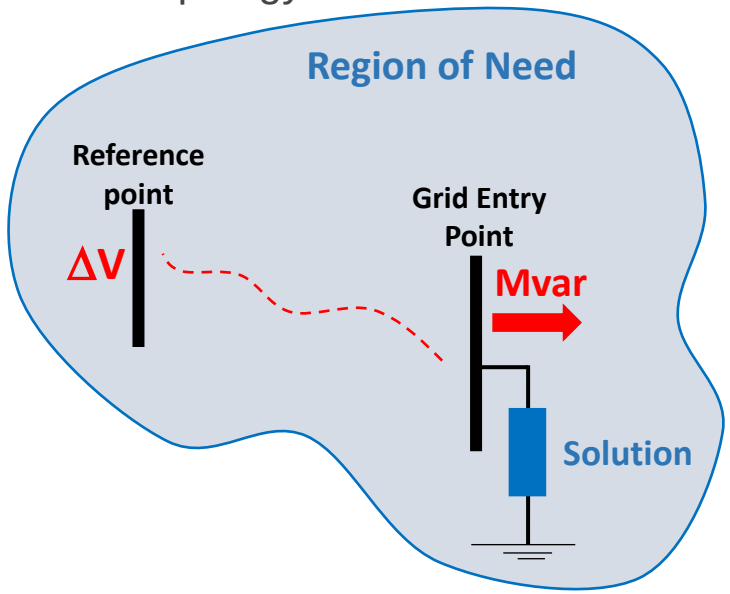
- This tender is to procure reactive power absorption for voltage management
  - Highly locational in nature
  - The effectiveness of the compensation drops sharply as the electrical distance from the reference point increases
- Two regions of need:
  - London
  - North England
- The reference point is chosen based on the network topology, considering both pre- and post-fault analysis

Region	Requirement	Reference point
London	-200 Mvar	Tilbury 400 kV
North England	-200 Mvar	Eggborough 400 kV



Acceptable Sites (1)

- The effectiveness factors reflect voltage sensitivities when compensation is connected at different locations
  - Extracted from nodal equations used in the load flow formulation
  - The effectiveness is calculated against the reference points
- To allow sufficient range of connection sites, a threshold of 40% has been applied
- For some locations, specific nodes are indicated depending on the substation topology



North England

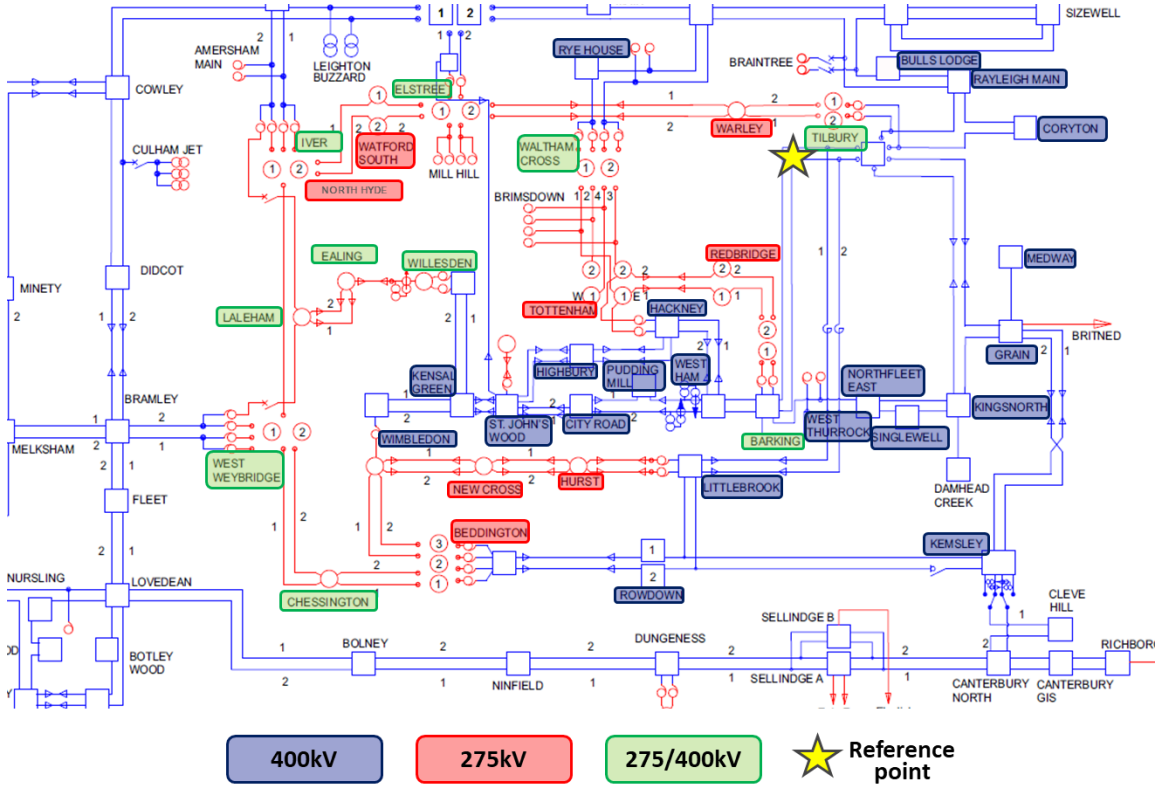
Location	Effectiveness Factor [%]	Specific node
Eggborough 400kV*	100	
Ferrybridge 400kV	98	
Monk Fryston 400kV	95	
Knaresborough 275KV	90	
Poppleton 275kV	89	
Monk Fryston 275kV	89	
Ferrybridge 275kV	89	
Thorpe Marsh 400kV	87	Mesh corner
Skelton Grange 275kV	87	
Drax 400kV	84	
Thorpe Marsh 275kV		

London

Location	Effectiveness Factor [%]	Specific node
Tilbury 400kV*	100	
Coryton South 400kV	94	
Rayleigh 400kV	87	
West Thurrock 400kV	86	Connection nodes to Littlebrook 400kV
Kingsnorth 400kV	85	
Tilbury 275kV	84	
Singlewell 400kV	83	
Rowdown 400kV	83	Connection node to Littlebrook-Kemsley 400kV (Circuit 2)
Northfleet East 400kV	83	
Littlebrook 400kV	82	
West Thurrock 400kV	82	Connection nodes to Barking
Barking 400kV	80	
Warley 275kV		

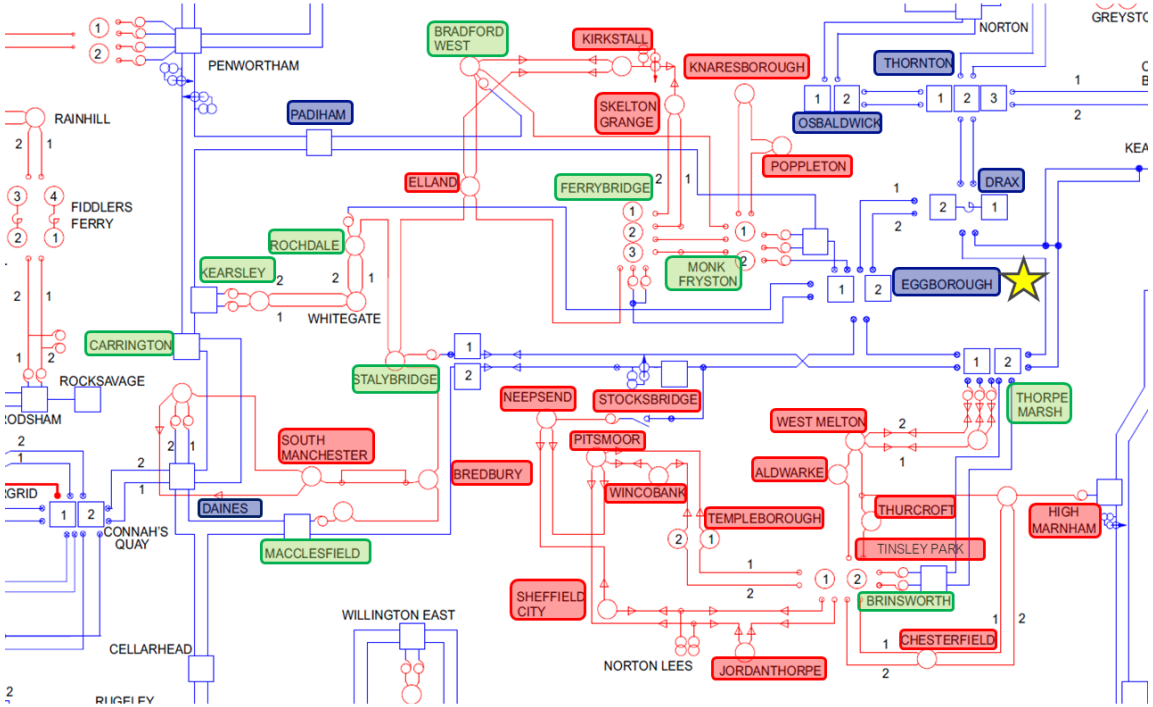
Acceptable Sites (2)

London



400kV | 275kV | 275/400kV | Reference point

North England

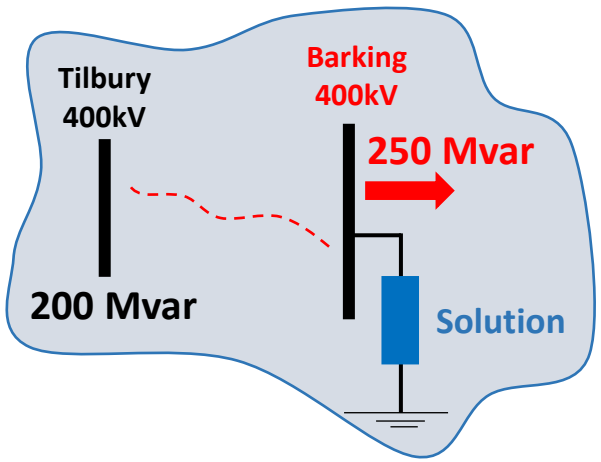


400kV | 275kV | 275/400kV | Reference point

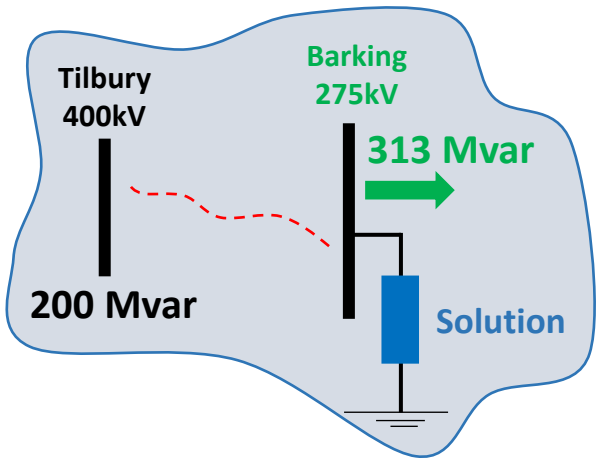
*Please note that, for some locations, specific nodes are indicated depending on the substation topology

How do the effectiveness factors work?

- **Example: Barking 400 kV and 275 kV**
- How much we need to meet the full requirement of London region (200 Mvar at Tilbury 400 kV)?
  - Barking 400 kV: 200 Mvar ÷ 80% = 250 Mvar
  - Barking 275 kV: 200 Mvar ÷ 64% = 313 Mvar



100%



100%

London		
Location	Effectiveness Factor [%]	Specific node
Tilbury 400kV*	100	
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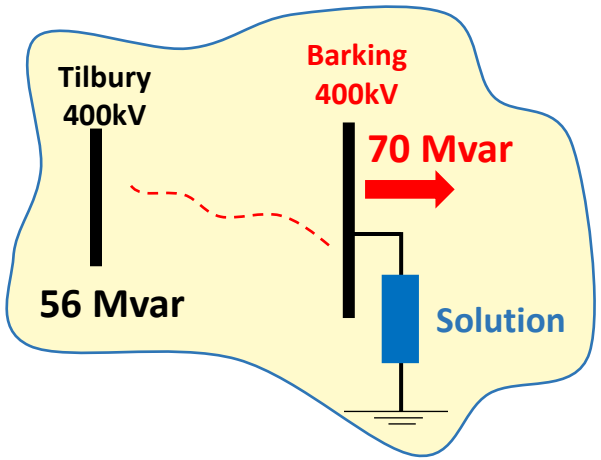
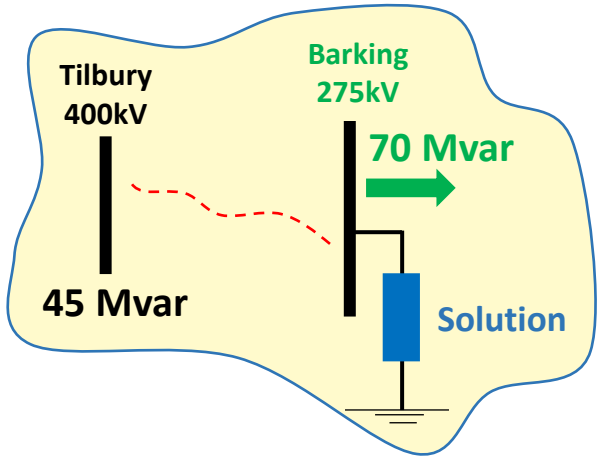
Littlebrook 400kV	82	
West Thurrock 400kV	82	Connection nodes to R...
Barking 400kV	80	
Warley 275kV		

Barking 400kV	80
Barking 275kV	64

- If a smaller solution is proposed, e.g., 70 Mvar:
  - Barking 400 kV: 70 Mvar × 80% = 56 Mvar → 28%
  - Barking 275 kV: 70 Mvar × 64% = 45 Mvar → 23%



28%



23%

Availability and Utilisation Profile

- This tender is seeking 90% availability
- An indicative utilisation is provided for information only
    - Static assets: required overnight and weekends primarily, but could be other times
    - Dynamic assets: full usage yet the reactive power output may vary
- Indicative annual utilisation:

Utilisation	Settlement Periods (SP)
Expected usage for static assets	11,000
90% availability full usage	15,768
100% availability full usage	17,520

Sizing Limits

- Each individual solution should observe sizing limits
  - Minimum size is defined according to the connection type (new or existing)
  - Maximum size is defined according to the voltage step change limits
- The maximum values correspond to the usual figures that can be switched by a single circuit breaker without violating voltage step change limits at different voltage levels
  - There might be viable solutions greater than these maximum values
  - The actual maximum limits should be identified during the connection application process with the relevant TO
- A solution can be composed by smaller units with individual switching capability, which may be beneficial for compliance with voltage step change limits

Limit	Connection	Total reactive power absorption
Minimum	New*	40 Mvar
	Existing	15 Mvar
Maximum	400 kV	200 Mvar
	275 kV	100 Mvar

Usual figures based on voltage step change limits

**Any asset not on the TEC register as at 06th October 2023*

Reactive Power Capability (1)

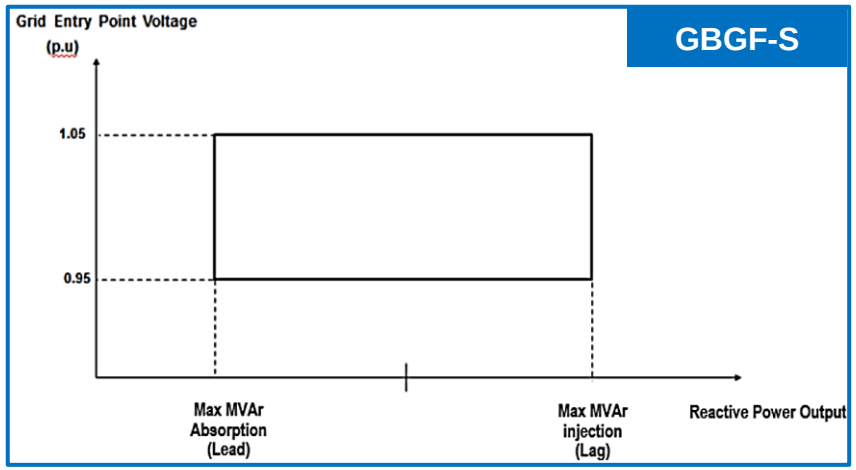
- **The reactive power capability should refer to the Grid Entry Point (GEP)**
  - The point where the solution will directly connect to the transmission system
  - Any equipment between the solution and the GEP must be considered when informing the reactive power capability
- **Voltage 2026 is technology agnostic**
  - Static or dynamic assets can be proposed
  - Dynamic assets may employ zero-MW or non-zero-MW solutions
- **The reactive power range should be declared at the GEP for each solution**
  - Voltage at the GEP equal to 1.0 pu
  - Both Mvar absorption and injection conditions

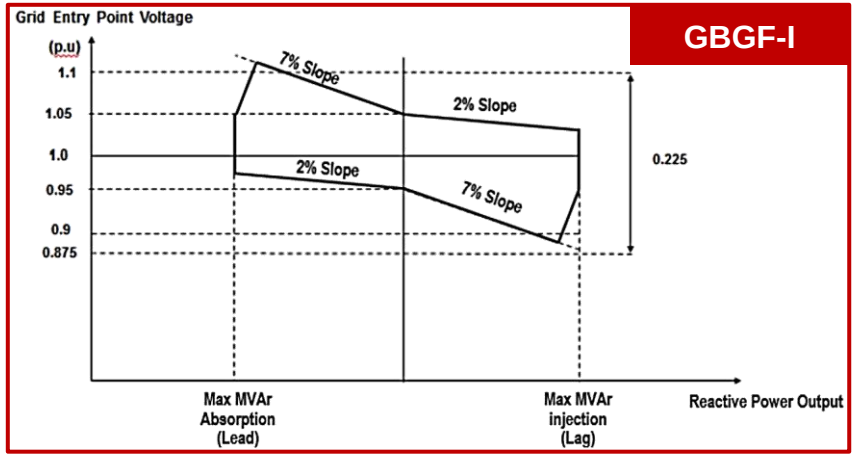
⇒ **Absorption capability** – Lead Mvar at GEP (-ve)
⇒ **Injection capability** – Lag Mvar at GEP (+ve)

Reactive Power Capability (2)

- All solutions will be assessed based on the **declared absorption capability** at the GEP
- For non-zero-MW solutions, the declared Mvar range must be accessible **independently from its MW output**
- The proposed solution must be compliant with all applicable Grid Code sections and any specifications in their Bilateral Connection Agreement (BCA), including but not limited to:
  - Excitation and voltage control requirements
  - Voltage variations, fluctuations, and TOV
  - Reactive power provision
- Grid Forming Plant for which there are no explicit reactive power provisions in the Grid Code, should meet these requirements

Grid Forming Plant for which there are no explicit reactive power provisions in the Grid Code





GBGF-S: GB Grid Forming Synchronous
GBGF-I: GB Grid Forming Inverter

Reactive Power Capability (3)

- **Operation modes** required for solutions with dynamic reactive support capability:
  - Voltage Control Mode
  - Constant Reactive Power Control Mode
- The solution must be able to:
  - Switch between Voltage Control Mode and Constant Reactive Power Mode
  - Change the preselected voltage and Mvar setpoints

On instruction from the ESO within an agreed time scale of no longer than 30 minutes

Model Provision

- Solutions with dynamic reactive power capability must submit (according to appropriate Grid Code sections):
  - A dynamic (RMS) model and
  - An electromagnetic transient (EMT) model
- The models must be submitted in a software version that is agreeable between the ESO and the provider
- The EMT model must be submitted 3 months before the Scheduled Commercial Operations date and should be in line with PC.A.9.4 and PC.A.9.6
- The models must be accepted by the ESO
- The models should be expected to be shared with the relevant TO

Other Requirements

- Dispatch
  - Providers must have capability of receiving and responding to instructions 24/7 for the duration of the contract period
  - Providers must inform ESO of planned outages or periods of unavailability
- Control and Indication Facilities
  - Where applicable, the following facilities shall be provided:
    - Start-up of the solution
    - Control mode selection
    - Voltage or reactive power target setting with required resolution
    - Slope setting with required resolution
  - Providers must make available operational and settlement metering
- Compliance
  - Compliance testing requirements should be discussed with the ESO and will be determined based on the solution technology
  - For Grid Forming Plant Owners, the Operational Notification Process contained in ECP.5 to ECP.7 shall apply

Connections Requirements

⚠ *In this webinar, key aspects of the document will be covered. Please refer to the document for full details.*

Voltage 2026 Connections Requirements

For each solution that is proposed by a bidder, **one of the four** below connection requirements must be satisfied

Option	Description
A	Confirm that the proposed solution will connect via the reserved bay
B	Demonstrate that an existing connection can fully accommodate the proposed solution as-is
C	Demonstrate that an existing connection with a full modification application offer can fully accommodate the proposed solution
D	Demonstrate that the bidder has a full connection offer for a new connection that can accommodate the proposed solution and can be entered into if the party is successful in the tender

Voltage 2026 Connections Requirements – Option A Summary

Option	Description
A	Confirm that the proposed solution will connect via the reserved bay

- Bidders who participate through this requirement will be required to confirm they intend to use the reserved bay as their form of connection
- Bidders will not need to submit a connection application for the reserved bay until after they have received confirmation they have been successful in the tender
- To enable this route to market ESO are liaising with the relevant TO to develop a Connection Feasibility Report about the reserved bay
  - This will provide an indicative view of the connection date and connection cost
  - This report should be used by bidders to inform their tender submission

Site	Region	No. of connection points secured	Target MVar	Associated contingencies/risks
Neepsend 275kV	North	1	274*	Non-contingent

Please note Table 1 is subject to change prior to the ITT stage, for example the target MVar could be amended, or the details of the reservation may have to be changed. ESO assume no liability for any future change to this table.

Voltage 2026 Connections Requirements – Option B

Option	Description
B	Demonstrate that an existing connection can fully accommodate the proposed solution as-is

- Bidders who participate through this requirement must evidence the countersigned connection agreement as part of their tender submission
- Bidders must also confirm that they have confirmed with ESO connections that a modification application is not required
- Under this option, the existing connection agreement must enable the tendered solution to be delivered in full

How will a bidder know if they require a modification application?

- If there is any change to the original connection application or DRC data submitted for the connection, e.g., to the MW capability, the Mvar capability, the fault level, or any change to the equipment, then it is likely that a modification application is required.
- Bidders should discuss their proposals with their ESO connections managers to confirm whether they require a modification application.
- This should be done prior to returning any tender submissions in response to the ITT to ensure bidders are able to meet the connection requirements.
- If you have any queries about this, please contact the ESO Voltage 2026 tender team

Voltage 2026 Connections Requirements – Option C Summary

Option	Description
C	Demonstrate that an existing connection with a full modification application offer can fully accommodate the proposed solution

- Bidders who participate through this requirement must evidence both the original connection agreement and the modification application offer to confirm the tendered solution is enabled in full
- This route to market suits bidders who are already connected (or have a countersigned agreement and will be connected) but they require an update to the connection agreement to enable the tendered solution
- The evidence modification application offer will need to be valid for acceptance
- By participating through this requirement bidders will be required to enter the connections process
- Bidders who participate through this requirement should be aware of the two-step offer process that is in place at the moment.

How will a bidder know if they require a modification application?

- If there is any change to the original connection application or DRC data submitted for the connection, e.g., to the MW capability, the Mvar capability, the fault level, or any change to the equipment, then it is likely that a modification application is required.
- Bidders should discuss their proposals with their ESO connections managers to confirm whether they require a modification application.
- This should be done prior to returning any tender submissions in response to the ITT to ensure bidders are able to meet the connection requirements.
- If you have any queries about this, please contact the ESO Voltage 2026 tender team

Voltage 2026 Connections Requirements – Option D

Option	Description
D	Demonstrate that the bidder has a full connection offer for a new connection that can accommodate the proposed solution and can be entered into if the party is successful in the tender

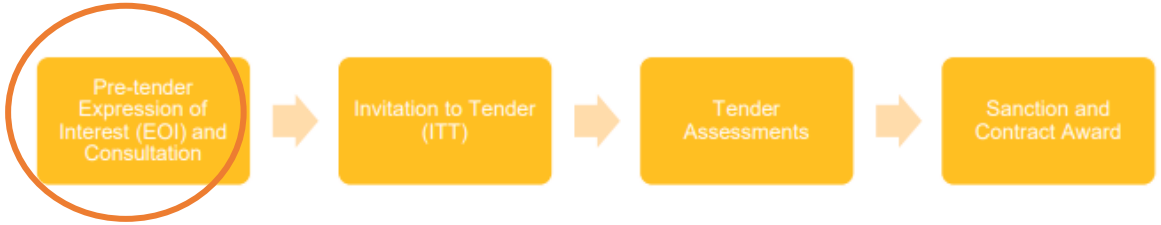
- Bidders who participate through this requirement will need to evidence the connection offer they have received and confirm that the new connection enables the solution in full
- The offer being relied upon needs to be valid for acceptance
- This option suits bidders who do not already have an existing connection who do not wish to use the reserved bay
- By participating through this requirement bidders will be required to enter the connections process
- Bidders who participate through this requirement should be aware of the two-step offer process that is in place at the moment.

Voltage 2026 timeline and next steps

Timeline

The Voltage 2026 tender will follow a one-stage process, consisting of a pre-tender Expression of Interest (EOI) stage followed by the Invitation to Tender (ITT).

We are currently in the 'Pre-tender Expression of Interest and Consultation' stage.



Voltage 2026 Indicative Timeline	
Task	**Date**
EOI Launch	6 October 2023
EOI Consultation Feedback Deadline	3 November 2023
EOI Registration Deadline	Early Bird: 24 November 2023 Backstop: 19 January 2024
ITT Launch	December 2023
ITT Window	December 2023 – May 2024
ITT Deadline	May 2024
ESO Internal Tender Assessments	May – July 2024
ESO Internal Sanction Process	August – September 2024
Contract Award	September – October 2024

Please note this timeline is subject to change/updates as the tender progresses

Immediate next steps

To participate in this Voltage 2026 tender and be invited to the ITT, participants must express an interest by sending an email to box.voltage2026@nationalgrideso.com

Expressions of interested must be received by the **EOI deadline.**

EOI Deadline

The '**Early Bird**' deadline is **5pm 24th November 2023**. Bidders who express their interest by this deadline will ensure they are invited to the ITT on Launch Day, with the ability to access all tender documents for the full tender window.

Bidders who miss the 'Early Bird' deadline will have until **5pm 19 January 2024** as the EOI **Backstop Deadline** to express an interest. Those who miss the Early Bird deadline can still register up until the EOI Backstop and be invited to the ITT. IBy registering after the Early Bird deadline, bidders accept the risk that they may not receive access to the ITT until after the ITT Launch Day. All bidders will have the same ITT deadline, regardless of when they received access to the ITT. All bidders are required to formally express their interest if they wish to participate.

Consultation Deadline

The market is invited to provide consultation feedback on the draft tender documents that have been shared.

The deadline to return any consultation feedback to ESO is **5pm 3rd November 2023.**

If a participant wishes to provide feedback it should be done using the **Consultation Feedback Form** and returned to box.voltage2026@nationalgrideso.com.

Providing feedback on the documents shared in this EOI is optional. Providing feedback does not result in an obligation to express an interest or propose a tender submission.

We will now open for Q&A

Please submit any queries via the Q&A functionality in teams

Any confidential queries should be sent directly to the team by email box.voltage2026@nationalgrideso.com

Any questions that we are unable to answer will be taken away and responded to offline

We will publish a Q&A document afterwards to capture the generic Q&A from this webinar