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Introduction

Purpose

- 1.1 The purpose of the Network Options Assessment (NOA) is to facilitate the development of an efficient, coordinated and economical system of electricity transmission consistent with the National Electricity Transmission System Security and Quality of Supply Standard and the development of efficient interconnection capacity.
- 1.2 This document provides an overview of the aims of the NOA and details the methodology which describes how the Electricity System Operator (ESO) assesses the required levels of network transfer requirement, the options available to meet this requirement and the ESO's recommended options for further development. It is important to note that whilst the ESO recommends progressing options in order to meet system needs, any investment decisions remain with the Transmission Owners (TOs) or other relevant parties as appropriate.
- 1.3 This methodology document describes the end to end process for the analysis and publishing of the NOA report and identifies the roles and responsibilities of the ESO and TOs.
- 1.4 Where this methodology refers to 'TOs', it means onshore TOs.

Key changes for 2019/20

- 1.5 We launched our Network Development Roadmap consultation¹ in 2018 and confirmed our direction of travel for the NOA for the following three years². This focuses on developments that should drive additional value to consumers and includes extending the range of needs the NOA approach applies to and the participants and options that can be put forward. We are building the capability and testing the value through a number of pathfinding projects. Where relevant we intend to include any applicable options in the 2019/20 economic analysis. We report the pathfinding projects separately on our Network Development Roadmap website³ and through the Electricity Networks Association (ENA) Open Networks Project⁴.
- 1.6 We completed phase 1 of our high voltage regions pathfinding project in 2018/19 and the findings are published on the ENA website⁵. In this first step, we have identified the reactive requirements in the Pennines region and are working with relevant stakeholders to find the most cost effective way to meet those requirements. For the first time we now include the assessment of high voltage regions as part of the NOA methodology. This assessment is conducted on an annual basis and published independently of the NOA report.
- 1.7 The NOA 2018/19 recommended investment in two ESO-led commercial solutions. We are refining our requirements and assumptions for those solutions so they can be better represented in our assessment. The ESO is keen to encourage commercial solutions providers to support our obligations for operating the system.
- 1.8 We are also enhancing and evolving the way we undertake our analysis. We recognise that the most challenging system needs are no longer just at the winter peak demand background. This is mainly due to ever increasing level of interconnections and renewable energy resources which bring greater volatility and intermittency to generation and demand patterns. As the energy background evolves, using a deterministic approach based on winter peak conditions to identify year-round system requirements may result in an overly optimistic or pessimistic view of system needs. As such we have conducted a case study of the use of probabilistic analysis to identify year-round thermal requirements for a region of the network

¹ <https://www.nationalgrid.com/sites/default/files/documents/Network%20Development%20Roadmap%20consultation.pdf>

² <https://www.nationalgrideso.com/sites/eso/files/documents/Network%20Development%20Roadmap%20-%20Confirming%20the%20direction%20July%202018.pdf>

³ <https://www.nationalgrideso.com/insights/network-options-assessment-noa/network-development-roadmap>

⁴ <https://www.energynetworks.org/electricity/futures/open-networks-project>

⁵ <http://www.energynetworks.org/assets/files/ON-WS1-P1%202018%20Investment%20Planning%20Processes%20-%20Approach%20vFinal.pdf>

where the system flows are considered volatile. This provided a comparison against our current approach. The report of the case study was published in the first quarter of 2019⁶.

- 1.9 For the NOA 2019/20, we intend to use the probabilistic tool and techniques to assess the credibility of the network assumptions used in the boundary analysis and results provided by the TOs when year-round conditions are considered. To further develop our capability and experience in probabilistic network assessment, we intend to study all boundaries for the NOA year 1 analysis. We will also select one or several boundaries on which to perform year-round analysis for all NOA study years.
- 1.10 Following major changes to the SRF template in 2017/18, and subsequent feedback following use in the 2018/19 process we have refined the template. This takes into account the feedback received and aims to deliver a smoother handover process of information for this cycle.
- 1.11 For this year's NOA IC, we continue to evolve the methodology based on stakeholder feedback. We have refocused the work on the core iterative analysis and will revise the interconnector baseline level to provide a lower level of interconnection, as requested by stakeholders.

Key similarities to 2018/19

- 1.12 The overall NOA process and philosophy are the same as used last year. Our NOA Methodology review that we submitted to Ofgem in March 2017 concluded that single year regret analysis is the best way to evaluate the needs of the national electricity transmission system. You can find the review document at <https://www.nationalgrid.com/sites/default/files/documents/NOA%20Methodology%20Review%202017.pdf>.
- 1.13 For the NOA 2018/19, we continued to operate the NOA Committee to provide additional scrutiny throughout the NOA process. They brought expertise from different parts of the ESO to ensure that the NOA recommendations are robust and in the best interest of GB's consumers. You can find the minutes of the past NOA Committee meetings on the NOA webpage at <https://www.nationalgrideso.com/insights/network-options-assessment-noa>. The NOA Committee will continue for the NOA 2019/20.

Background

- 1.14 In order to recommend options, the ESO uses the established investment recommendation process. This ultimately leads to the selection of recommended options based upon their capital investment and constraint savings across a range of scenarios. Constraint costs are a factor of bid/offer prices and the amount of generation constrained. Both factors vary across the scenarios resulting in no one scenario necessarily seeing higher constraint costs than another.
- 1.15 The ESO performed seasonal validation checks for boundaries assessed in the first NOA report. The constraint cost modelling tool (ELSI at that time) used assumptions to scale the boundary capabilities across seasons. It scaled the capabilities from the winter reference values to values for other seasons and also for outages. The purpose of the seasonal validation checks was to see how the scaled values compared with the values from technical studies of the same boundaries. The validation checks showed that the assumptions were broadly correct and needed only slight adjustment. Appendix B gives a more detailed review of the seasonal validation checks.
- 1.16 This methodology describes the process and the headers used follow the flow diagram in Appendix C for clarity. Appendix D contains the SRF template; Appendix E is the cost checking process; and Appendix F is the form of the NOA report.

⁶ <https://www.nationalgrideso.com/document/140781/download>

- 1.17 In accordance with Standard Licence Condition C27, the ESO has sought the input of stakeholders. Appendix G includes a summary of any views that the ESO has not accommodated in producing this NOA report methodology.

Differences between NOA and ETYS

- 1.18 The NOA process is the ESO's licence obligation as required by Electricity Transmission Standard Licence Condition C27 (The Network Options Assessment process and reporting requirements). Specifically, paragraph 15 defines the required contents of the NOA report, which are the ESO's best view of options for reinforcements for the national electricity transmission system together with alternatives and recommended options.
- 1.19 The Electricity Ten Year Statement (ETYS) is the ESO's licence obligation as required by Electricity Transmission Standard Licence Condition C11 (Production of information about the national electricity transmission system). Paragraph 3 defines ETYS's required contents which are the ESO's best view of the design and technical characteristics of the development of the national electricity transmission system and the system boundary transfer requirements.
- 1.20 In summary, ETYS describes technical aspects of the system and the system's development while NOA describes options for reinforcement to meet system needs.

The methodology

- 1.21 The Network Options Assessment (NOA) process set out in Electricity Transmission Standard Licence Condition C27 facilitates the development of an efficient, coordinated and economical system of electricity transmission and the development of efficient interconnection capacity. This NOA report methodology has been developed in accordance with Standard Licence Condition C27.
- 1.22 This document defines the process by which the NOA is applied to the onshore and offshore electricity transmission system in GB. The process runs from identifying a future reinforcement need, to assessing available options to meet this need, to recommending and documenting the option(s) for further development. It also defines the process of assessing the suitability of recommended options for competition in onshore electricity transmission. This assessment is against criteria defined by Ofgem in their document Guidance on the Criteria for Competition⁷. The ESO identifies and evaluates alternative options such as those based around commercial arrangements or reduced-build options in addition to those provided by the TOs. on page 17 covers these alternative options in more detail.
- 1.23 The ESO has engaged with the TOs to develop this methodology statement. Following publication of the NOA report, further stakeholder engagement is undertaken to inform the methodology statement for supporting subsequent NOA reports.
- 1.24 As background information changes and new data is gained, for example in response to changing customer requirements, both the recommended options and their timing will be updated, driving timely progression of investment in the electricity transmission system.
- 1.25 The ESO engages stakeholders on the annual updates to the key forecast data used in this recommendation process, and shares the outputs from this process through the publication of the NOA report.
- 1.26 Transmission Licence Standard Condition C27 Paragraph 15 sets out the contents of the NOA report. The licence condition is undergoing consultation and review⁸ but this process will finish after the NOA methodology is submitted to Ofgem. We will take a view on reviewing the NOA methodology once the revised licence condition is published.

⁷ https://www.ofgem.gov.uk/system/files/docs/2019/02/criteria_guidance.pdf

⁸ <https://www.ofgem.gov.uk/publications-and-updates/statutory-consultation-modify-standard-condition-c27-electricity-transmission-licence>

Each NOA report (including the initial NOA report) must, in respect of the current financial year and each of the nine succeeding financial years:

(a) set out:

(i) the licensee's best view of the options for Major National Electricity Transmission System Reinforcements (including any Non Developer Associated Offshore Wider Works that the licensee is undertaking early development work for under Part D), and additional interconnector capacity that could meet the needs identified in the electricity ten year statement (ETYS) and facilitate the development of an efficient, co-ordinated and economical system of electricity transmission;

(ii) the licensee's best view of alternative options, where these exist, for meeting the identified system need. This should include options that do not involve, or involve minimal, construction of new transmission capacity; options based on commercial arrangements with users to provide transmission services and balancing services; and, where appropriate, liaison with distribution licensees on possible distribution system solutions;

(iii) the licensee's best view of the relative suitability of each option, or combination of options, identified in accordance with paragraph 15(a)(i) or (ii), for facilitating the development of an efficient, co-ordinated and economical system of electricity transmission. This must be based on the latest available data, and must include, but need not be limited to, the licensee's assessment of the impact of different options on the national electricity transmission system and the licensee's ability to co-ordinate and direct the flow of electricity onto and over the national electricity transmission system in an efficient, economic and co-ordinated manner; and

(iv) the licensee's recommendations on which option(s) should be developed further to facilitate the development of an efficient, co-ordinated and economical system of electricity transmission;

(b) be consistent with the ETYS and where possible align with the Ten Year Network Development Plan as defined in standard condition C11 (Production of information about the national electricity transmission system), in the event of any material differences between the Ten Year Network Development plan and the NOA report an explanation of the difference and any associated implications must be provided; and

(c) have regard to interactions with existing agreements with parties in respect of developing the national electricity transmission system and changes in system requirements.

- 1.27 References to 'weeks' in the NOA report methodology are to calendar weeks as defined in ISO 8601. Week 1 is at the start of January and is the same as the system used the Grid Code OC2.

Major National Electricity Transmission System Reinforcements

- 1.28 Standard Licence Condition C27 Section C refers to the term Major National Electricity System Reinforcements for the purpose of this NOA report methodology statement. The definition has been agreed from consultation with the onshore TOs and the Authority (Ofgem) as:

Major National Electricity Transmission System Reinforcements are defined by the ESO to consist of a *project or projects in development to deliver additional boundary capacity or alternative system benefits as identified in the Electricity Ten Year Statement or equivalent document.*

- 1.29 The intention of this definition is to maximise transparency in the investment decisions affecting the National Electricity Transmission System while omitting schemes that do not provide wider system benefits. Such as schemes for a user connection or to improve system reliability.

Eligibility criteria for projects for inclusion / exclusion

- 1.30 The NOA report presents projects as options to reinforce the wider network that are defined by Major National Electricity System Reinforcements (see definition above).
- 1.31 The ESO provides a summary justification for any projects that are excluded from detailed NOA analysis.
- 1.32 Once a Strategic Wider Work (SWW) Needs Case has been approved by Ofgem, the option is excluded from the NOA analysis although the report refers to it and it is included in the baseline. This is due to it being managed through the separate SWW process. Ofgem have agreed the approach of excluding options where they have already agreed the SWW Needs Case. The NOA report will include analysis of options under construction that are funded through the incremental wider works (IWW) mechanism.

Roles and responsibilities of ESO and TOs

- 1.33 The ESO role and responsibilities are based around its overview of the network requirements. Specific role areas are as follows:
 - analysis of UK FES data
 - devising and developing alternative options including operational options, commercial agreements and Offshore Wider Works (OWW)
 - identifying boundary transfer requirements and issuing SRFs to TOs
 - verification studies of some boundary analysis performed by the TOs to corroborate the TOs' analysis
 - review of reinforcement options and their cost estimates that the TOs propose
 - assessment of outages and other system access availability that might affect the options' Earliest in Service Dates (EISD)
 - running cost-benefit analysis studies
 - recommending options for further development
 - assessing eligibility for competition
 - advise on the performance of boundary reinforcement proposals in the cost-benefit analysis to facilitate further option development by the TOs
 - providing an explanation of the NOA Committee recommendations
 - recording details if a TO does not follow a NOA recommendation
 - producing and publishing the NOA report.
- 1.34 The TOs' roles and responsibilities include:
 - technical analysis of boundary capabilities of the base network and uplifts from reinforcement options
 - proposing and developing reinforcement options and reduced-build options and providing their technical information to the ESO
 - cost information for options
 - outage and system access requirements for options
 - environmental information for options
 - consents and deliverability information for options
 - EISD of options
 - stakeholder engagement (following review of draft outputs of the NOA outcome)
 - community engagement
 - review of the draft NOA report and appendices relating to TO options.

Stakeholder consultation

- 1.35 The ESO has consulted with the TOs and Ofgem whilst preparing this NOA report methodology and used webinars and other meetings to seek other parties' inputs.
- 1.36 The key consultation areas are the NOA methodology, form of the NOA report and the NOA report outputs and contents.
- 1.37 This section shows the timescales for the ESO's consultation of stakeholders during the period of writing the NOA report.

Methodology review

- 1.38 The ESO seeks stakeholder views annually for consideration and where appropriate implementation before the NOA process starts its annual cycle.
- 1.39 Following the final publication of the NOA report, the ESO undertakes an internal review of the NOA process. This is completed within 18 weeks of the publication of the NOA report with the publication of an updated NOA methodology. This is then open for stakeholders' consultation where comments/feedback are invited. The consultation will close six weeks after the methodology is published for consultation. The ESO considers these comments for a revised NOA methodology and submits the methodology to Ofgem by 1 August of that year.
- 1.40 The ESO seeks approval from the Authority (Ofgem) on the NOA report methodology and form of the NOA report as part of the annual stakeholder engagement process.

Report output

- 1.41 The ESO makes available selected parts of the pre-release NOA report to key stakeholders, particularly the relevant TOs, on a bilateral discussion basis to ensure confidentiality obligations. This is as the NOA report is being written based on assessment data, particularly economic data, becoming available. These discussions will occur as results become available and the report is being drafted.
- 1.42 Further key stakeholder engagement occurs with release of drafts of the NOA report, three weeks ahead of publication. This provides a final opportunity for stakeholders to comment on the NOA report and raise any significant concerns. When a stakeholder expresses concern with the conclusions of the report, a comment is incorporated in the relevant section(s).

Provision of information

Engagement with interested parties to share relevant information and how that information will be used to review and revise the NOA methodology

- 1.43 The NOA methodology and NOA report adequately protects any confidential information provided by stakeholders or service providers, for example, balancing services contracts. For this reason, this methodology seeks to be as open and transparent as possible to withstand scrutiny and provide confidence in its outcomes, while maintaining confidentiality where necessary.
- 1.44 In accordance with Licence Condition C27 Part C, the ESO provides information to electricity transmission licensees, interconnector developers and to the Authority (Ofgem) if requested to do so. The ESO will assist TOs with cost-benefit analysis for SWW Needs Cases. Where appropriate the ESO can use the NOA results as part of a SWW initial Needs Case with the agreement of the relevant TO(s).

Future developments

- 1.45 The ESO expects the following changes and developments in the NOA report methodology and process as it evolves:
 - Building on the pathfinding projects to test distribution solutions as NOA options including identifying non-MW requirements and the necessary cost-benefit analysis methodology.
 - Further refinement of the process for ESO-led options building on our experience.
 - Modification of the process for assessing eligibility for competition taking into account developments in the legislative framework and our experience with assessments to date.
 - Probabilistic tools that would need a high level of automation and facilitate:
 - i. Year-round (24/7/365) consideration of a wide range of possible patterns for demand and generation to ensure that potential operational issues are discovered and also understood on the basis of the likelihood of that condition occurring (such as varying mixes of renewable generators, for example, wind and solar PV on a regional basis)

- ii. Automated optimisation of power flow controllable devices (e.g., Quad Boosters (QBs) and other similar Flexible AC Transmission System (FACTS) devices)
- iii. Automation of study set-up and contingency analysis
- iv. Automated data manipulation and results handling and filtering.

Our current work led to a thermal probabilistic case study to investigate the concept that aims to assess the viability of using probabilistic tools for thermal studies in the year 2019. This was published in March 2019. Having gained experience with thermal studies, which includes performance levels and validation, we envisage voltage and any other elements would follow in the subsequent two years.