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

Jun 2025

Project Reference Number

NIA2_NESO080

Project Progress

Project Title

Regional Dynamic Reserve Setting

Project Reference Number

NIA2_NESO080

Funding Licensee(s)

NESO - National Energy System Operator

Project Start Date

September 2024

Project Duration

1 year and 1 month

Nominated Project Contact(s)

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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.

Objectives

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.

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

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

The project comprises four work packages (WPs) aimed at building, validating, and integrating the necessary regional reserve models for flexibly defined regions:

1. Data Acquisition and Processing: Acquire, clean, and process data, ensuring that the current data processing code for national DRS is adapted to accept regional data.

2. Data Aggregation and Model Adjustment: Aggregate data at specified spatial scales and adjust the modelling code to make predictions at these scales.

3. Model Training and Validation: Train, tune, and validate the new regional models.

4. Proof-of-Concept Delivery: Deliver a proof-of-concept judgement for Regional DRS.

At this interim stage, the project completed the first and second WPs as outlined in the project deliverables. This involved identifying the necessary locational data, finding data sources, preprocessing the data, revising the original DRS script for regional applications, and providing model features and targets aggregated for each region where the model will be applied. The project is now in the final stage of the third package. The model training procedures, including hyperparameter tuning and feature selection, have been adapted to utilise these regional features and targets, facilitating the development of reserve setting models at the regional level.

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

At this stage, no major modifications to the planned approach have been required. The only adjustment involved was addressing the missing regional demand forecast data for a few years. An alternative data source was identified and validated to ensure continuity and accuracy in the model development process.

Lessons Learnt for Future Projects

This project builds upon the highly successful National Dynamic Reserve Setting model, that has delivered savings of hundreds of megawatts per reserve settlement period compared to the previous national methodology. For the initial part of this project, locational data was provided for Grid Supply Points (GSPs), grid nodes, and grid regional boundaries, providing the geographical framework for the aggregation of model features and target variables at the regional level. To achieve alignment of datasets, the project developed mapping methods that standardise the integration of regional information across heterogeneous data sources. This process provided validation of the classifications made when assigning regions to both model features and target data, eliminating inconsistencies that could compromise model performance or interpretability. Strategic Spatial Energy Planning (SSEP) and Regional Energy Strategic Planning (RESP) are integral to NESO's comprehensive energy strategies. The mapping methods and data sources utilised in this project would be relevant to the RESP process as well as related applications and future projects.

In the feature selection stage of model training, both national-level features and region-specific predictors were included as initial candidate features for each given regional model. National features were included as they can capture broader system dynamics that could influence local conditions, meaning they may retain power for predicting reserve at the regional level. The initial pool of candidate features was refined using rigorous selection techniques, including correlation analysis and feature importance plots, to determine the optimal set of predictors for estimating reserve requirements in each region. Preliminary results indicate that national-level features remain significant drivers of regional reserve needs. These are effectively complemented by region-specific variables such as demand forecasts and errors, embedded wind forecasts, and air temperature. The relevance of these features has also been highlighted in related regional modelling efforts, including constraint forecasting. This underscores the potential for improved forecast accuracy to enhance the performance of various regional forecasting applications, particularly in the context of reserve setting as explored in this project.

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 existing data has been meticulously cleaned, processed, and validated, with missing data identified from both internal and external sources. Initial feature selection for each regional model has been completed, resulting in feature sets that will be used for training each regional model.

The next phase involves training the models to generate initial regional reserve setting results, followed by fine-tuning the models and developing a geographical dashboard to display reserve predictions in real-time.

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 NIA projects (and formerly NIC)” and Innovation | National Energy System Operator.

National Energy System Operator already publishes much of the data arising from our 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 final report is anticipated to be published on the Smarter Networks Portal at the end of the project. It will encompass sections on data processing, model development, results, and discussion.