

NOA Voltage Pathfinder

Pennine and North England Tender

Technical Webinar

We will start at 13:05 to allow sufficient time for everyone to connect.

The audio for this webinar is via computer or telephone:

Call in (audio): +44 20 3443 6278 United Kingdom

Conference ID: 866 228 146#

Please ensure you are on mute during the presentation.

Please use Sli.do code **NOAP9** if you would like to submit a question.

Introduction

- Context
- What should I know?
- Technical Tender Phase –1
- The Requirements – North East & West Yorkshire
- Q&A session

Context

Why are we doing this?

- The System Operability Framework (SOF) has highlighted operability risks expected due to the decline in transmission connected synchronous generation over the next decade, and an increasing need to absorb reactive power.
- As part of our Network Development Roadmap, we want to explore the benefits and practicalities of applying a Network Options Assessment (NOA)-type approach to the operability aspects of system voltage.
- NOA Voltage Pathfinder for Pennine and Northern England is the next step in expanding the opportunity for varied technologies and providers to participate in the assessment of market-based solutions against Network Owner options. It will seek solutions which absorb reactive power to manage high volts downwards.
- The outcome of this NOA Voltage Pathfinder procurement process will be a recommendation of the most economic & efficient solution for securing voltage in the Pennine and Northern England region over the contracted period.

What approach are we using?

The pathfinders are using a 'learn by doing' approach. This means:

- We are developing the pathfinders within the existing industry framework. Where we see areas which could be improved in the framework these will be flagged. This approach enables us to continue moving forward but recommendations may not be implemented before the pathfinder is completed given the timescales to make changes to the framework.
- We will learn lessons from other pathfinders which will influence how the process develops.
- We are buying new services from new technologies and will learn new information about these during the process.
- Participants are invited to feedback on the contract terms, assessment methodologies or other elements of the tender pack or process using the feedback template provided.

What should I know?

Static reactive power procurement is considered for 2024-2034, requirement from 1 April 2024 23:00 – 1 April 2034 07:00

Reactive capability available 24/7 year round

Forecast utilisation – capped at 5,500 hours (11,000 Settlement Periods (SP)) per annum per provider

Reactive Lead (Absorption) requirement: -200MVA in North East area and -500MVA in West Yorkshire area

We invite embedded and transmission connected parties to participate

One contract type to cover all providers, availability payments only (£/SP)

We do not require tender parties to have a connection agreement or have submitted a connection application to participate in the tender. We encourage parties to wait until the results of the tender have been published in January 2022 before submitting any connection applications.

TO initial site feasibility report is available on request – We require each recipient to confirm that they shall not communicate, reproduce or disclose any part of the report, without the express written consent of National Grid Electricity Transmission plc. To receive a copy of the report please email us with the above confirmation at: box.pennine.tender@nationalgrideso.com. Overview scope of studies included in tender pack.

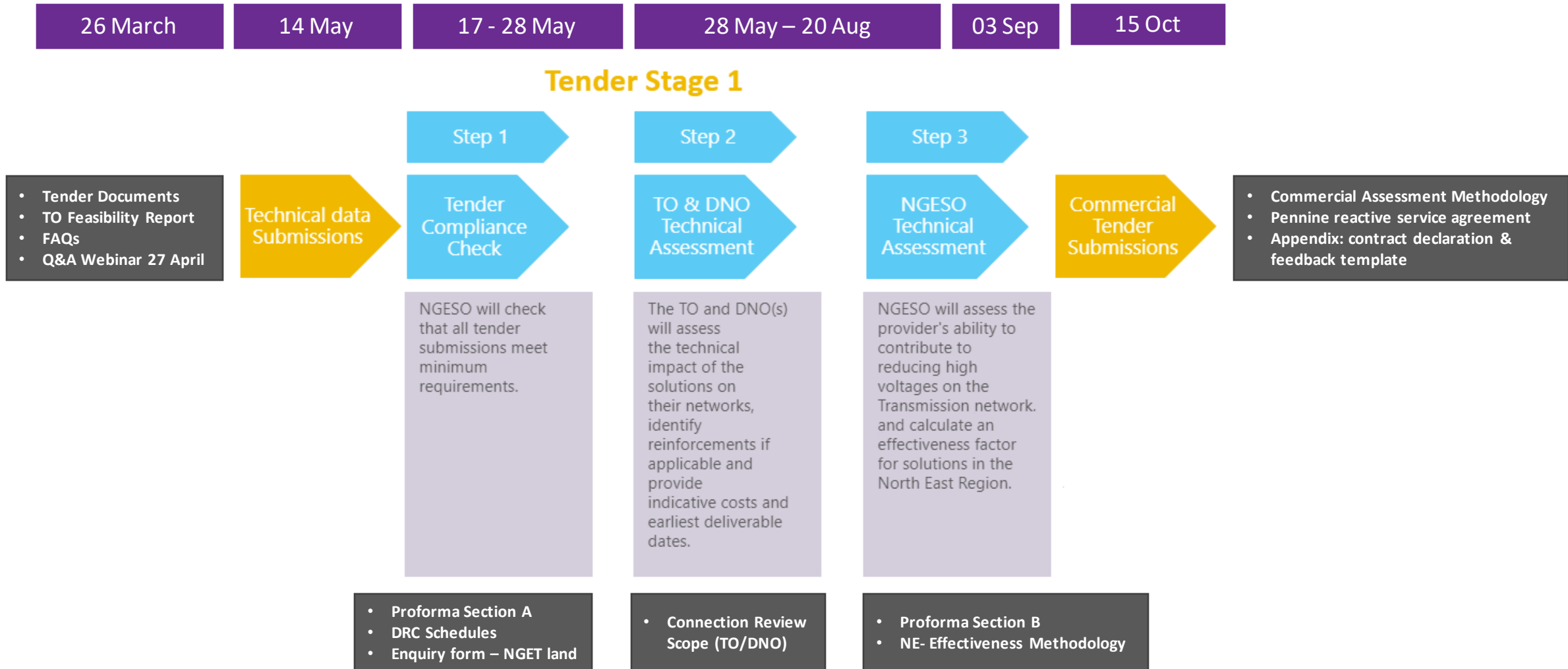
We are introducing a cap on the number of solutions submitted per parent company:

Any change in asset, MW value, MVA value, Voltage Level or Connection type counts as a different solution.

In West Yorkshire region, participants can provide a total of 9 solutions only, with a maximum of 3 solutions per site

In North East region, participants can provide a total of 5 solutions only, with a maximum of 3 solutions per site

Tender Stage 1: Technical

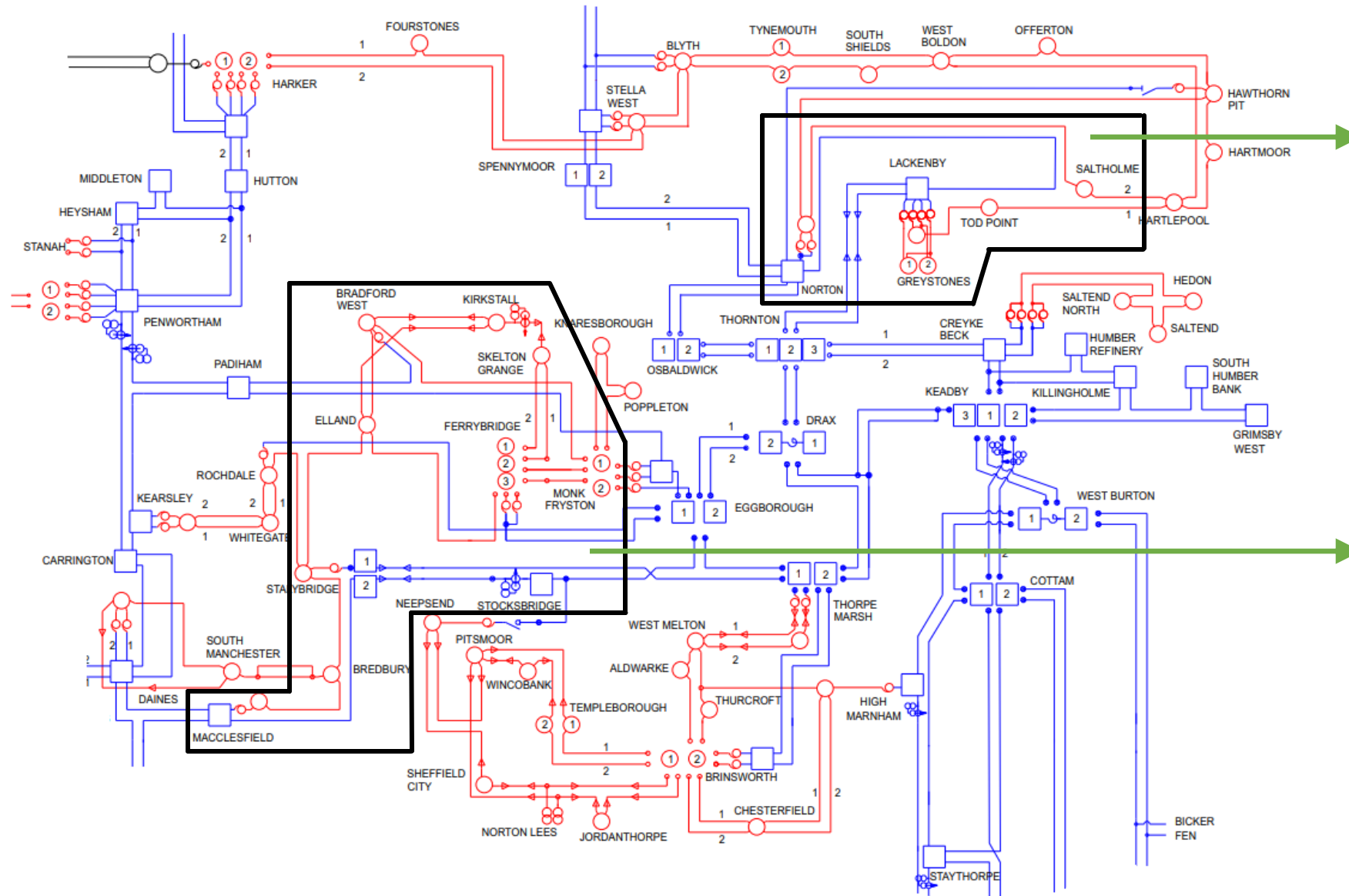


Regional Requirements

North East Region

West Yorkshire Region

Requirements Overview

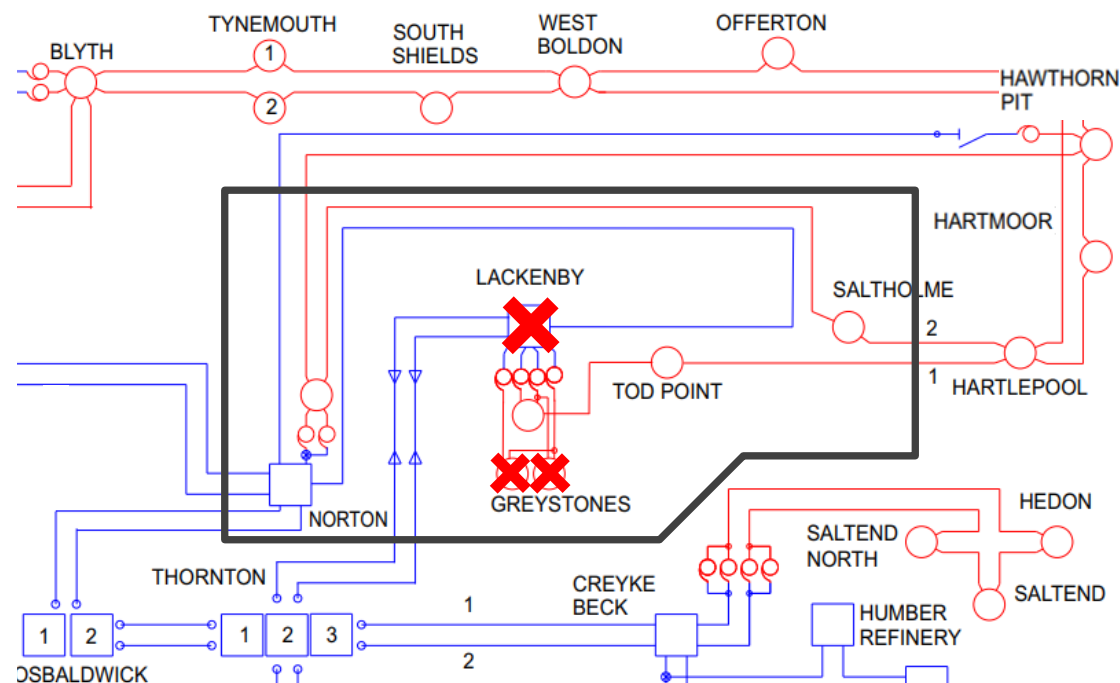
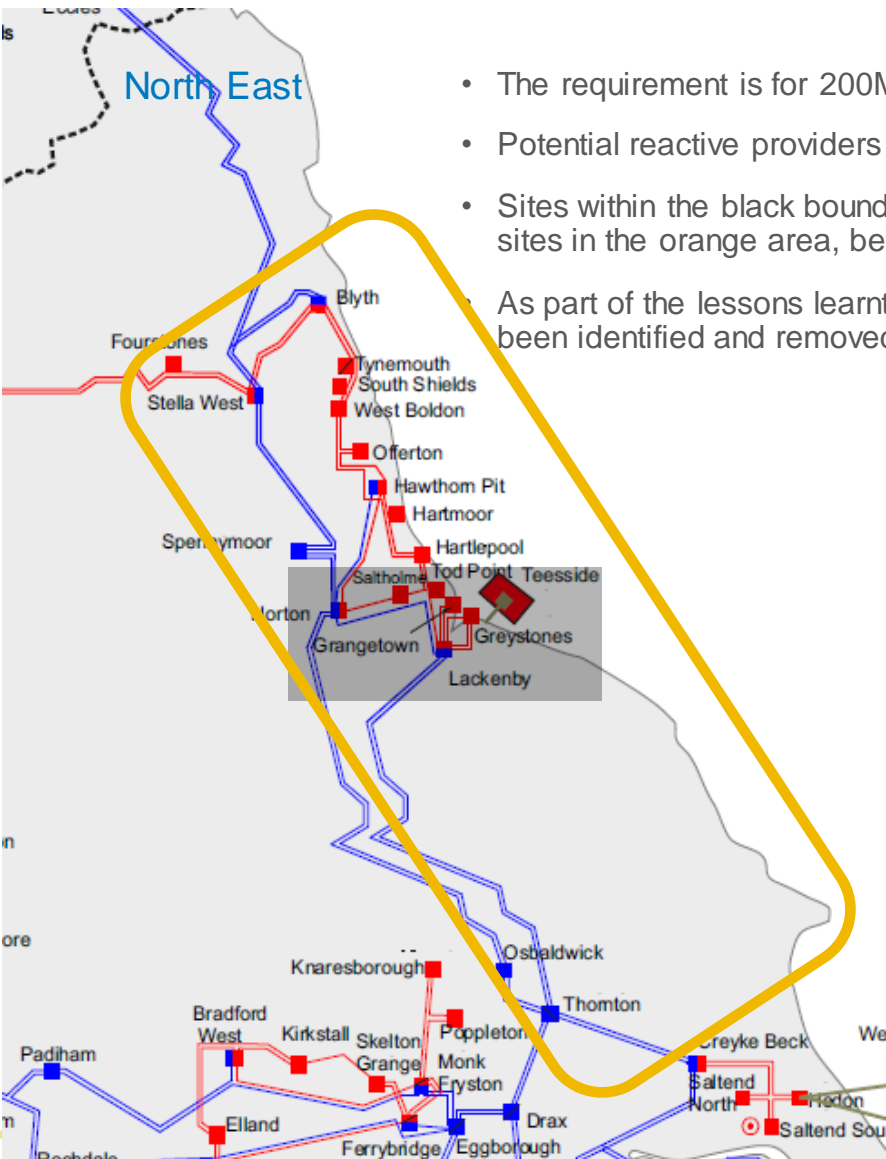


200 MVA_r

500 MVA_r

Requirement – North East

- The requirement is for 200MVar 'effective' absorption, with Norton 400kV as the reference point.
- Potential reactive providers must be within the black boundary.
- Sites within the black boundary contribute to alleviating high voltage in the entire area bordered orange in the left diagram. The remaining sites in the orange area, being skewed towards either the North or South, have limited effect on the opposite extremity.
- As part of the lessons learnt from Mersey, transmission sites that are unavailable for **new** connections within required timescales have been identified and removed. These are shown with red crosses. For avoidance of doubt, this does not affect connections at DNO level.



Requirement – North East

North East

- The 'counterfactual' option represents the default investment that would be adopted without the pathfinder approach. For high voltage this would be by the installation of reactors, and hence installation of a 200MVA reactor at Norton represents the North East counterfactual.
- A similar approach to Mersey is used for the effectiveness calculation. As electrical distance from Norton 400kV increases, effectiveness decreases and so greater volume of MVA needed for same result. The methodology is detailed in the Effectiveness methodology document.
- The table shows indicative effectiveness for various sites. The generally assumed maximum reactive power absorption for the relevant voltage level has been used, accounting for the large effectiveness drops between voltage levels.
- Distribution level effectiveness tends to be lower due to higher impedance (i.e. electrical distance) between absorption source and requirement location.
- Actual effectiveness of tendered options will be calculated during the technical assessment stage (tender stage 1).
- Site information for some of the available transmission sites is available on request from the ESO, as noted in the table opposite. Request a copy by emailing us at: box.pennine.tender@nationalgrideso.com

Indicative effectiveness (connecting to busbar)

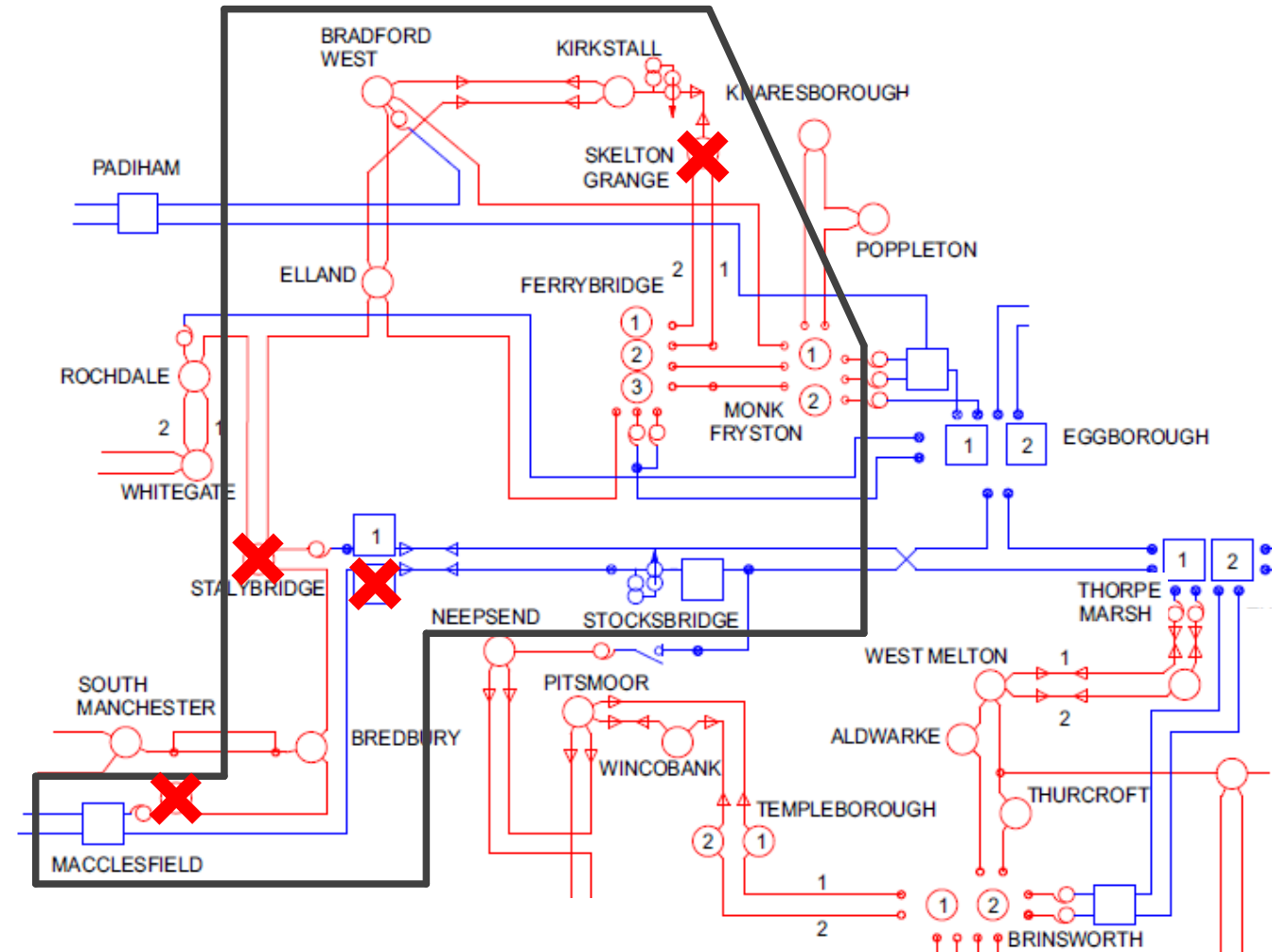
	Modelled Size (MVA)	Effective MVA	Effectiveness %	NGET Site Information Available?
Norton 400kV	200	200	100%	Yes
Lackenby 400kV*	200	190	95%	N/A*
Norton 275kV	100	90	45%	Yes
Saltholme 275kV	100	85	42.5%	No
Lackenby 275kV	100	80	40%	No
Tod Point 275kV	100	80	40%	No
Norton 132kV	60	56	28%	-
Saltholme 132kV	60	56	28%	-
Greystones 66kV	30	30	15%	-
Lackenby 66kV	30	26	13%	-
Tod Point 66kV	30	26	13%	-
Grangetown 66kV	30	26	13%	-

*Existing connection parties only – substation is full

Requirement – West Yorkshire

West Yorkshire

- This is a highly interconnected and electrically complex area of network containing long cable lengths, and thus is subject to high voltage rise.
- Requirement is 500MVA minimum, across at least three sites.
- Potential reactive providers must be within the black boundary.
- This boundary has been defined based on our technical studies, to focus on the most beneficial sites to ensure the entire region is compliant when considering contingencies across a wider network area.
- As part of the lessons learnt from Mersey, transmission sites that are unavailable for **new** connections within required timescales have been identified and removed. These are shown with red crosses. For avoidance of doubt, this does not affect DNO connections.
- Site information for all available transmission sites in this area is available on request from the ESO. Request a copy by emailing us at: box.pennine.tender@nationalgrideso.com



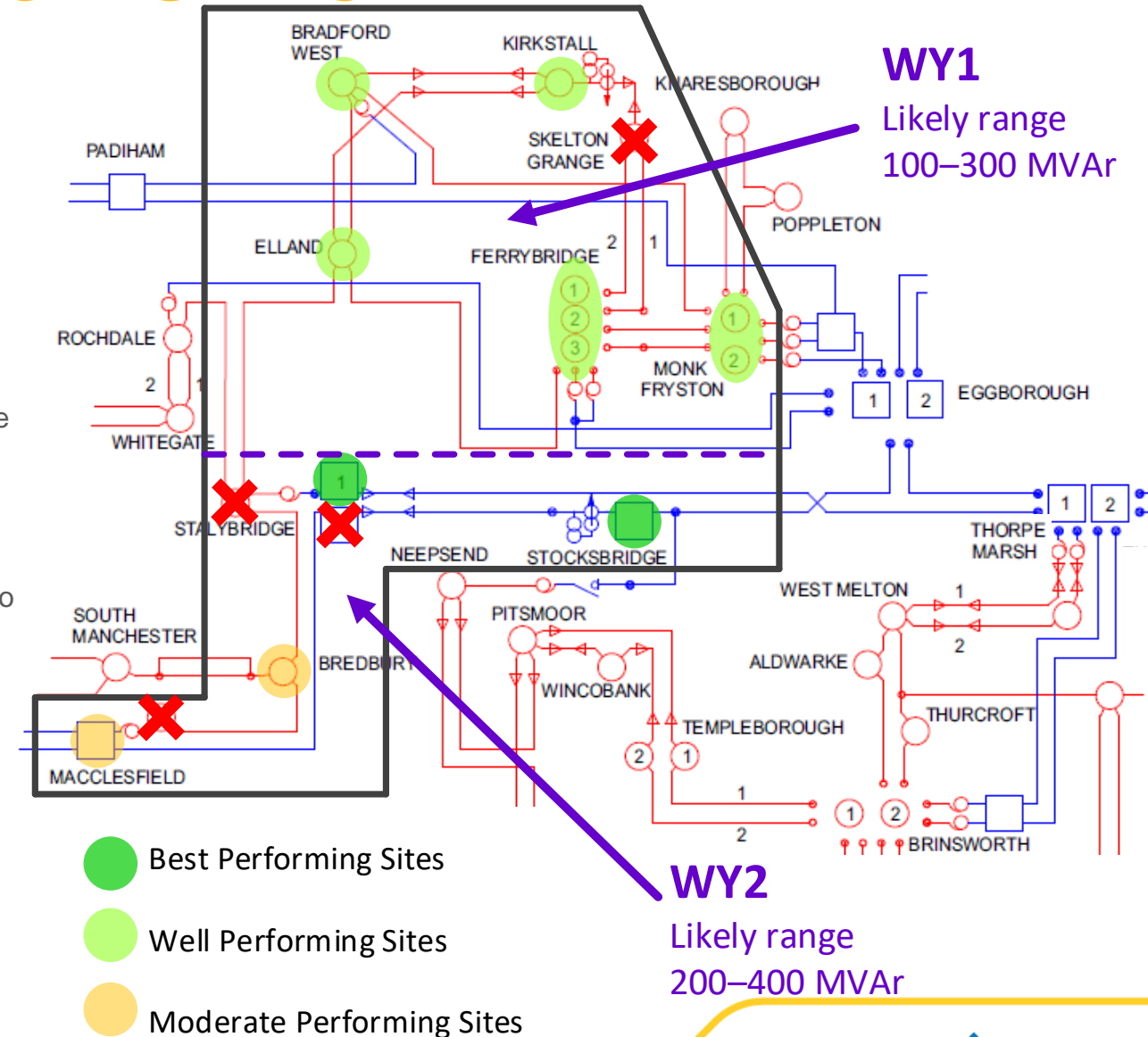
X Denotes sites within tender area but unavailable for new connections

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Requirement – West Yorkshire

West Yorkshire

- The region has been subdivided into two. Minimum requirements are:
 - 100MVA in WY1 region
 - 200MVA in WY2 region
 - Total combined minimum of 500MVA.
- The previously described 'Effectiveness' measure works well when there is a single worst case contingency, and a single electrically optimal site, as was true for Mersey and in the North East. Here, the several critical contingencies and higher total volume required, mean solutions are needed across multiple sites.
- Assuming standard sizes of 100MVA at 275kV sites and 200MVA at 400kV sites, we have analysed all combinations at transmission level giving 500MVA and 600MVA in total. Based on this analysis, we have colour coded the sites to indicate which performed best.

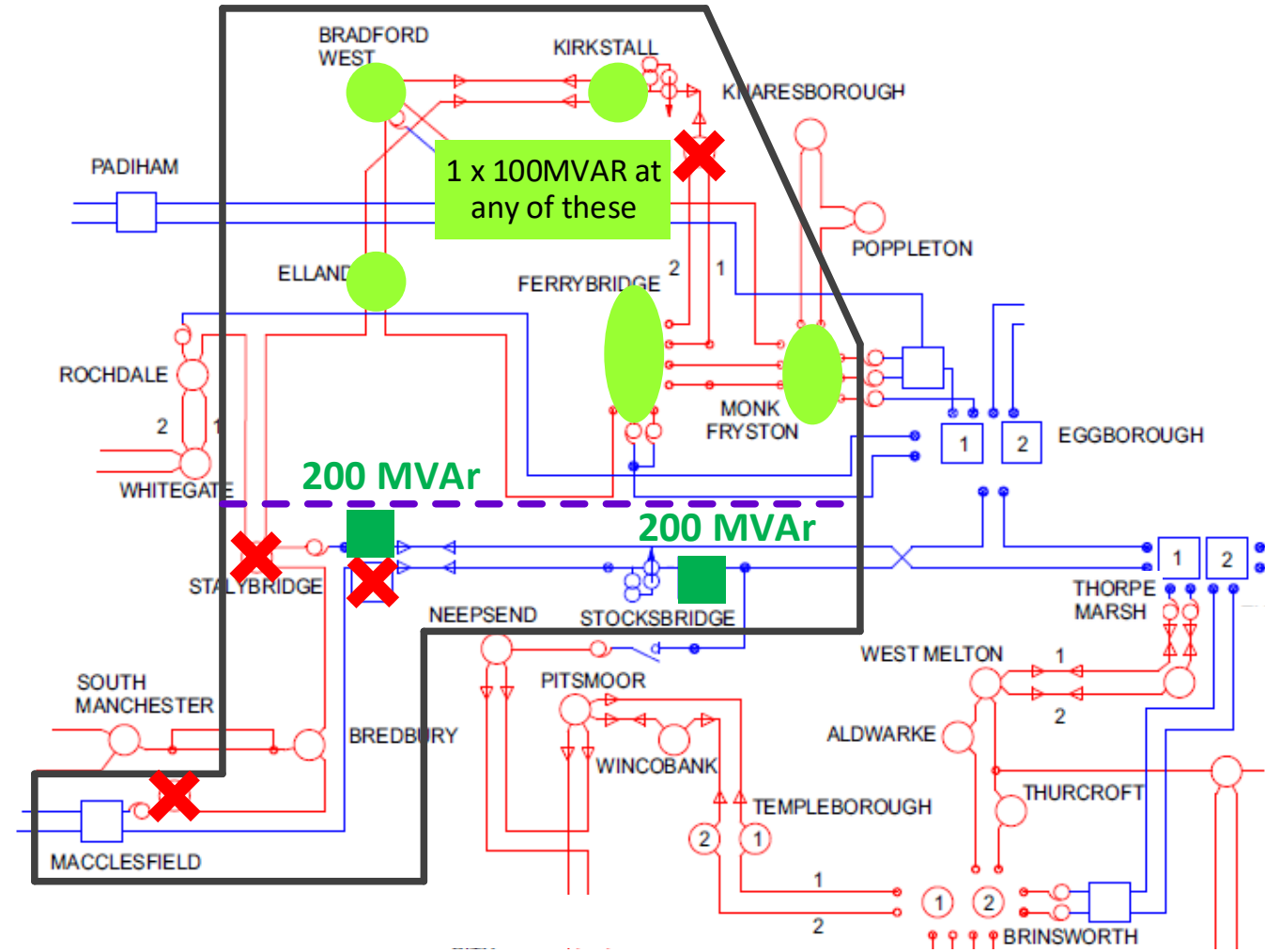


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Requirement – West Yorkshire

West Yorkshire

- The counterfactual for this region has been designed to minimise the total theoretical investment cost by:
 - Using standard sized reactors
 - Utilising the minimum number of reactors and sites.
- Aside from the basic tenets above, it is an ‘electrical-only’ analysis, so assumes equal costs and availability at all non-excluded sites
- The counterfactual case is:
 - 200MVA_r reactor at Stocksbridge 400kV
 - 200MVA_r reactor at Stalybridge 400kV
 - 100MVA_r reactor at any of the sites in WY1.



Power Quality and Solution Sizes

Power Quality

- Contrary to the usual connections process, we require “full and final” submissions ahead of a formal connection agreement
- Hence participants need to be aware of all technical requirements
- Pragmatically, this is mainly applicable to **larger/non-standard sized solutions** which will not have been ‘type-tested’.
- The aim in highlighting this is not to stifle such options, only to avoid problems further down the line!
- Please note **Stocksbridge 400kV** specific requirements!

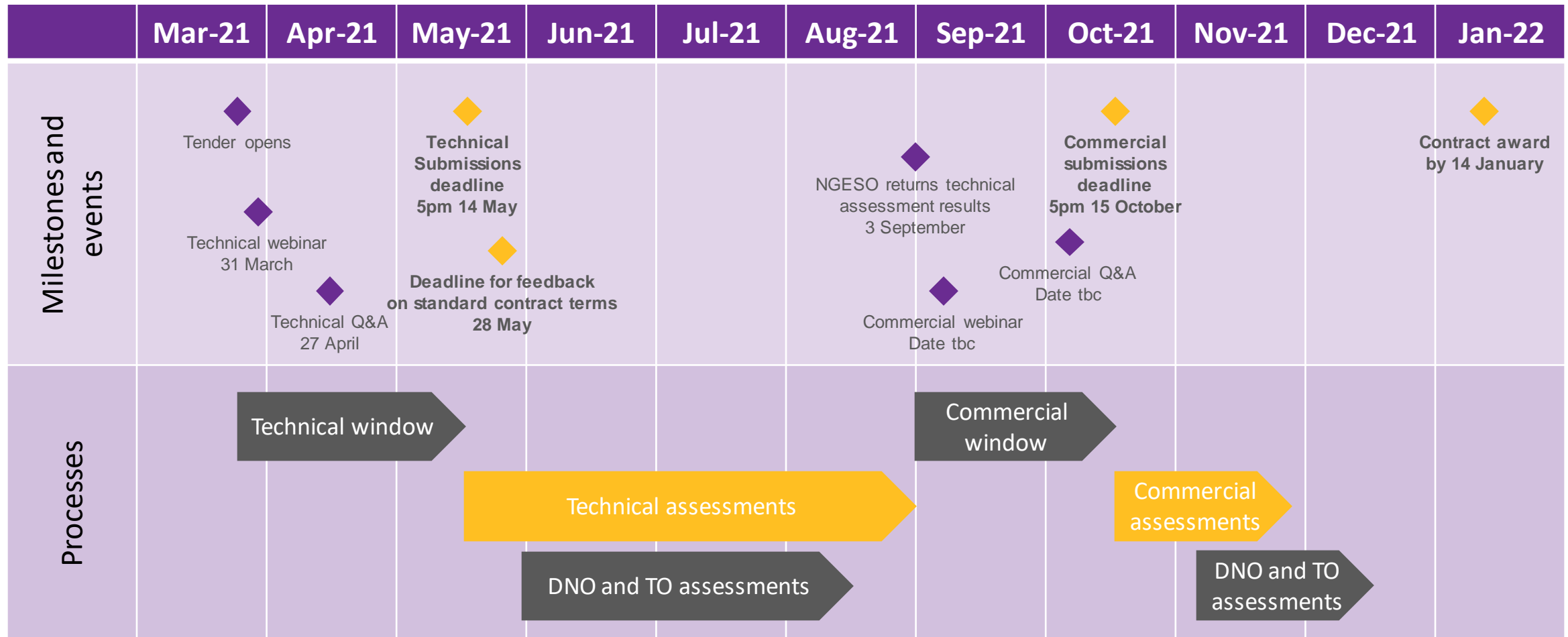
Voltage Level	Standard MVar Size	
400kV	200	} NGET Shunt Reactors
275kV	100	
132kV	60	
66kV	30	} DNO estimates
33kV	15	

From “*Pennine Pathfinder Connections Review Scope*”...

- Complex studies assessing the impact on system stability, power quality, sub-synchronous interaction, protection, etc. will not form part of the scope of the connections review process. With regards to connections at transmission level:
 - We would draw attention to the obligations to be placed on connectees through the Bilateral Connection Agreement (BCA) for meeting AC System Voltage Variations, covering TOV (Grid Code CC.6.1.4, and TGN(E) 288 requirements) and Electromagnetic Transients, Voltage Fluctuations and Transformer Energisation, covering inrush (Grid Code CC.6.1.7) requirements.
 - Standard BCA templates can be found on the NGESO website at: <https://www.nationalgrideso.com/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
 - Steady state analysis has determined that inductive shunt compensation (i.e. reactors) at Stocksbridge 400kV **must be at least 200MVar in size** (and not variable or tappable), since lower values of MVar absorption may give rise to onerous resonance conditions that could require mitigation measures in order to satisfy the above connection conditions.
 - Participants should make allowance for meeting these above requirements in their submissions. The following CIGRE Technical Brochures provide useful guidance: 556 – Power System Technical Performance Issues Related to the Application of Long HVAC Cables. 568 – Transformer Energisation in Power Systems: A Study Guide

Timeline

NGESO Pennine pathfinder team – box.pennine.tender@nationalgrideso.com



Q&A

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