

Network Development Roadmap

Confirming the direction

12th July 2018

This *Network Development Roadmap* confirms the direction of travel for the Electricity System Operator's network planning activities over the next three years.

Our intention is that the changes set out in the roadmap will help drive additional consumer value, estimated to be in the hundreds of millions of pounds over the next ten years.

Introduction

Our *Network Development Roadmap consultation*¹ was published in early May. This proposed how the Electricity System Operator (ESO) could develop our network planning tools – primarily the *Electricity Ten Year Statement (ETYS)*² and *Network Options Assessment (NOA)*³ – to drive greater value for consumers. We received 13 responses to the consultation, across network companies, academics and potential participants in the new process. We also received input from a wider number of stakeholders through conversations at industry events.

Summary of feedback

We are grateful for all of the time and effort that has gone into providing feedback on the roadmap consultation, which has helped shape the direction of travel. It is great to see

potential participants getting involved and helping us understand how their solutions can contribute in future. A summary of responses is provided in the annex to this document and the non-confidential responses are available on the *NOA* website.

Responses were generally positive about the proposals, with a couple challenging the principle of expanding the *NOA*. Many sought clarification and also had helpful suggestions for improvements. Another theme was ensuring we work with and through the Electricity Network Association (ENA) Open Networks project, whilst balancing that with moving at pace. We have aimed to clarify the questions raised in this document or, where the answer is not yet known, intend to do so through our pathfinding projects, our “learning by doing” approach to developing our capability.

¹ <https://www.nationalgrid.com/uk/publications/network-options-assessment-noa>

² <https://www.nationalgrid.com/uk/publications/electricity-ten-year-statement-etys>

³ <https://www.nationalgrid.com/uk/publications/network-options-assessment-noa>



Key roadmap proposals

Following the consultation, we have considered the feedback carefully and will be taking forward the proposals to:

1. Expand the *NOA* to invite network and non-network solutions across the transmission and distribution networks to meet transmission network needs
2. Assess the year-round transmission network needs to a greater extent through taking a probabilistic approach
3. Apply a *NOA*-type approach to regional voltage challenges
4. Consider expanding a *NOA*-type approach to the operability aspects of system stability
5. Building our capability to make these changes through pathfinding projects, in conjunction with the ENA Open Networks Project and wider stakeholder groups
6. Phase more detailed, regional information and processes throughout the year alongside the existing annual, national assessment.

These proposals are set in more detail on the following pages.

It is worth highlighting that the proposals do not change the accountabilities of the current participants in these processes. Our aim is to try to use these tools to find economic solutions to transmission network needs that may take us above compliance.

Change 1

Expand the *NOA* to invite network and non-network solutions across the transmission and distribution networks to meet transmission network needs

We will take steps over the next three years to expand the *NOA* to allow the longer-term comparison of network and non-network solutions across transmission and distribution to meet transmission network needs at best value to consumers.

We will use our planned pathfinding projects, work with the ENA Open Networks project and engage more widely with non-network stakeholders to develop the capabilities we and other parties need to take forward the expanded approach. Our aim is to develop a transparent process, with clear accountabilities that recognises the interactions across the networks. Developing a cost benefit analysis that compares network and non-network solutions that have different lifetimes or contracting periods will be challenging and we will develop our approach through our pathfinding projects.

As we go forward with the developments there will be a number of questions to answer specifically on the inclusion of market participants and what the contracts could look like. The pathfinding projects will explore the value reflected by different length contracts, particularly when the provision of new, long term market solutions are being considered. We also need to consider the interaction between non-network solutions and potential providers' access rights and obligations. The approach taken in this area will be in line with the direction of travel set out in our System Needs and Product Strategy and Product Roadmaps⁴.

We see the *NOA* considering options in long-term, network planning timescales, and

⁴ <https://www.nationalgrid.com/uk/electricity/balancing-services/future-balancing-services>



ensuring efficient compliance with the Security and Quality of Supply Standard (SQSS). This differs from our suite of Balancing Services which are designed to ensure economic and efficient operation in real time, taking into account fluctuations in generation patterns, network outages and faults.

In terms of the interactions with network companies, we will continue to work with the ENA Open Networks project to consider and progress mechanisms to allow participants in the NOA process to be appropriately rewarded for their solutions.

Change 2

Assess the year-round transmission network needs to a greater extent through taking a probabilistic approach

The changing nature of the electricity system means that it is increasingly important that we study the needs across more of the year than our current primary focus of winter peak. We will progress with our proposal to explore the use of probabilistic analysis to achieve this and will publish the outcome of a case study to test the approach in Q1 2019.

We will be using a probabilistic approach in support of the existing deterministic approach to enhance our compliance with the SQSS. The SQSS requires the study of winter peak demand with an intact system and also credible conditions over the whole year. A probabilistic approach will help us enhance our analysis on the second aspect beyond our current, simpler approach to boundaries outside winter peak. It should help improve the value that the ETYS and NOA drive for consumers by providing more informative data and therefore helping ensure the right balance between operational and network investment solutions. This could mean an increase or decrease in the amount of network investment recommended, based on whichever is the better outcome for consumers.

As we touched on in the consultation document, we can also use probabilistic techniques to ensure that the right network boundaries are used to accurately represent current issues and amend the existing boundaries using a year-round representation of system conditions. These aspects will be considered for a specific region in the case study mentioned above. We will share the emerging findings with the ENA Open Networks project to explore interactions and consistency with approaches taken by other network operators.

In the future a probabilistic approach could also allow us to pinpoint specific issues down to circuit level so the most cost-effective whole system solution is identified, be that a network or non-network solution across transmission and distribution.

Change 3

Applying a NOA-type approach to regional voltage challenges on the transmission network

Reflecting the increasing challenge and cost of managing high voltage on the transmission system beyond the requirements for transfers across boundaries, we will look at priority areas within regions in more detail and apply an approach of comparing network and non-network solutions to regional voltage challenges. We consider this will drive additional value for consumers.

The pathfinding projects and our work through the ENA Open Networks project will help us understand the value of taking this approach and also facilitate conversations on when and who is best placed to undertake the analysis and the interactions with solution providers.



Change 4

Consider expanding a *NOA*-type approach to the operability aspects of system stability

We consider there is value in exploring the potential benefit and practicalities of applying a *NOA*-type approach to the operability aspects of system stability. We will publish the outcomes of our work in this area towards the end of this year.

There are a number of elements to system stability, some which the TOs design into their networks through connections and other processes. Others are the responsibility of the ESO to manage through our operational tools. When we are referring to the stability of the system in this context we are talking about the stability of frequency, voltage and the ability of a network user to remain connected to the system during normal operation, during a fault and after a fault. Synchronous generation provides many benefits to system stability that will need to be replaced when this type of generation runs less frequently.

We are currently trying to understand how to articulate and quantify the properties that synchronous generation gives us, including fault level, dynamic voltage control, static voltage control and inertia, such that they could be provided by as wide a range of technologies as possible. As we understand the impact on system stability of a decline in these properties, we aim to understand the value of including a range of system stability needs and options to address them in a *NOA*-type process. We will report on our findings in this area by the end of the year.

Change 5

Building our capability through pathfinding projects

The changes set out in the roadmap are challenging and require developments to

modelling, processes, data exchanges and financial arrangements. How we communicate our needs to a new audience is also a key area in which we need to improve our understanding and our approach.

We consider a “learning by doing approach” will help us develop the relevant capability and consistent, replicable processes across the involved organisations. We will take the developments forward through a number of pathfinding projects and through the ENA Open Networks project and involving wider stakeholders where relevant.

The first phase of the pathfinding projects will deliver over the course of 2018:

- We will take learnings from the **Regional Development Programmes** on the relevant whole system processes. We aim to publish a consolidated report on this in Q3.
- We are looking at **high voltage challenges** in a number of regions. Phase 1 is focused on working with DNOs, and is establishing the modelling, processes, interactions and data exchanges. We aim to publish a report on the first region before the end of this year in conjunction with the ENA Open Networks Project. This will cover voltage challenges in the Pennine region, on which we are working with Northern Power Grid and Electricity North West. We are also extending the approach to South Wales, working with Western Power Distribution, and discussing extending the approach to a third region. A second phase of the work will also be developed, in which we will extend the potential solutions to market providers in 2019.

Alongside these two pathfinding projects, in Q4 2018 we are for the first time requesting information on commercial options that could help increase boundary capability for the northern boundaries in the 2019 *NOA*. This aims to drive additional consumer value from the early 2020s. Although not a pathfinding



project, this will also help us develop the required modelling tools and processes to carry out these activities in the longer term.

Other projects will also provide insight into new types of solution through 2019 and 2020. For example, the Power Potential project will assess the use of distributed resources to address voltage challenges in the South East and the Phoenix project will assess the potential for hybrid synchronous compensation to provide voltage and system stability services.

Change 6
 Phasing regional information throughout the year

We see there is a continuing need for an annual communication of national needs and recommendation of options to meet them as is currently the case with the *ETYS* and *NOA*.

We also see value in focusing on the more regional transmission issues, such as voltage challenges. We will focus on specific areas each year; those which we assess as highest priority and spread them over the course of

the year. These regions would be carefully considered, feeding from the national *NOA*, and take account of practicalities such as DNO and TO boundaries.

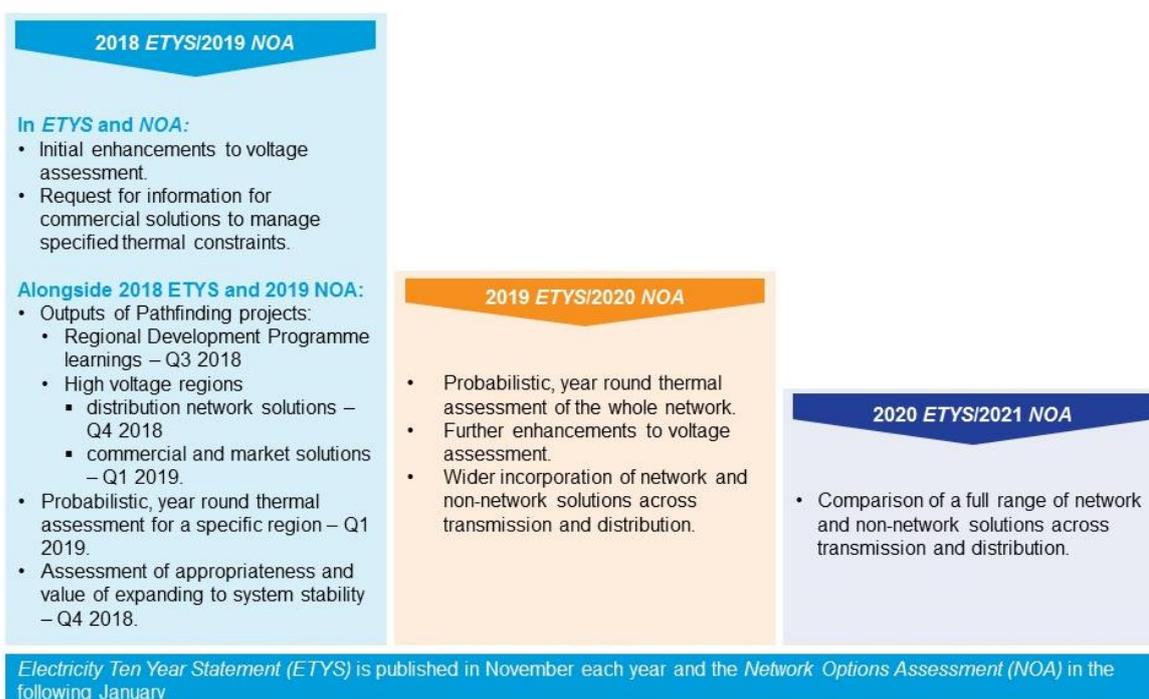
We will consider further how this could work as we develop our regional high voltage work.

Next Steps

We will continue to progress these developments, primarily through the pathfinding projects and working with and through the ENA Open Networks Programme and other non-network stakeholders. With the other members of the Open Networks Programme, we will look to ensure that work is moved forward quickly.

We will be publishing the outcomes of the developments at the relevant points through the year and rolling them out as business as usual in line with the following timeline. We will also highlight further opportunities to get involved with the pathfinding projects or other developments through existing channels.

If you would like to contact the team to find out more or get involved please get in touch via box.networkdevelopment.roadmap@nationalgrid.com



Annex – summary of consultation responses



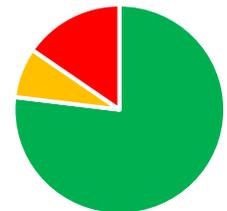
■ Positive ■ Neutral ■ Negative

13 responses to the consultation were received from network companies, potential market participants and academics. The majority were positive overall, with a couple challenging the changes as a whole. Those challenges were around whether the SO should be expanding the *NOA* beyond its current regulatory remit and whether the proposals change the role of the SO and TOs.

Many respondents sought clarification on elements of the proposals and had helpful suggestions for improvements, which we have aimed to pick up through this finalised roadmap or will do through the pathfinding projects. There was a general push to work through ENA Open Networks but others also challenged whether the group would move at sufficient pace. More than one response also highlighted the need to ensure the focus on system security remains.

Q1 – Value in expanding *NOA* to network and non-network solutions

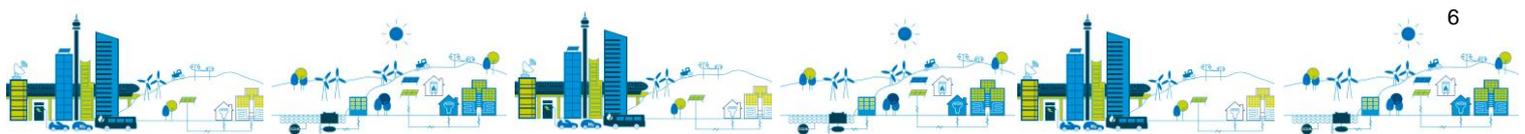
The majority of respondents saw value in extending the *NOA* to allow network and non-network solutions across transmission and distribution to compete to meet transmission network needs. There was recognition this approach enhances investment signals and provides reassurance of the most cost effective solution being taken forward.

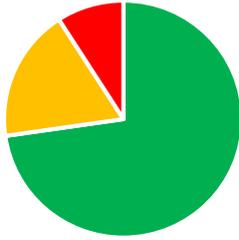


■ Positive ■ Neutral ■ Negative

There were questions around transparency, ensuring a level playing field, how different types of solution will be assessed against each other and what the SO's, TOs' and DNOs' roles should be. More than one respondent highlighted the need to consider the interactions and impact of distribution connected generators on distribution networks and how those relationships and potential conflicts are managed. The ENA Open Networks work to develop regional future energy scenarios and the need for that greater granularity when considering more local issues and the impact on DNO networks was also highlighted.

Contracting and funding arrangements featured in responses. Potential market participants highlighted the drivers for longer term contracts to bring forward new, innovative solutions. Some network operators highlighted the need to ensure appropriate funding routes were in place for their solutions not currently covered by the *NOA* or existing price controls.





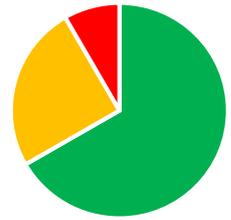
■ Positive ■ Neutral ■ Negative

Q2 - Opportunities and limitations of bringing a probabilistic approach into analysis

The majority of responses sought clarity, transparency and general understanding of how the probabilistic approach might be used whilst continuing to ensure a secure system and compliance with the SQSS. We have aimed to explain further its intended use in the body of the roadmap.

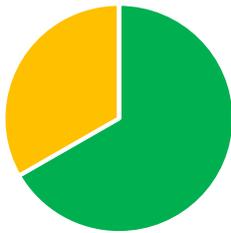
Q3 – Extension of needs covered by NOA to year-round and regional voltage challenges

A generally positive response was received to this question. There was seen to be significant value in providing greater visibility of more regional transmission network needs and across the year. Questions were raised around the role for the SO, TOs and DNOs in relation to regional voltage challenges.



■ Positive ■ Neutral ■ Negative

The challenges around developing appropriate technical and economic assessments were highlighted as well as the need to consult on them as is currently the case with the NOA. Others highlighted the need for sufficient information to be provided to enable potential solution providers to understand where there is the greatest need and what that need is. There were also reservations raised around the challenge of meeting the ambition of the roadmap.



■ Positive ■ Neutral ■ Negative

Q4 – Application of a NOA-type approach to system stability

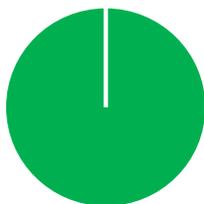
Responses were generally positive to this question although many queried exactly what was meant by stability, the respective responsibilities between the SO and TOs and what is already included in the ETYS and NOA. Again, the need for sufficient information was raised, with others also raising challenges around the confidentiality of information.

Q5 – Further system needs to apply a NOA-type approach to

There was a helpful range of responses to this question, suggesting further needs we could consider applying a NOA-type approach to. These included:

- Enhance SO capability in dynamic modelling
- Feed across new areas from the System Operability Framework analysis
- Any service the SO requires, eg response and reserve
- Solutions that meet both transmission and distribution needs
- Wider works in connection offers – not related to boundary capability





Q6 – Phasing information throughout the year

The proposal for phasing regional information throughout the year received a positive response. There was also a desire to retain an annual publication for national needs and options as is currently the case.

■ Positive ■ Neutral ■ Negative

Q7 – Information required for understanding of needs and to submit options

We received a number of helpful suggestions on the information that would be required to understand needs and to submit options. We will explore these further as we develop the approach through our pathfinding projects. The information highlighted included:

- A GB transmission network model and economic model
- Location, duration and time of day or season to which the need is applicable and how it builds over time
- A magnitude of the costs relating to each constraint
- A high-level specification in the *NOA* linked to a separate detailed requirement
- Performance specifications for each service

