Notes on Completion: Please refer to the appropriate NIA Governance Document to assist in the completion of this form. The full completed submission should not exceed 6 pages in total.
Network Licensees must publish the required Project Progress information on the Smarter Networks Portal by 31st July 2014 and each year thereafter. The Network Licensee(s) must publish Project Progress information for each NIA Project that has developed new learning in the preceding relevant year.

NIA Project Close Down Report Document

Date of Submission

Jun 2025

Project Reference Number

NIA2_NESO096

Project Progress

Project Title

Centralised Strategic Network Plan Decision Making Tool (CSNP)

Project Reference Number

NIA2_NESO096

Project Start Date

November 2024

Project Duration

0 years and 3 months

Nominated Project Contact(s)

innovation@uk.nationalenergyso.com

Scope

The project aims to recommend a decision-making tool for the CSNP that identifies the preferred electricity transmission network reinforcement options based on a range of potential future generation and demand backgrounds including SSEP pathway, FES scenarios, and sensitivities around those pathways and scenarios. The focus is on economic factors.

The project will:

- Review tools available that are suitable for the CSNP, that is high-investment requirements for the Net-Zero environment but also provide consumer value.
- Identify what tools are used elsewhere, in other industries facing high uncertainty and potentially high investment.
- Highlight the strengths and weaknesses of each tool. The chosen tool must be robust, transparent, and easily understood by the industry. It must seamlessly integrate with the outputs of the SSEP, FES and other CSNP processes and be flexible enough to accommodate changes in the number of scenarios and other developments in subsequent iterations. The project will explain why the recommended tool is the most appropriate.

The recommendation will include examples of how the tool would work in practice, including:

- Examples relating to the current and future energy landscape of high uncertainty
- High investment costs and the potential need for anticipatory investment
- Examples of how the tool would be flexible enough to cope with major changes in the energy landscape, for example zonal pricing or pathways with multiple sensitivities.

Out of scope

Balancing other factors such as environmental and community considerations, as well as deliverability and operability of network design options, are outside the scope.

In summary
The project will explain why the recommended tool is the most appropriate in an environment that demands timely and proactive network investment. The proposed tool will focus on delivering robust and transparent recommendations to ensure anticipatory investments align with Net Zero 2050 goals, as opposed to tools with less proactive approaches that may fail to meet these targets.

Objectives

The objective of the project is to:

- Deliver a decision-making tool for the Centralised Strategic Network Plan which will allow NESO to identify the optimal electricity transmission network reinforcement options based on a range of potential future energy pathways and sensitivities.

The tool will:

- Ensure informed and effective decision-making for the benefit of consumers and the environment.
- Ensure transparency in the assessment methodology and decision-making process.
- Consider the sensitivities and risk profiles associated with the input pathways and scenarios.
- Facilitate timely investments.
- Strive to minimise costs for consumers while maintaining the reliability and efficiency of the network.
- Contribute to achieving Net Zero goals.

Success Criteria

The project will be deemed successful if the following criteria are met:

- Decision making tools and approach are clearly identified for the economic assessment of network reinforcement options within the CSNP
- Implementation approach defined and clear worked examples are provided
- Internal and External Stakeholder buy-in and executive support

Performance Compared to the Original Project Aims, Objectives and Success Criteria

National Energy System Operator (“NESO”) has endeavoured to prepare the published report (“Report”) in respect of Automated Identification of Sub-Synchronous Oscillations (SSO) Events, NIA2_NGESO018 (“Project”) in a manner which is, as far as possible, objective, using information collected and compiled by NG and its Project partners (“Publishers”). Any intellectual property rights developed in the course of the Project and used in the Report shall be owned by the Publishers (as agreed between NG and the Project partners).

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The project successfully achieved its aims, objectives, and success criteria by recommending an assessment framework based on Robust Bayesian Analysis for conducting robust and defensible economic assessments of transmission network reinforcement options within the CSNP. The following steps outline the approach taken and how the final outcome was reached:

- DEFINE Requirements: The project began by defining the requirements for the CSNP analytical decision support tool. This was accomplished through a user survey and a workshop involving NESO stakeholders, which identified 51 key user requirements. These requirements were prioritised and encompassed themes such as explainability, the ability to handle uncertainties, and seamless integration with the broader CSNP process.
- REVIEW Potential Tools and Frameworks: A comprehensive review of potential tools and analytical frameworks was conducted. Various decision support tools, including decision trees, robust programming, info-gap theory, stochastic optimisation, robust Bayesian analysis, and least worst regret analysis, were explored. Each tool underwent a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis to evaluate its relevance.
- RECOMMEND the Most Appropriate Option: Based on the SWOT analysis, four tools were shortlisted: info-gap theory, stochastic optimisation, robust Bayesian analysis, and least worst regret analysis. These were further examined against criteria identified through the survey and workshop to determine the most suitable option. The comparative assessment was conducted, which was independently reviewed by the University of Edinburgh for verification. Both assessments concluded that Robust Bayesian Analysis was the preferred technique.
- ASSESS Practicality: To assess the practicality of the recommendation, a well-defined worked example using Robust Bayesian Analysis was undertaken. This example utilised data from a historic NOA (Network Options Assessment) to determine if the proposed tool offered sufficient benefits over the Least Worst Regret approach to justify internal changes to the CSNP process.

In summary, the project met its goals by providing a defined implementation approach and clear worked examples. By exploring a range of economic decision-making frameworks and assessing them against predefined criteria such as explainability, transparency and usability, the project ensured that the recommended tool was robust, transparent, and easily understood by stakeholders. The project also successfully navigated challenges related to uncertainty and practical implementation. Additionally, through stakeholder engagement activities, such as the initial user requirement survey and presentations of interim and final outcomes, the project secured stakeholder buy-in and executive support, fulfilling a key success criterion.

Required Modifications to the Planned Approach During the Course of the Project

N/A

Lessons Learnt for Future Projects

Although it was identified early on that worked examples were a key deliverable requiring data sharing with external consultants, preparation of this data only began halfway through the project. The data needed to be anonymised for sharing. While the project was ultimately successful and delivered on time, addressing data preparation earlier could have mitigated unnecessary rushing. On a positive note, the project team from all parties met weekly, which helped clearly identify and address any outstanding issues promptly. Regular progress meetings and close monitoring of the project progress were instrumental in delivering the project on time.

Note: The following sections are only required for those projects which have been completed since 1st April 2013, or since the previous Project Progress information was reported.

The Outcomes of the Project

The project successfully delivered a recommendation for a Robust Bayesian Analysis decision-making framework for the economic assessment of future network transmission reinforcement options within the CSNP. It also provided outputs from a literature review comparing different candidate economic assessments using a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis.

Through an initial survey with NESO internal stakeholders, the project identified a key set of user requirements for the proposed assessment framework. The survey outputs were included in the final report and integrated into the comparative analysis to determine

the best decision-making framework for CSNP economic assessment.

The project presented worked examples using anonymised real data to compare the existing Least Worst Regret (LWR) method with the proposed Robust Bayesian approach. It also outlined a clear implementation strategy for the recommended Robust Bayesian approach.

Compared to the existing LWR method, Robust Bayesian Analysis accounts for uncertainty in inputs by assigning probabilities. In the context of the CSNP, uncertainties relate to the future pathway of the UK energy system. To address this, costs associated with multiple scenarios can be estimated, with probabilities assigned to each scenario and associated regret calculated for that probability distribution.

The project outcomes were compiled into a final report which will be uploaded to the ENA Smarter Network Portal.

Data Access

Details on how network or consumption data arising in the course of NIA funded projects can be requested by interested parties, and the terms on which such data will be made available by NESO can be found in our publicly available "Data sharing policy related to NIC/NIA projects" and www.neso.com/innovation.

National Energy System Operator already publishes much of the data arising from our NIC/NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Foreground IPR

Final report including:

- Outcomes of the Literature Review: A SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis of various economic decision-making frameworks.
- Worked Examples: Detailed examples demonstrating the application of the recommended approach.
- Implementation Approach: A guide for integrating the recommended Robust Bayesian Analysis framework into the CSNP economic assessment stage.

A note from the University of Edinburgh team outlining the mathematical framework for comparing the different decision-making tools.

The final project report titled 'CSNP: Economic Decision-Making Under Uncertainty' and the notes from the University of Edinburgh team are expected to be released on the Smarter Networks Portal.

Planned Implementation

The recommendation for future work involves exploring the potential of the suggested Robust Bayesian decision-making framework within the upcoming CSNP process. As the CSNP methodology is still under development, this project recommendation will provide valuable input into its development process.

Net Benefit Statement

A successful proof-of-concept application of Robust Bayesian Analysis for the economic assessment of future network transmission reinforcement options within the CSNP was delivered. The outcomes clearly demonstrated the benefits of this approach compared to the existing Least Worst Regret method through worked examples.

The final report includes an assessment of various decision-making frameworks and provides valuable insights to the wider industry on different approaches for economic assessment of infrastructure projects, particularly in navigating uncertainties in the energy landscape.

Furthermore, the report offers guidance on integrating the Robust Bayesian Analysis approach within the CSNP process without disrupting the existing framework steps. It outlines key stages in the economic decision-making process of the CSNP and highlights important considerations when applying the proposed approach:

- Cost Assessment: Enables a more robust comparison of investment options by estimating costs under multiple energy demand and generation scenarios or pathways.
- Robust Bayesian Analysis: Improves confidence in investment decisions by identifying the most frequently optimal options and

quantifying the associated certainty.

- Review: Supports better risk management by investigating where the preferred option may not be optimal, helping identify critical decision-making ‘tipping points.’
- Recommendation: Enhances stakeholder engagement through tailored recommendation materials, improving clarity and alignment across parties involved in decision-making.

Other Comments

The Project outcomes and results contain confidential information and intellectual property rights that cannot be disclosed in this Report due to their proprietary nature. Should the viewer of this Report (“Viewer”) require further details this may be provided on a case-by-case basis following consultation of all Publishers. In the event such further information is provided each and any Publisher that owns such confidential information or intellectual property rights shall be entitled to request the Viewer enter into terms that govern the sharing of such confidential information and/ or intellectual property rights including where appropriate formal licence terms or confidentiality provisions. Dependent upon the nature of such request the Publishers may be entitled to request a fee from the Viewer in respect of such confidential information or intellectual property rights.

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