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.

NIA Project Registration and PEA Document

Date of Submission

Oct 2024

Project Reference Number

NIA2_NESO080

Project Registration

Project Title

Regional Dynamic Reserve Setting

Project Reference Number

NIA2_NESO080

Project Licensee(s)

National Energy System Operator

Project Start

September 2024

Project Duration

1 year and 1 month

Nominated Project Contact(s)

innovation@nationalgrideso.com

Project Budget

£700,000.00

Summary

Reserve is essential in securing the electricity grid. Choosing how much reserve to procure is a balance between risk and cost. This problem has been tackled in a previously successful project named Probabilistic Machine Learning Solution for Dynamic Reserve Setting (DRS) NIA2_NGESO003; however, this project considered reserve at the national level and in practice, different amounts of reserve are required in different locations across Great Britain. This project will further the DRS work by building explainable, risk-based dynamic models for reserve that generate predictions at finer spatial resolutions. Using these models, NESO will have access to accurate, risk-based predictions of reserve requirements at different locations and can then make more informed decisions to maximise its usage and minimise costs.

Preceding Projects

NIA2_NGESO003 - Probabilistic Machine Learning Solution for Dynamic Reserve Setting

Nominated Contact Email Address(es)

Innovation@neso.energy

Problem Being Solved

Procuring reserve day ahead at the national scale can result in situations where some of this reserve is inaccessible when needed as it is located behind a constraint boundary. In cases where this occurs, additional costs are incurred that could be avoided by better

understanding reserve requirements in different regions of the country. The previous DRS project proved that setting reserves dynamically can yield savings and this project will extend this success to look at dynamically setting reserve regionally

Method(s)

The project comprises four work packages (WPs) to build, validate and incorporate the required regional reserve models for flexibly defined regions. The first work package will focus on acquiring, cleaning and processing data, ensuring that the current data processing code for national DRS is adapted to accept regional data. In the second work package, data will be aggregated at specified spatial scales and modelling code will be adapted to predict at these spatial scales. The third work package centres on training, tuning and validating the new regional models. At the end of this stage, a proof of concept judgement will be delivered for Regional DRS.
If the proof of concept judgement is in favour, a fourth work package will focus on further finetuning of the models and developing a PowerBI dashboard which will be delivered with the refined codebase.

The benefits to NESO of regional-level reserve modelling are:

- Insight not only into how much reserve will be needed at a given time, but also where this reserve will be needed
- Additional reserve setting savings which can be delivered without compromising on system stability

The financial benefits of this project would directly accrue to the GB electricity distribution.

Scope

Smith Institute will deliver explainable, risk-based dynamic models for reserve setting that generate predictions at finer spatial resolutions. These predictions will be derived by applying machine learning techniques to data that has been provided by the Frequency Risk and Modelling Group who specify the requirements of the models and evaluate the findings.
The benefit to NESO and National Grid of regional dynamic reserve setting is that accuracy in forecasting enables the secure delivery of additional reserve setting savings. BP1 of the balancing transformation journey delivered £368m in reduced balancing and reserve setting costs, and regional DRS would form part of the drive for continuous forecasting product improvements.

Objective(s)

Early estimates as to the value of setting reserve dynamically on a national scale indicate that it has the potential to deliver up to 300MW of reserve savings per settlement period. Setting the reserve regionally could unlock further savings by allowing NESO to:

- Procure reserve where it is required, lowering transmission losses
- Ensure reserve purchased is not inaccessible due to constraints and so minimise regret spend

Further lower overall reserve setting costs by allowing for offsetting of reserve in neighbouring regions

Better modelling reserve requirements at desired risk appetites would maintain the trajectory that NESO is on to move to a carbon free electricity grid by 2035 and to do so in a way that maintains security of supply while optimising the balancing cost.

Consumer Vulnerability Impact Assessment

The intended outcome of this project is to lower the cost of balancing for NESO and hence consumers, which will have the greatest benefits for those who are vulnerable

Success Criteria

- Delivery of dynamic, regional level reserve models with accompanying validation results showcasing performance
- Identification of key factors driving reserve predictions in each region from these models
- Delivery of codebase to train and run these models

Project Partners and External Funding

The project is undertaken by NESO's Frequency Risk and Modelling team (FRM) and the Smith Institute. Smith Institute will develop and deliver the models that generate predictions regionally, FRM will provide the relevant data, check the results against acceptance criteria and receive the developed models at agreed delivery points. No external funding support is required.

Potential for New Learning

Until recently, reserves were set in a static way. The dynamic reserve setting project successfully looked at the benefits of changing to a dynamic reserve setting system and is already recommending savings that can be safely delivered. The constraints in the energy system will affect the practical use of the recommendations for DRS, and so extending the logic to regions will allow the recommendations to be more accurate and useful, both in terms of security and available savings. There is no tool that delivers this ability in NESO or more widely in the GB electricity system, although regional reserve setting is a feature of the electricity grid in Sweden. In Sweden, the imbalance of generation and demand over their existing regions has resulted in the emergence of locational marginal pricing and the associated change in electricity markets. These new ideas could lead to the development of future markets in GB.
A final report will be published on to the Smarter Networks Portal.

Scale of Project

This is a small-scale project (12 months). Outputs from the project will help NESO to optimise the regional reserve setting.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The project will look at data from across the whole GB network

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£700,000

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

The project could lead to a need for lower reserve holdings, carbon emissions, and costs, creating better visibility of reserve requirements for the control room, and decrease unusable MW procured by balancing reserve service behind constraints..

How the Project has potential to benefit consumer in vulnerable situations:

n/a

Requirement 2 / 2b

Has the potential to deliver net benefits to consumers

Project must have the potential to deliver a Solution that delivers a net benefit to consumers of the Gas Transporter and/or Electricity Transmission or Electricity Distribution licensee, as the context requires. This could include delivering a Solution at a lower cost than the most efficient Method currently in use on the GB Gas Transportation System, the Gas Transporter's and/or Electricity Transmission or Electricity Distribution licensee's network, or wider benefits, such as social or environmental.

Please provide an estimate of the saving if the Problem is solved

n/a

Please provide a calculation and/or description of the expected benefits of the solution

The total cost for reserve in 2023 is around 200M and most of them resulted from the regional constraints. Using Regional Dynamic Reserve Setting could ensure that reserve is procured appropriately, mitigate the impacts of constraints on reserve, and further decrease the cost significantly. Consumers could also get the benefits of lower energy costs and lower carbon emissions.

Please provide an estimate of how replicable the Method is across GB

The output of the model will be applicable to the whole GB grid as the model will be designed for NESO, The finding of the models and the method used to develop it may be useful for DSOs.

Please provide an outline of the costs of rolling out the Method across GB.

n/a

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects must have the potential to have a Direct Impact on a Network Licensee's network or the operations of the System Operator and involve the Research, Development, or Demonstration of at least one of the following (please tick which applies):

☐ A specific piece of new (i.e. unproven in GB, or where a method has been trialled outside GB the Network Licensee must justify repeating it as part of a project) equipment (including control and communications system software).

☐ A specific novel arrangement or application of existing licensee equipment (including control and/or communications systems and/or software)

☐ A specific novel operational practice directly related to the operation of the Network Licensees system

☐ A specific novel commercial arrangement

Involve Research, Development or Demonstration - Please select all that apply

☐ A specific piece of new equipment (including monitoring, control and communications systems and software)

☐ A specific piece of new technology (including analysis and modelling systems or software), in relation to which the Method is

unproven

☑ A new methodology (including the identification of specific new procedures or techniques used to identify, select, process, and analyse information)

☐ A specific novel arrangement or application of existing gas transportation, electricity transmission or electricity distribution equipment, technology or methodology

☐ A specific novel operational practice directly related to the operation of the GB Gas Transportation System, electricity transmission or electricity distribution

☐ A specific novel commercial arrangement

Specific Requirements 4 / 2a

Please explain how the learning that will be generated could be used by the relevant Network Licensees

Other operators of grid systems also have requirements to procure reserve in order to ensure that their system remains balanced and secure. They, like NESO, may also have challenges in terms of ensuring that the reserve procured is free from constraints and therefore able to be efficiently used, If the regional reserve setting models can be shown to be useful to NESO, it is likely that the approach used here may be applied in other localities.

Not applicable.

Is the default IPR position being applied?

☑ Yes

Project Eligibility Assessment Part 2

Not lead to unnecessary duplication

A Project must not lead to unnecessary duplication of any other Project, including but not limited to IFI, LCNF, NIA, NIC or SIF projects already registered, being carried out or completed. Networks must explicitly mention similar projects that they have considered and how these differ.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Whilst there are other projects exploring innovative approaches to reserve setting, they are not prototyping a regional model of this complexity for the GB system.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not applicable.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The project has not been tried before because the facility to dynamically predict reserve requirements did not exist. Now that this facility does exist, the most obvious next step is to think about how reserve is procured regionally, as constraints affect how efficiently reserve can be used.

Relevant Foreground IPR

A final report will be published on to the Smarter Networks Portal.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click ‘Contact Lead Network’. NESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website at Innovation | National Energy System Operator (neso.energy)

- Via our managed mailbox innovation@nationalgrideso.com

Please identify why the Network Licensees will not fund the project as a part of it's business and usual activities

Until the completion of the first project, DRS, reserve was set in a more static way, through the analysis of historical data alone. The completion of DRS has shown that it is beneficial for NESO to take into account additional features that vary on a daily and even hourly basis, when procuring reserve. Now that the concept of dynamic reserve setting has been shown to be of use, it will be drawn into BAU. Since dynamic reserve setting is not yet part of business as usual, it follows that regional dynamic reserve setting is not a part of BAU either.

Please identify why the project can only be undertaken with the support of the NIA, including reference to the specific risks (e.g. commercial, technical, operational or regulatory) associated with the project

The TRL of the overall framework is relatively low; therefore, innovation funding is more suitable for exploring the project's potential and increasing the TRL before transferring into subsequent development. Also, conducting this project with NIA funding will ensure that the project findings can be shared more widely with other interested Network Licenses. There are increased risks associated with the availability of required data and a high level of assumptions, which makes this project better suited to NIA.

This project has been approved by a senior member of staff

☑ Yes