nationalgrid

Network Development Roadmap Consultation

MAY 2018

How to use this interactive document

To help you find the information you need quickly and easily we have published the *Network Development Roadmap* as an interactive document.

Home
This will take you to the contents page. You can click on the titles to navigate to a section.

Arrows
Click on the arrows to move backwards or forwards a page.

Hyperlinks
Hyperlinks are highlighted in bold throughout the report. You can click on them to access further information.

This first version of our *Network Development Roadmap* is a consultation. Your feedback is important on all aspects of our approach to developing our network planning. We included some questions throughout to provide structure, although your comments are also welcomed more broadly.

Please email your feedback to:
transmission.etys@nationalgrid.com
by 15 June 2018.

You can also use this address to let us know if you would like to give your feedback in person, or if you have other comments.

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As the UK transitions to a low carbon economy, it brings fundamental changes and opportunities to the way we plan, develop and operate the electricity system.

This Network Development Roadmap consultation sets out our proposals on how we could develop our network planning tools over the remainder of RIIO-T1 to drive greater value for consumers. Your feedback is key in helping us set the direction.

As the Electricity System Operator, we have the potential to drive significant value for consumers, open up new opportunities for a range of industry participants, forge closer working across distribution and transmission networks, and facilitate new opportunities for competition through transforming our approach to network development.

We currently use our network development tools to facilitate a secure, coordinated and efficient electricity transmission system across Great Britain, in partnership with the Transmission Owners. Recently we have driven significant additional value through the introduction of the *Network Options Assessment*, which helps manage uncertainty around the potential future requirements of the network. The *NOA* process has saved consumers £44m over the three years it has been in place through deferring spend.

As the electricity system changes and brings new challenges there is the potential to drive even greater value from the *NOA* approach. We propose expanding the *NOA* to cover an increased number of network requirements, opening the process up to a wider number of participants, and taking a more holistic approach across the transmission and distribution systems. This transformation of our approach to network planning will allow network and non-network solutions across transmission and distribution to compete to meet transmission needs at least cost. We consider there is the potential to save consumers tens of millions of pounds per year as a result of the developments. As an example, the identification of reduced build options in the 2018 *NOA* – two commercial tripping schemes – should deliver savings of between £100m and £600m between 2022 and 2026.

The developments help us introduce competition in transmission while anticipated legislation to extend competition to onshore transmission network build is brought forward. The proposed changes should also make our processes more transparent and the information we provide clearer.

Progressing these changes in a coherent, coordinated way across the industry will be key to our success. Part of this is through working closely with transmission and distribution networks through the Electricity Networks Association Open Networks Project.

The changes proposed in this roadmap play an important part in the Electricity System Operator meeting the stretching commitments we have made in our Forward Plan[1] under principles 5 – Coordinate across system boundaries to deliver efficient network planning and development and 7 – Facilitate timely, efficient and competitive network investment.

Your feedback is really important in directing our future business planning. Please let us know what you think of our proposals at *transmission.etys@nationalgrid.com*

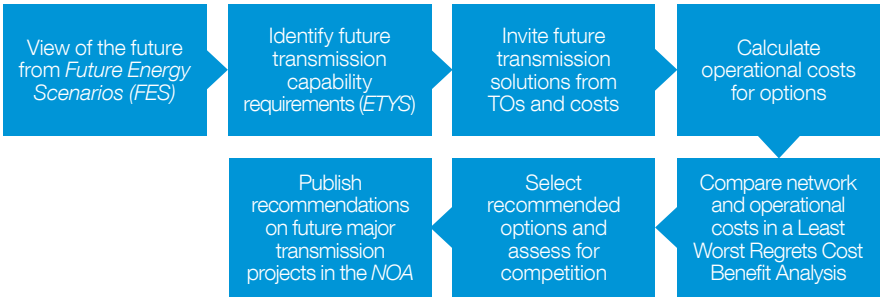
Julian Leslie
Head of Network Capability
Electricity

[1] https://www.nationalgrid.com/uk/about-grid/our-role-industry/future-electricity-system-operator

Developing our network planning

Our current approach to network planning

In our role as the GB System Operator (SO) we use a suite of network analysis and economic tools to assess and recommend the best value approach to developing the future transmission network when considering a range of potential scenarios.



The GB Transmission Owners (TOs) take our recommendations into account when they make their investment decisions and the *Network Options Assessment (NOA)*[2] helps ensure that the TOs' investments in their transmission networks are efficient, economical and coordinated. Where the recommendation is for a commercial or market approach, the arrangements are taken forward through ahead of time contracts, forward energy trades or through the Balancing Mechanism. Information on current and proposed approaches is set out in more detail in our Product Roadmaps[3].

The *Electricity Ten Year Statement (ETYS)*[4] and *Network Options Assessment (NOA)* documents are supplemented by the *System Operability Framework (SOF)*[5], which takes a holistic view of the changing energy landscape to assess the future operation of Britain's electricity networks. The *SOF* combines insight from the *Future Energy Scenarios (FES)*[6] with a programme of technical assessments to identify medium-term and long-term requirements for operability.

[2] https://www.nationalgrid.com/uk/publications/network-options-assessment-noa
[3] https://www.nationalgrid.com/uk/electricity/balancing-services/future-balancing-services
[4] https://www.nationalgrid.com/uk/publications/electricity-ten-year-statement-etys
[5] https://www.nationalgrid.com/uk/publications/system-operability-framework-sof
[6] https://www.nationalgrid.com/uk/publications/future-energy-scenarios-fes

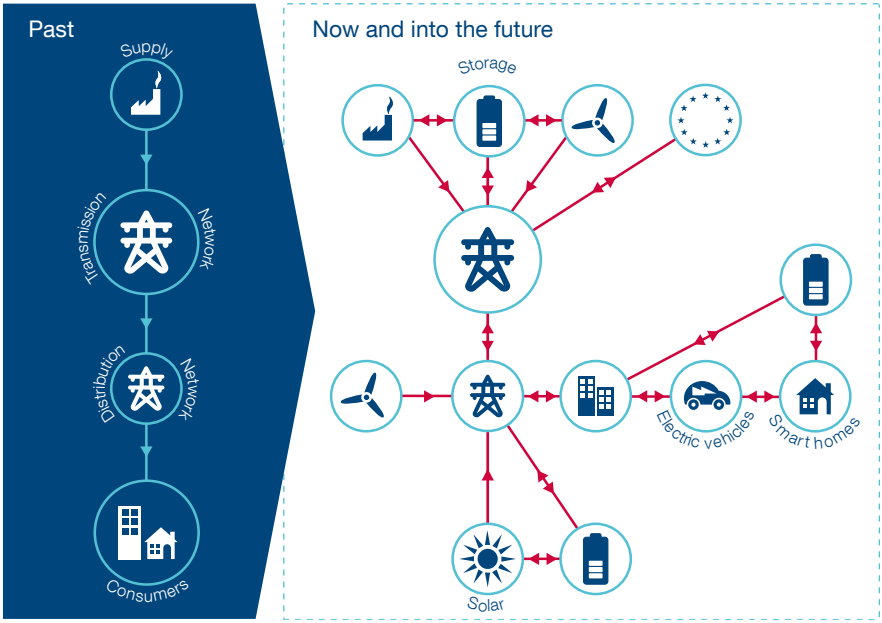
Maximising the value in a changing electricity system

Summary of proposals

The rapid decentralisation of generation and a more integrated approach across the transmission and distribution systems mean that the requirements of the system are changing but also opening up new ways to meet them. Our proposals aim to maximise those opportunities and develop the *Electricity Ten Year Statement* and *Network Options Assessment* to assess and recommend the most efficient ways of meeting transmission network needs. We suggest taking a number of steps to achieve this objective:

- expanding the *Network Options Assessment* to allow the longer-term comparison of network and non-network solutions across the transmission and distribution systems to meet transmission network needs at best value to consumers.
- taking a whole system approach, by carrying out more focused, regional *NOA*s which consider how regional voltage issues can more efficiently be managed
- investigating the value and feasibility of expanding the *NOA* approach to system stability in the longer term
- communicating our transmission network needs and the recommended options for meeting them, in a way a wider audience can understand.

The proposals are set out in more detail on the following pages. We welcome your views on them and whether you see value in the developments we set out.



Driving value through alternative solutions to transmission system needs

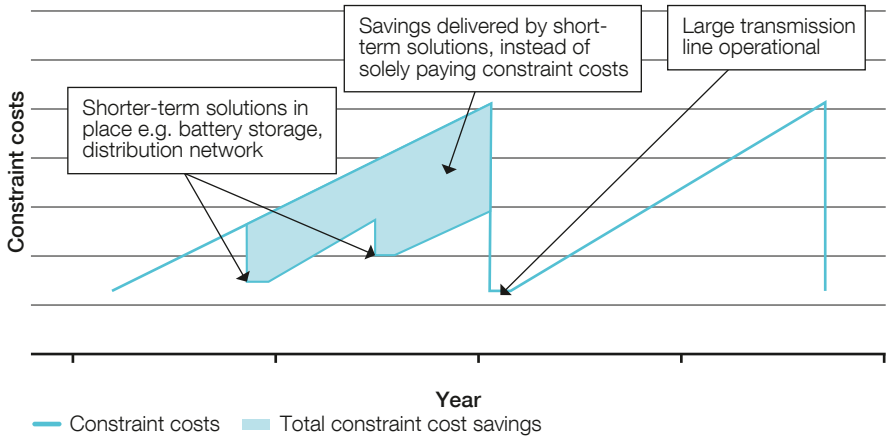
As the users and requirements of the electricity system change, we recognise that there is the potential for value from considering alternative options to meeting transmission network needs. We have already made steps in this area by considering to a greater extent the value commercial tripping schemes can provide in this year's *NOA.* Commercial tripping schemes are a way of maximising the use of the existing network by taking automatic action following a system incident. In the 2018 *NOA* we have identified two such schemes that we anticipate will save between £100m and £600m in the period 2022 to 2026.

Commercial tripping schemes
The automatic tripping of circuit breakers to remove generating units and/or demand.

In the 2019 *NOA* we will be looking at such commercial approaches in more detail and inviting potential providers to participate in a tender to help manage rising constraint costs from flows across specified boundaries ahead of large transmission reinforcements. We consider this is very much in line with the role set out in the ESO principle 7 – Facilitate timely, efficient and competitive network investment[7]. During 2018 and 2019 **we also propose developing the *NOA* process to allow DNOs and market participants to put forward options to be assessed alongside the current transmission options**, with the aim of incorporating this approach into the 2020 *NOA*. These may be solutions that are utilised in place of transmission assets in the long term.

They may also provide shorter-term solutions that help manage constraint costs while large transmission assets are built or shorter-term solutions to manage uncertainty while the value of larger network assets is uncertain. This use of shorter-term solutions to manage constraint costs is demonstrated by the illustrative diagram (Figure 1).

Figure 1
Illustrative example of how different solutions may be used to manage constraint costs



[7] https://www.ofgem.gov.uk/system/files/docs/2018/02/eso_roles_and_principles.pdf

Driving value through alternative solutions to transmission system needs

We propose moving to:
- clearly setting out the needs for the network, such as the requirement and the timescale
- inviting anyone who can meet that need to tell us how and the associated cost.

We then intend to:
- feed those options that meet the needs of the network into our cost-benefit analysis
- compare the different short- and long-term options
- and make a recommendation on the option(s) to take forward that represents the best value to consumers against the range of potential scenarios.

This robust, objective analysis should support the business case for recommended options for all participants.

The approach proposed in this *Network Development Roadmap Consultation* would allow us to compare transmission and distribution network asset solutions to transmission network needs against market solutions in longer-term, network planning timescales. Where the best value approach is assessed to be contracting for a market solution or through managing the costs in the Balancing Mechanism, the more detailed approach that will be taken is set out in our Product Roadmaps.

For the first time these developments will support a consistent, clear approach to assessing network asset solutions against market solutions for a range of transmission network needs. This will effectively facilitate competition between different solutions, with the potential to save consumers tens of millions of pounds once incorporated in the *NOA*. We will also assess the applicability of extending this approach to other transmission network developers when legislation to enable competitively appointed TOs is brought forward.

Q1: Do you consider there is value in expanding the *NOA* to allow network and non-network solutions across the transmission and distribution networks to compete to meet transmission network needs at least cost? What are the downsides or complexities we should consider? How could we go further in promoting competition?

Expanding the NOA approach to a wider range of network requirements

Enhanced year-round analysis

Comparing asset solutions against market and commercial solutions, across the transmission and distribution networks, has the potential to drive real value for consumers in meeting transmission network needs. **We propose expanding the *NOA* approach to cover the additional network requirements that are becoming increasingly challenging and costly to manage**. Currently the *ETYS* and *NOA* consider the requirements for the flow of electricity across defined transmission network boundaries, primarily to meet winter peak conditions, although with the other seasons and sensitivities also considered. The changes we are seeing on the electricity system mean that winter peak is no longer always the biggest driver of system requirements, with other times of the year, such as periods of low demand in summer and sunny and windy days bringing different requirements.

Over the coming year we intend to enhance our approach to analysing the transmission network needs required to manage flows throughout the year and ensure that we have a secure, operable and efficient network beyond the historic focus of winter peak. We will introduce the first steps of this enhanced approach alongside January 2019 *NOA* and have it fully in place for the January 2020 *NOA*.

This will take the form of a case study alongside the 2018 *ETYS* as a first step, and will include probabilistic information on network flows. This should help us understand how often there are issues with the boundaries over the course of the year and therefore provide more information on the priority of reinforcement. Once we have taken this initial step we will assess the benefit this provides.

It will also inform consideration of whether the boundaries that are used should be updated more systematically and regularly to better reflect the current drivers of reinforcement on the network. The *ETYS* and *NOA* as well as TO funding are currently linked to transmission boundaries. The electricity system and drivers of network requirements have changed since these boundaries were defined. Although there have been some amendments to the boundaries over the years, there could be benefit from more regularly and systematically updating the boundaries or by taking a more granular approach to defining constraints, such as through considering circuits rather than boundaries. We would like to understand the value to consumers of these changes and will investigate them further with our customers and stakeholders.

Probabilistic vs deterministic approach

With a probabilistic approach, there are acceptable levels of risk of specific events occurring. It is only above set levels of likelihood that planning for them takes place.

With a deterministic approach, the likelihood of events occurring are not considered; it is a black and white approach in that if there is any possibility of an event occurring, regardless of the likelihood, it has to be planned for.

Q2: What do you see as the opportunities and limitations of bringing a probabilistic approach into analysis?

Tackling local voltage challenges

We are also conscious that managing the voltage of specific regions of the country, where it is not related to transfers across boundaries, is increasingly challenging and costly. The costs of managing voltage are rising year on year and will continue to do so if we do not take a longer-term approach that considers the comparative benefits of a range of transmission and distribution network and market solutions. We therefore propose expanding the approach of identifying network needs and assessing a range of options to address voltage challenges in normal operating conditions in specific regions of the network.

Expanding the NOA approach to a wider range of network requirements

Q3: Do you consider there is value in expanding the network needs covered by the *ETYS* and *NOA* to a greater extent across the year and to more regional voltage challenges? What are the downsides or complexities we should consider?

Future developments

The *NOA* has the potential to drive even greater value by applying the approach of comparing network and non-network solutions to an even wider range of network requirements.

We have had some initial thoughts on which areas to consider beyond those outlined above. One possibility is to expand to consider system stability, an issue on which we are spending increasing amounts of money as the electricity system changes. We intend to carry out work over the course of the year to understand the potential value of applying the *NOA* approach to all, or elements, of system stability. This includes whether it is more effectively addressed with policy or regulatory requirements, and when there would be most value from its inclusion. We will provide an update by the end of the year, once this has been completed.

Q4: Do you consider there is value in expanding the *NOA* to cover system stability needs? What are the downsides or complexities we should consider?

We see the *NOA* approach as having the potential to drive value in further areas and would welcome your suggestions on where you see it driving the greatest value.

Q5: Which other network requirements do you consider the *NOA* approach could be expanded to cover in order to drive value to consumers? What are the key benefits and considerations?

What is system stability?

System stability is the ability of a generator to stay connected to the electricity system through both normal operation and when there are faults. This has historically been a by-product of an electricity system with a core of large, synchronous generators[8]. As we move to an electricity system made up of an increasing amount of renewable generation and interconnection we need to find alternative ways to provide the stability historically delivered as an automatic and intrinsic part of the way synchronous generation operates. The inclusion of system stability would take our identification of system needs a step further from looking at normal operation to looking at requirements for faults, such as dynamic voltage and fault levels.

[8] www.nationalgrid.com/uk/publications/system-operability-framework-sof Pages 62 to 63 of the *SOF* 2016

How we are developing our capability and ways of working

We propose taking a phased approach to developing our modelling capability and ways of working by breaking them into manageable chunks. This is through undertaking pathfinding projects between now and March 2019 in conjunction with the ENA Open Networks project. We will publish the outcomes from the projects as they become available. We will also learn from other recent or ongoing projects such as the Regional Development Programmes and our work with Scottish Power Transmission in Dumfries and Galloway.

1. **Western Power Distribution and UK Power Networks Regional Development Programme learnings** – We will take the learnings from the Regional Development Programmes on managing areas with high volts and other network issues and feed them into pathfinding projects on specific regions with high voltage challenges. This will help us understand the potential for distribution network solutions to transmission network needs.

2. **High voltage regions** – These will assess localised high voltage issues and compare transmission and distribution network solutions to develop a cost-benefit analysis. For example, assessing whether the greatest benefit to consumers is through building network equipment to manage high voltage on the distribution or transmission network.

3. **Commercial and market solutions to high voltage issues** – Development of the *NOA* to assess local commercial solutions to transmission issues, considering the process, information requirements and technical and economic assessment requirements. Where there is the potential for solutions from distributed energy resources to meet these requirements we will engage through the ENA Open Networks Project to deliver consistent results.

We will also learn from Power Potential[9] on the effectiveness and appropriate market structure for distributed energy resources in managing regional voltage issues, with the aim of incorporating any recommendations within the 2021 *NOA*, once the Power Potential project is completed.

Once we have developed the ways of working with individual types of participants, we will develop our ability to compare the different options against each other. This approach will largely be incorporated in the 2020 *NOA*, with full roll-out for the 2021 *NOA*.

[9] https://www.nationalgrid.com/uk/investment-and-innovation/innovation/system-operator-innovation/power-potential

How we are developing our capability and ways of working

How we are working with the ENA Open Networks Project

Taking a whole electricity system approach in the *NOA* to meet the needs of the future system will need collaboration across the industry. The Electricity Networks Association (ENA) Open Networks Project[10] is crucial to a successful outcome. It provides the platform for industry participants to share experience and coordinate the transformation of our networks and markets to operate efficiently in a more decentralised world. The group also brings in a wider range of stakeholders through its Stakeholder Advisory Group and consultations.

Workstream 1 of the ENA Open Networks Project is focused on making improvements for customers and consumers through the development and implementation of whole system approaches. One of its deliverables will play a key part in the extension of the *NOA*. It will develop whole system investment planning models, which include options to manage regional transmission system issues that could span the transmission and distribution boundaries. We are bringing our commercial expertise and experience with the *NOA* to help shape the approach to whole system planning. By working with the Open Networks Project we can ensure we are engaging fully and effectively with the DNOs and TOs to develop the approach.

A paper on shorter-term planning was published at the beginning of 2018[11]. A further report will be consulted on towards the end of 2018, which looks at the approach to longer-term investment planning across the transmission and distribution networks. This will include the broader use of commercial/market-based solutions. Both of these papers are very closely aligned to the developments of the *NOA* set out in this roadmap. While they are focused on how we can bring a whole system approach to meeting transmission network needs today, they provide the opportunity to consider distribution network needs to a greater extent into RIIO-2.

[10] http://www.energynetworks.org/electricity/futures/open-networks-project/open-networks-project-overview/

[11] http://www.energynetworks.org/assets/files/electricity/futures/Open_Networks/ON-WS1-P3%20Investment%20Planning%20Model%20(Short%20Term)-v2.1(published).pdf

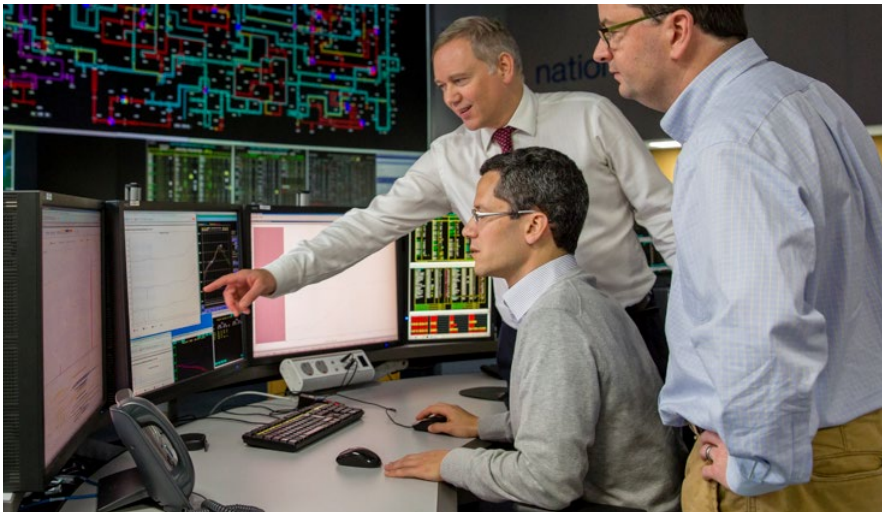
How we are developing our capability and ways of working

Regional Development Programmes

Related to the ENA Open Networks Project, and also driving towards more of a whole system approach, we are also currently collaborating with a number of DNOs through Regional Development Programmes (RDPs). These take a 'design by doing' approach, allowing us to tackle challenging areas on the network jointly with the DNOs. This process allows us to identify key areas of development to unlock additional network capacity, reduce constraints and open up new revenue streams for market participants. The RDPs will significantly enhance transmission and distribution systems' coordination and control, creating whole system efficiencies and providing new tools and resources to manage system constraints – ultimately reducing costs for customers.

This approach allows us to share our relative expertise and also support the development of Distribution System Operator capabilities. Strong working-level relationships and an effective governance structure form an agile, collaborative environment in which challenges can be carefully considered.

We will build on the two existing Regional Development Programmes by considering at least two new areas over the coming year. They will continue to help establish the ways of working for the regional elements of the expanded *NOA* and focus on the regions which will provide the most benefit to consumers.



Roadmap of actions

Summary of actions set out in this roadmap

2018 *ETYS*/2019 *NOA*

In *ETYS* and *NOA*:

- Initial enhancements to voltage assessment.
- Tender for commercial solutions to manage specified thermal constraints.

Alongside 2018 *ETYS* and 2019 *NOA*:

- Outputs of Pathfinding projects:
  - Regional Development Programme learnings – Q2 2018
  - High voltage regions
    - distribution network solutions – Q4 2018
    - commercial and market solutions – Q1 2019.
- Probabilistic, year-round assessment of network flows for part of the network – Q4 2018 and Q1 2019.
- Assessment of appropriateness and value of expanding to system stability – Q4 2018.

2019 *ETYS*/2020 *NOA*

- Probabilistic, year round thermal assessment for the whole network.
- Further enhancements to voltage assessment.
- Wider incorporation of distribution and transmission network and non-network options.

2020 *ETYS*/2021 *NOA*

- Comparison of full range of distribution and transmission network and non-network options.
- Full implementation of voltage enhancements.

Electricity Ten Year Statement (ETYS) is published in November each year and the *Network Options Assessment (NOA)* in the following January

Improving accessibility

How we'll set out information on the network needs and options assessments

Our network planning documents and information have historically been aimed at a fairly narrow audience that has a good understanding of the technical issues. As we expand the scope of the *NOA* and *ETYS* the complexity will also increase. Combined with a broader and new audience, we need to ensure we are communicating our needs, options assessment and processes in a way that is understandable to all.

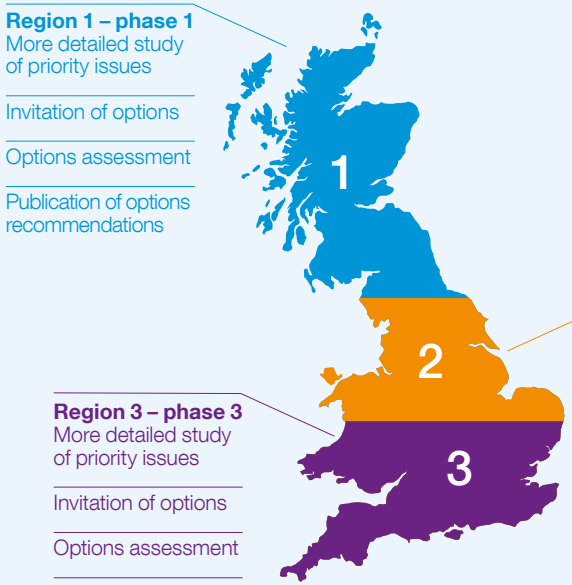
We currently publish the majority of our network needs and options assessment information annually in the *ETYS* and *NOA* publications. They are supplemented throughout the year by the information provided in the *SOF*. As we move to providing more information and seeking options to meet more needs, we consider there will be benefits to our customers and stakeholders as well as our internal teams to phasing elements of the information and processes throughout the year.

We propose that we will carry out a national needs assessment annually for flows across boundaries, similarly to the *ETYS* today. We will then invite and assess options for those needs, as the *NOA* does today. Subject to the successful conclusion of the pathfinding projects, we propose developing discrete regions of the network as part of the *ETYS* process. For each region in turn we will look in more detail at the priority operational issues and parts of the region, and then invite options from a range of providers to meet the region's identified needs. These will be the options assessment and recommendations against those will then be progressed for that specific region. These will be in different timescales to the current *ETYS* and *NOA* processes. An illustrative example of how this may work is outlined on the following page.

Improving accessibility

Annual assessment

- Identification of national transmission network needs for boundaries.
- Invitation and assessment of options to meet those needs.
- 3–4 regions determined.



(illustrative example)

Q6: Do you agree with the proposed approach to phasing information throughout the year? If not, how could we best present this information, with the aim of avoiding publishing all in one large publication per year?

As we move to providing more information for more people to view we are also considering how we present the information on our website and how best to provide transparency to give potential participants sufficient information to understand the impact and value of their options. We want to ensure the information and processes are as accessible and understandable as possible.

We will work with our customers and stakeholders to identify the best way to share information that balances the desire for transparency with the confidentiality obligations we have in relation to information provided to us.

Q7: What information and in what format would you find beneficial in order to understand the network needs and submit well thought-out options? This could be specific data, guidance to understand the process or support as you go through it.

Getting involved

We hope that you have found these proposals on our direction of travel for network planning over the remainder of the RIIO-T1 period useful and agree that there is value from the developments we outline.

Your feedback is an important part in setting the direction of travel and we welcome your views on all aspects of our approach to developing our network planning. We have listed some specific questions on the next page to provide structure but we would be interested to hear any feedback on the issues and proposals set out by 15 June 2018 to the email address transmission.etys@nationalgrid.com. We are also happy to meet you directly or at other events such as trade association meetings. Please get in contact if you would like to talk through your thoughts.

We will consider your responses to this document and provide an update on our proposals in July. We have a number of other documents out for consultation between now and then, including our consultation on the *NOA* methodology, which was published in April. We encourage you to read and respond to the *NOA* methodology with consideration to its development in future in line with this roadmap.

Getting involved

Network Capability and Development Roadmap consultation questions

Q1: Do you consider there is value in expanding the *NOA* to allow network and non-network solutions across the transmission and distribution networks to compete to meet transmission network needs at least cost? What are the downsides or complexities we should consider? How could we go further in promoting competition?

Q2: What do you see as the opportunities and limitations of bringing a probabilistic approach into analysis?

Q3: Do you consider there is value in expanding the network needs covered by the *ETYS* and *NOA* to a greater extent across the year and to more regional voltage challenges? What are the downsides or complexities we should consider?

Q4: Do you consider there is value in expanding the *NOA* to cover system stability needs? What are the downsides or complexities we should consider?

Q5: Which other network requirements do you consider the *NOA* approach could be expanded to cover in order to drive value to consumers? What are the key benefits and considerations?

Q6: Do you agree with the proposed approach to phasing information throughout the year? If not, how could we best present this information, with the aim of avoiding publishing all in one large publication per year?

Q7: What information and in what format would you find beneficial in order to understand the network needs and submit well thought-out options? This could be specific data, guidance to understand the process or support as you go through it.

Continuing the conversation

Join our mailing list to receive email updates for *NOA* and the *Network Development Roadmap*.
www.nationalgrid.com/noa

Email us with your views on this Roadmap, *NOA* or *ETYS* at:
transmission.etys@nationalgrid.com
and we will get in touch.

Access our current and past *NOA* documents and data at:
www.nationalgrid.com/noa

Keep up to date on key issues relating to National Grid via our Connecting website:
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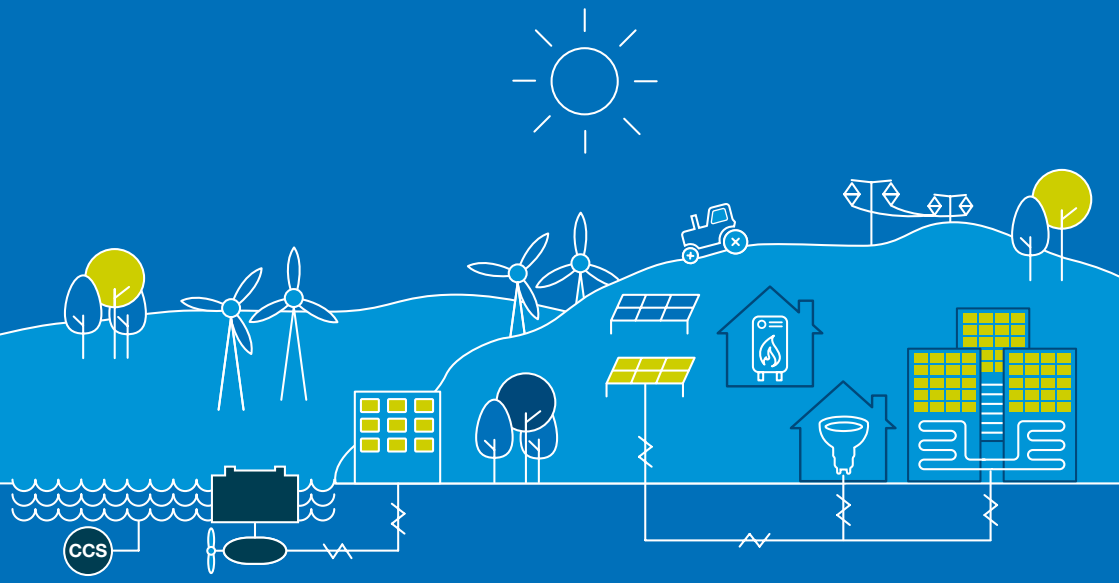

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