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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 Annual Progress Report Document

Date of Submission

Jul 2021

Project Reference

NIA_NGSO0028

Project Progress

Project Title

Study of Advanced Modelling for Network Planning Under Uncertainty

Project Reference

NIA_NGSO0028

Funding Licensee(s)

NG ESO - National Grid ESO

Project Start Date

October 2019

Project Duration

0 years and 11 months

Nominated Project Contact(s)

Jason Hicks

Scope

The overall aim of this project is to identify potential alternatives and opportunities for new planning methodologies that evaluate both technical and economic aspects in a more integrated manner and introduce flexibility and risk awareness in dealing with large-scale planning uncertainty. Differently from other projects that may look at testing specific solutions, this project will investigate more fundamental and wider aspects of how the current planning process could be improved to deal with an evolving energy system, new technologies and potential operational solutions, and addressing long-term uncertainties in a more systematic way. Clear recommendations will be produced for how new techniques could be adopted to enhance the overall planning process in light of all the relevant emerging issues and opportunities.

Objectives

The project will undertake the following objectives:

- Review/identify issues with the current deterministic planning processes and standards
- Review the state-of-the-art methodologies for energy system planning under uncertainty
- Review/identify issues with the current (i.e., one snapshot-based) technical modelling used in planning
- Outline a general decision-making framework for planning under uncertainty, e.g., to inform/extend the current NOA process
- Define the key and most desirable elements and methodological options for such a framework, for example based on stochastic optimization, decision theory techniques, and risk analysis.

Success Criteria

The project will be considered successful if at the end we will be able to:

- Clearly evaluate the pros and cons of using a LWR approach, whilst identifying and proposing alternative decision making approaches that could improve the recommendations output in the NOA
- Better understand potential issues in using a deterministic approach to planning while there are increasing uncertainties in the longer time scales
- Better understand potential issues in using a single-snapshot approach or oversimplified assumptions for the technical modelling while the system becomes increasingly more complex
- Identify the most desirable features for a new framework that can consider more integrated technical and economic modelling as well as better incorporate uncertainty and risk in planning
- Outline a roadmap and the required steps for actual implementation of the identified framework.

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

National Grid Electricity System Operator ("NGESO") has endeavoured to prepare the published report ("Report") in respect of Study of Advanced Modelling for Network Planning Under Uncertainty - NIA_NGSO0028 ("Project") in a manner which is, as far as possible, objective, using information collected and compiled by NGESO 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 NGESO and the Project partners).

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Project Activities

National Gird ESO (NGESO) is responsible for the secure operation of the UK's electricity system today and in the future. One of our key roles is performing the Network Options Analysis (NOA). This is our yearly analysis of proposed options by the transmission owners and our recommendations for which options provide the most benefit to the consumer. This is a vital step which helps to save billions of pounds of consumer value over the next 20 years whilst aiming to reduce risk as much as possible in an uncertain environment. The NOA process is a year-long annual process with a tight schedule. Each year projects to improve the process are identified and implemented if they are relatively straightforward. However, if the suggestion has a potentially larger impact then it poses a high risk to the NOA decisions and could affect the network reinforcement recommendations, which involve billions of pounds of investment decisions. For such large changes further insight is needed, calling for proper scientific research and feasibility studies before we can consult with the stakeholders on any big decisions.

Each publication of our NOA methodology is sent to Ofgem for approval, this is an opportunity for Ofgem to highlight certain areas that could be improved in future years. In their approval letter of the NOA 19/20 methodology they had several recommendations related to reviewing our approach for planning under uncertainty. These recommendations touch upon a core aspect of the NOA process, and so following this feedback, this NIA project was launched and a team of academics from the University of Melbourne (UoM) were tasked with performing a thorough review of our decision-making approach within the NOA process, and to identify areas for improvement. We tasked UoM with performing a literature review of the different methods which system operators around the world use in planning their transmission expansions, then to compare the ESO's processes alongside these. The UoM then investigated our decision-making technique 'Least Worst Regret' (LWR) to compare it with the possible new techniques available.

In the second part of the project UoM were also tasked with reviewing the boundary analysis techniques used as inputs in the NOA process, specifically the ongoing work in the ESO of considering more network uncertainties, adopting risk indices and moving towards probabilistic thinking. They were tasked with process mapping the probabilistic analysis, suggest improvements and better data visualization techniques using state-of-the-art methodologies.

Several academics from the UoM spent several weeks with NGESO in order to study and analyse our techniques, they also investigated the approaches of several other countries around the world. Two detailed reports of their findings were released in

January, initially finishing this part of the project.

One major outcome of the first part of the project was the creation of a new technique for decision making called Least Worst Weighted Regret (LWWR). The project has since been extended in order to develop a user-friendly tool to perform the LWWR technique. This started in April and will last for 6 months.

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

The project has been extended by 6 months to develop the LWWR tool.

Lessons Learnt for Future Projects

The report provided by the UoM is a review by an independent party of our NOA methodology. Their detailed report shows us an outside perspective of our approach and compares it to the approaches of other countries. The report is split into two parts, one part on the economic aspects, and the other on the technical side. The report is very useful and provides some new tools and ideas to go forward with, to perform our NOA CBA and technical probabilistic analysis with roadmaps to implement them. Furthermore, the report provides a very detailed description of our approaches and will be a great resource for interested readers to better understand the work the NGESO undertakes.

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

This project has created a very detailed and thorough report prepared by the UoM. The reports have been released in January 2021. The extension of the project will provide a new tool to perform the LWWR analysis.

Data Access

Details on hownetwork or consumption data arising in the course of a NIC or NIA funded project can be requested by interested parties, and the terms on which such data will be made available by National Grid can be found in our publicly available "Data sharing policy related to NIC/NIA projects" and https://www.nationalgrideso.com/future-energy/innovation.

National Grid Electricity 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

The following reports have been released as part of the completion of the initial project:

- A report by Uni of Melbourne (UoM) reviewing the economic side of the NOA methodology
- A report by UoM on the technical side of the NOA boundary analysis

The tool will not be made public, as it will be used in house for National Grid ESO's use.