Constraint Management Pathfinder

Request for Information

Interactive Guidance Document

nationalgridESO

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How to use this guide

- A menu button on each page allows access back to the main menu:


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A toolbar runs along the bottom of every page, allowing for quick navigation to section menus. Coloured icons allow navigation to relevant sections of the document**.**

1. Market Information	2. Pathfinder Overview	3. Requirements	4. Assessment Criteria	5. Contract Options	6. Next Steps

- Sections of the guidance are colour coded, for ease of use.

- Please contact box.networkdevelopment.roadmap@nationalgrideso.com if you have any questions or feedback.

Note: icons on this page are for illustration only - links do not work.

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1. Market Information

1.1. Context

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1.1. Context

Why are we doing this?

- Network flows continue to change due to variations in the GB generation mix, and these changes escalate with time. This has led to a change in the constraints (inability to transmit power to the location of demand) we see on the transmission network and in our requirements for managing them. Therefore, we require commercial solutions to increase network capacity to avoid increased level of constraints.
- As part of this pathfinder, we are aiming to explore the procurement of a range of commercial products to alleviate network constraints and unlock maximum GB consumer benefit.
- This Request for Information (RFI) is the next step in establishing the process for constraint management solutions procurement to be included in the assessment of market-based solutions.
- The outcome of the constraint management pathfinder will be a recommendation of the most economic and efficient solution(s), which should be taken forward.
- The recommended solution(s) should consist of market-based options.
- For the avoidance of doubt, an outcome could be that we accept no market tender if none of the options considered in the process provide benefits against forecast Balancing Mechanism (BM) costs to otherwise mitigate NOA *residual** constraints.

*Residual constraints are constraints that are not alleviated by the NOA optimal path – the optimal path involves reinforcements selected within the NOA 2018-19 document based on feasibility studies..

1.1. Context

Aims	We would like to understand through this RFI: ■ The level of interest to provide a service to meet the identified needs and requirements ■ The ability of all interested parties to provide solutions to meet the identified constraint management needs ■ The delivery timescale of options ■ Potential framework restrictions and barriers to your proposed solutions(s) We would also like to seek feedback on: ■ Assessment criteria and principles ■ Preferred contract structure, payment methods and operational strategies Who we would like feedback from: ■ All technology types are encouraged to feedback into this RFI. We hope to hear from peer-to-peer energy traders, heat sinks, hydrogen storage, wind generators and many more potential providers.

1.1. Context

Further guidance	
	■ Due to the novelty and complexity of this pathfinder, we carried out a pre-market engagement webinar for all our stakeholders on 13th May 2019. Please refer to the webinar slides in conjunction with this RFI pack. The webinar slides can be found on the Network Development Roadmap website or accessed directly by following this link.
	■ Based on the webinar feedback, we have also compiled an FAQ pack that addressed the questions and suggestions received. You can access the FAQ pack by following this link.

1.2. Different Pathfinders

As part of our network development roadmap, we are undertaking various pathfinder projects. These pathfinder projects are a way for us to 'trial and test' a new process. For more information on pathfinders, please see our Network Development Roadmap webpage.

For the Constraint Management pathfinder, we are looking at selected ETYS* boundaries in detail as explained in our Locational Criteria.

High Voltage Pathfinders	Stability Pathfinder	Constraint Management Pathfinder
Mersey	Scotland detailed analysis	Above **B6 boundary** (Scotland) and between **B8 and B9 boundary** (North to Midlands)*
Pennine	England & Wales high-level analysis	

*ETYS- Electricity Ten Year Statement. Please see the ETYS for more information on defined boundaries.

1.3. How information will be used

We will use the information received to inform our decision on next steps and shape:

- Any new service that might be created
- Contract structures and payment methods
- Operational strategies
- Assessment criteria and principles
- Alternative solutions to pursue

We will publish an anonymised summary of the findings of the RFI. At this stage, no commercial sensitive information will be published.

1.4. Current Service Vision

We do not guarantee we will tender for a service after the conclusion of this RFI. However, at the moment we foresee benefit for a service that could resemble the following:

- The requirement for this service is considered to be a minimum of 10 years starting earliest 2021/22. We are open to a variety of contract lengths.
- We would require a high level of availability year-round within the contractual period – actual utilisation will vary across the times of day and year depending on system conditions and level of constraints.
- It is likely that any potential service will be limited to those that are not connected behind any load management system; and to simplify implementation, connection to existing National Grid ESO Control Room communication infrastructure will be required to provide full visibility of the service's behaviour.
- Based on our technical and economic studies, we have identified at least 200 MW for a 2 hour service duration period to be beneficial.
- The above information does not necessarily represent the full constraint management requirement of the system

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2. Constraint Management Pathfinder Overview

- 2.1. Constraint Management Overview
- 2.2. Network Constraint Characteristics
- 2.3. Proposed Operational Strategies
- 2.4. Solution Effectiveness
- 2.5. Aggregation and Stacking of Services

2.1. Constraint Management Overview

Constraints Overview	■ A constraint is defined as an inability to transmit power to the location of demand, due to congestion at one or more parts of the transmission network. This inability stems from physical limitations of the assets. ■ Constraints cause bottlenecks on the system, limiting the energy transmission across different locations. ■ Import constraints occur when net demand exceeds capacity of network in an area, whereas export constraints occur when net generation exceeds capacity of network in an area. ■ We currently manage thermal transmission constraints through the Balancing Mechanism (BM), trading and contracts, amounting to monthly costs from £10m to £80m*, which is why we are aiming to make this process more economic and efficient.
Cause of Constraints	■ The GB energy landscape is expected to keep changing in order to meet the 2025 target for GB zero carbon operation capability and the 2050 Net Zero carbon emissions target. ■ This has caused a change in the thermal constraints, as we need to transport low carbon energy to the demand centres. This will cause very high north-south flows, particularly in Scotland and north of England networks.

*Source: Monthly Balancing Services Summary 2018/19

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2.1. Constraint Management Overview

Managing Constraints	■ The amount of synchronous generation is decreasing while renewable generation is increasing. ■ The "bid-off" prices for renewable energy sources are much higher than the traditional forms of generation (such as CCGTs and coal power plants). This has led to higher constraint costs.
Electricity System Operator Obligations	■ As the ESO, our vision is to make the most effective and economic use of our network resources by adapting the electricity system to be more flexible overall. ■ Our aim is to involve more service providers to actively participate in the improvement of the future thermal constraint management of the network. ■ By considering contractual, longer term commercial options, we are hoping to procure the most economic and technically efficient solutions to manage constraints.

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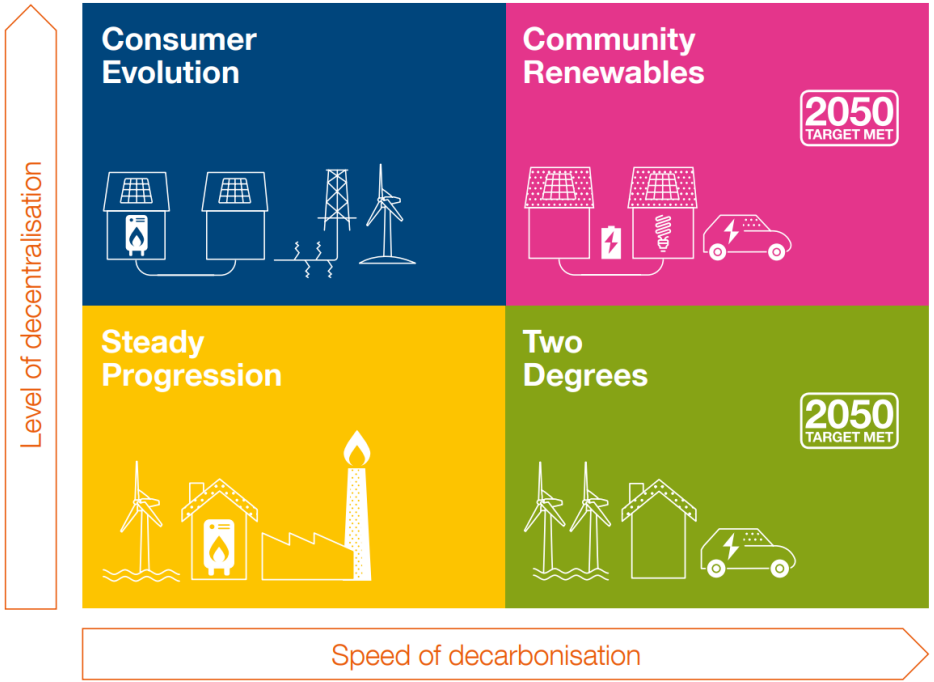
2.2. Network Constraint Characteristics

- Network constraints on the northern boundaries are projected to worsen over the future years.
- The characteristics of constraints across the network are likely to change at different time horizons. These characteristics include size, volume, duration and occurrence.
- Since a substantial level of correlation between different boundaries is present in the network, we must consider a *wider system* approach by grouping boundaries in each region.
- Although a time-limited constraint management product can reduce a certain volume of constraints across the network, such a service is unlikely to be economically feasible for removing all constraints on the network.

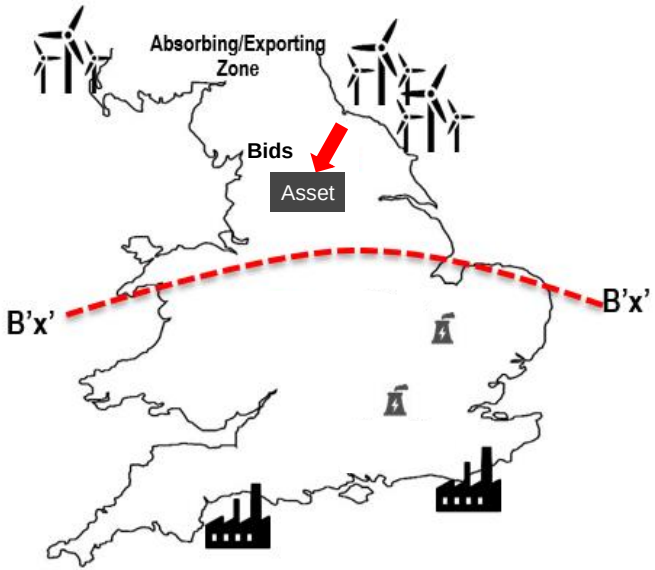
Time Horizons	Average Size of Constraint (MW)	Average Constraint Volume (MWh)	Average Constraint Duration (hour)	Average Number of Constraint Periods
Early 2020s	High	High	High	High
Mid 2020s Onwards	Higher ↑	Higher ↑	Lower ↓	Higher ↑

2.2. Network Constraint Characteristics



- The graph to the left represents the future energy scenarios identified in the FES18 document.
- For all analysis, the NOA 2018/19 optimal path reinforcement is assumed in the background.

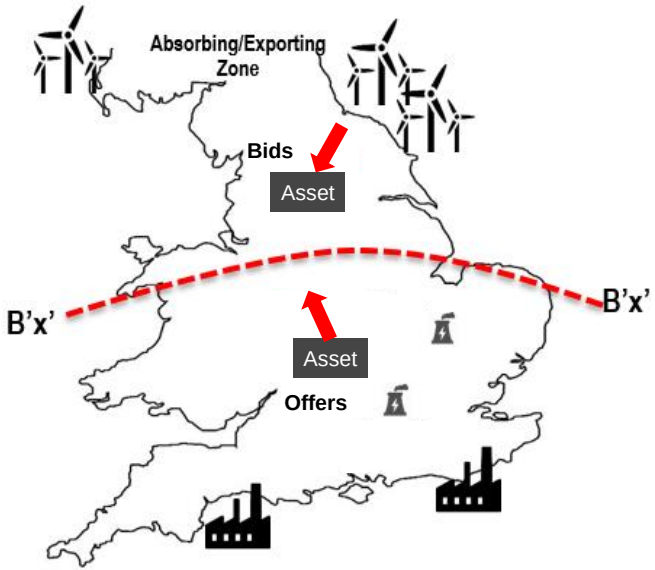
2.3. Proposed Operational Strategies



Single Location Concept

- Post-fault constrained energy is taken off the grid on the exporting side of the boundary.
- Action *may* be required on the importing side to increase generation or decrease demand to retain system balance, which has a potential cost associated to it.
- The asset(s) needs to be armed (in response to ENCC signalling and in compliance with the SQSS standards) to be ready for the next round of the constraint period.

2.3. Proposed Operational Strategies



Dual Location Concept

- Post-fault constrained energy is taken off the grid on the exporting side of the boundary.
- The same amount of energy is injected on the importing side of the boundary in a mirroring effect.
- Greater level of effectiveness compared to single location, due to knowing the location of the providers/assets
- *May* require implementation of a communication infrastructure between each asset, as well as between each asset and the ESO.

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2.4. Solution Effectiveness

- By strategically placing commercial option(s), the benefit can be seen across a number of boundaries. This is particularly seen in the northern boundaries due to the high correlation of network flows. This is often referred to as the *nesting effect.*
- Analysis for both operational strategies has been carried out for the targeted north region. This analysis included an asset to the north of B1 boundary for the single location approach, and an additional one to the south of the B8 boundary for the dual location approach. (See Slide 24 and Slide 25.)
- The results have shown an enabled additional power flow across the network pre-fault, when using a single location strategy.
- However, for additional benefits to be unlocked and the network constraints alleviation to be as effective as possible, the dual location strategy enables an even further power flow pre-fault, based on the power reduction and injection concepts.
- Additionally, the fact that power is injected closer to the demand centres south of the constrained boundaries makes the dual location operational strategy more effective.

Analysis Key Points

- Methodology was aligned with ETYS and NOA processes.
- NOA 2018/19 optimal path in the background.
- For each boundary, contingencies have been considered similarly to the ETYS process, in order to secure the network against trips including the limiting contingencies.
- A 200 MW, 2-hour service was considered for the initial analysis. Further analysis will need to be done following the response from the RFI which may consider larger volumes.

2.4. Solution Effectiveness

Boundaries	Single Location Effectiveness	Dual Location Effectiveness
B4	99%	104%
B6	80%	95%
B7a	82%	100%
B8	102%	129%

Study Summary

- Northern service located above B1 and for dual location, below B8. See Slide 24 and Slide 25 for boundary locations.
- Boundaries not studied are assumed to benefit but have not be included in service needs case.
- Effectiveness is measured in percentage of the 200MW that can flow pre-fault across a boundary.

Key Points on Effectiveness

- The further north the service operates the more constrained boundaries it alleviates and therefore the more beneficial the service is to the ESO.
- Only services located above a boundary can impact the boundaries constraints. Therefore any services located below B4 will not exhibit effectiveness as seen in the study results.
- Value is still seen in alleviating boundaries B6 to B8 for services located closer to the B6 boundary.

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2.5. Aggregation and Stacking of Services

Aggregation	■ At the moment, we are considering the aggregation of new and existing assets, as long as they are located within our specified regions of focus. ■ All of the formal requirements apply for each aggregated asset, with the minimum requirements being scaled down based on the number of aggregated assets in a particular region (for further clarification, see Page 30).
Stacking of Services	■ As part of this pathfinder, we are open to facilitating the stacking of services, but are also interested in understanding the impact on providers if this is not practically possible. ■ Stacking of services is permitted provided it does not impact the ability to provide this service in accordance with our technical and performance requirements (Page 28 and Page 29). ■ Since constraint management is related to the reliability of the network, appropriate penalties for non-delivery will be incorporated in contracts to ensure that the solutions are fit for commercial purpose of this pathfinder and can provide the required level of service.

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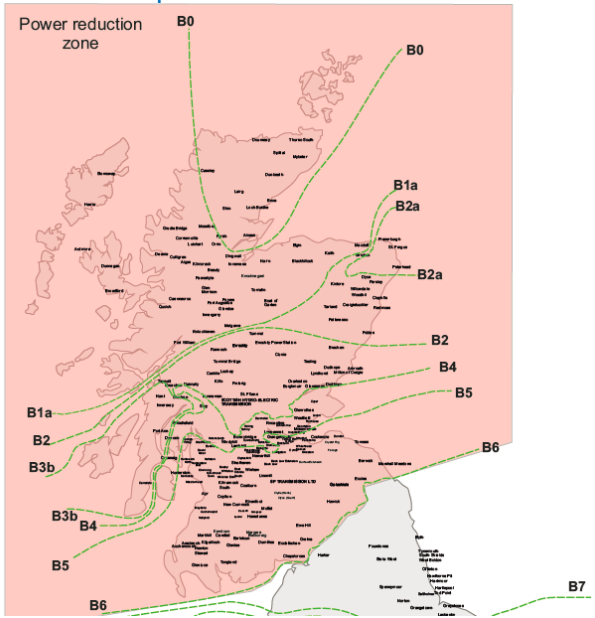
3. Requirements

3.1. Locational Requirements

3.2. Technical Requirements

3.1. Locational Requirements – Single Location Approach

Potential solutions need to be above the B6 boundary. The area has been expanded since the webinar held earlier in the year. This is to increase the options available to interested parties and to better meet our technical requirements.



For the full GB Transmission System Boundaries Areas of Focus map, please see Attachment 2 of the RFI pack.

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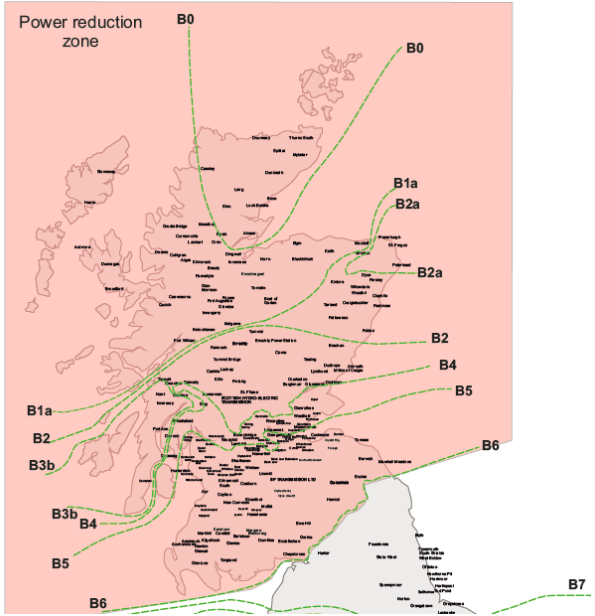
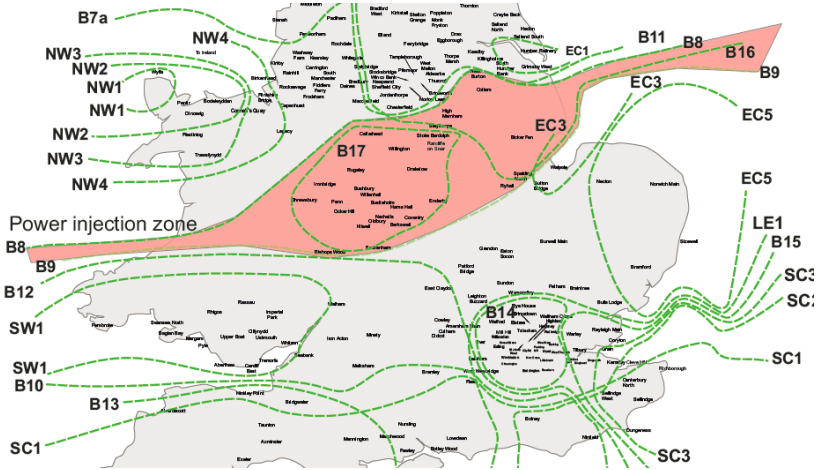
3.1. Locational Requirements – Dual Location Approach

Potential solutions need to be above B6 or between the B8 (North to Midlands) and B9 (Midlands to South) boundaries. See Attachment 2 of the RFI pack.





3.2. Technical Requirements

Required size	■ Based on the constraints characteristics analysis, we require at least 200 MW for 2 hours service duration.
Aggregated block sizes	■ To avoid overcomplicating the communications line between the assets, we expect to limit the number of aggregator assets per location. This is something we are willing to seek feedback on.
Location	■ All solutions must be within the locational requirements specified in Section 3.1. ■ The same locational requirements extend to all aggregators.

3.2. Technical Requirements

Response time	■ All solutions must be responsive to the signals provided by the ENCC. ■ Any potential service will be triggered automatically ■ We would like services to act within intertrip timescales of 150ms. We seek feedback on the response timescales of different technology types. ■ Arming time will be specified if a future service is created though we expect to be at least day ahead if not closer to real-time. Feedback is needed on the notice required by specific technology types.
Technology Readiness Level (TRL)	■ If a service is tendered for, the solutions are required to have a TRL score of 7-9. ■ For further clarification of TRL levels and their definitions, please see Attachment 1 – *"TRL Description"* of the RFI Pack.
Availability	■ At this stage, we are still investigating the market signals required for service stacking opportunities. We would like to work with the market participants to understand whether Operation Option 1 or 2 (Slide 30) is the most appropriate. ■ The specific availability requirements will be decided if a service is tendered for.

4. Assessment Criteria

The criteria that will be used for evaluation of all proposed solutions for this RFI include, but are not limited to:

- The proposed service meeting the minimum technical requirements
- Cost of service
- Estimated provider effectiveness based on operational strategy
- Proposed availability of the service
- Speed of response
- Location of service

Other areas that might be assessed if a service is tendered for:

- Earliest in Service Date (EISD)
- Previous projects which have delivered relevant or related services
- The vendor's connection agreement or evidence of connection application being made

Please note that at this stage we will not be specifying the exact assessment criteria weightings used for evaluation purposes. If positive feedback is received from this RFI, there could be scope for a new service; any new service will have comprehensive requirements and assessment criteria stipulated.

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5. Contract Options

5.1. Operation Options

5.2. Payment Options

5.1. Operation Options

Operation Option 1	■ The service provider fully operates the asset and is available for the service to be provided when the arming signal is received. ■ Stacking services is available if the service provider can demonstrate they will still be able to meet the technical and commercial requirements of the constraint management service. ■ The service provider is responsible for ensuring that the asset is responsive to appropriate signals. ■ Penalty clauses included for failure to provide correct operation. ■ Maintenance, system access and other relevant ongoing costs are borne by the service provider.
Operation Option 2	■ The service provider fully operates the asset and is available 24/7 continuously to provide this service. ■ Stacking of services is not allowed under this option. ■ The service provider is responsible for ensuring that the asset is responsive to appropriate signals. ■ Penalty clauses included for failure to provide correct operation. ■ Maintenance, system access and other relevant ongoing costs are borne by the service provider.

5.2. Payment Options

Payment Option 1	■ Distinct availability and utilisation payments. ■ Availability payment is a £/MWs against an agreed fixed rate for periods of availability. ■ Tripping fee paid at an agreed rate, subject to relevant UK and EU laws.
Payment Option 2	■ Provider is paid a fixed amount for the service provision – a single payment including both the availability and utilisation of MWs for the whole contractual period. ■ Availability payment is a £/MW/h against an agreed fixed rate for periods of availability regardless of how often and how much power is provided (within contract limits). ■ There is no payment for utilisation.

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6. Next Steps

6.1. How to Participate

6.2. Proposed Timeline

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6.1. How to Participate

Please use the Feedback template in Attachment 3 of this RFI pack to respond.

The deadline for submission of information is **28th February**. Please send your responses via email to box.networkdevelopment.roadmap@nationalgrideso.com

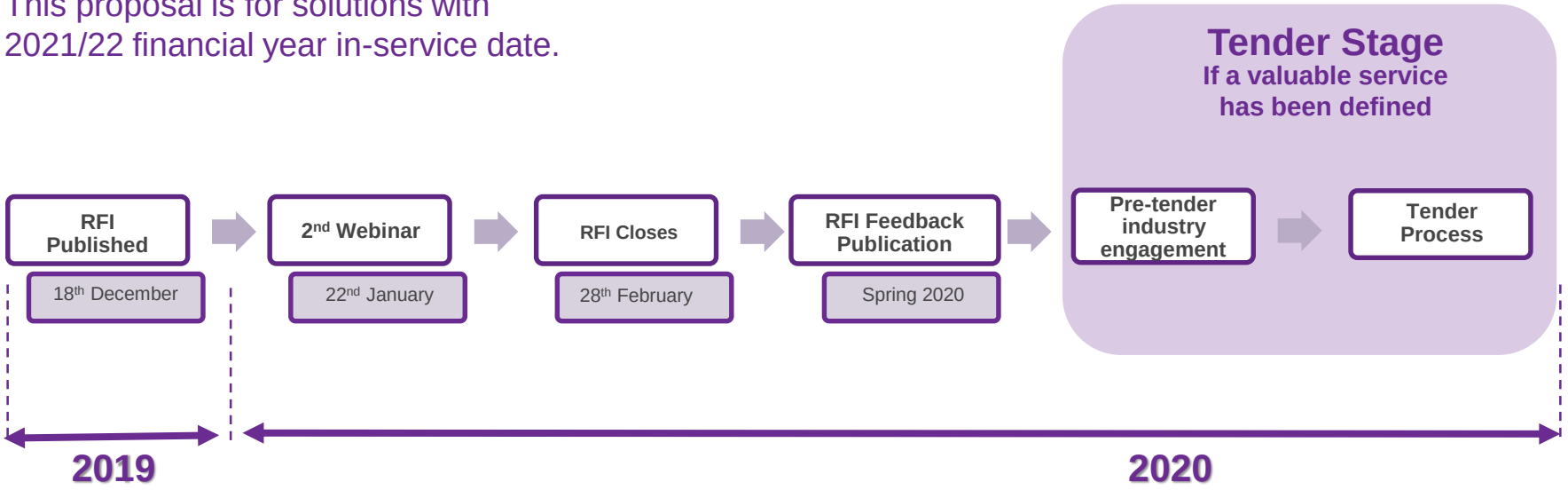
For any queries, please contact us via email: box.networkdevelopment.roadmap@nationalgrideso.com

Webinar will be held on **22nd January**

Webinar sign up

6.2. Proposed Timeline

This proposal is for solutions with 2021/22 financial year in-service date.



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Key documents

- Network Development Roadmap
- Pre-RFI Webinar Slides
- Pre-RFI FAQ Pack
- Network Options Assessment (NOA)
- Electricity System Balancing Reports
- Electricity Ten Year Statement (ETYS)

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