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

Jul 2025

Project Reference Number

NIA2_NGESO057

Project Progress

Project Title

Alternative Metering (Baselines)

Project Reference Number

NIA2_NGESO057

Funding Licensee(s)

NESO - National Energy System Operator

Project Start Date

September 2023

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Gus Clunies-Ross

Scope

This project will focus on reviewing the theoretical options and developing suitable ones into a usable PoC algorithm which can be implemented as a Minimum Viable Product (MVP) to begin trials for provider generated operational delivery data.

The final deliverable will be the development and coding of the chosen algorithmic model in a suitable format and language for delivery in to the existing ESO performance monitoring systems to allow external submission trials to begin.

The algorithm should use metered data, possibly combined with historical delivery data to output a score indicating the probability of manipulation. The algorithm must also be calibrated to set an appropriate threshold for the score to suggest if further investigation should be conducted

WP1: Scoping
Workshops will be undertaken to generate a process map indicating: the data sources available; any short- and long-term outputs likely generated by the analysis algorithm that will require presentation or storage; and interoperation of data streams with the algorithm itself.

WP2: Solution identification
There are several possible algorithmic avenues to quantify baseline legitimacy. With scope and data availability known, one or more suitable approaches will be designed based on mathematical analysis and machine learning.

Solutions could include:

- Direct correlation analysis between submitted baseline and response
- Unit capability and service attribution
- Time series analysis
- Hybrid methodology

WP3: Implementation and evaluation
Following design agreement, the chosen solution will be delivered as end-to-end demonstration scripts. These will clearly show both pre-training on historic data, if applicable to the selected methodology, and the regular assessment process. This will initially be deployed as a proof of concept but could be expanded to a full production solution.

If a successful solution is developed, the ESO IT teams will undertake the delivery and testing required for implementation on the IT systems, upon completion of the project.

If there is a successful solution developed, found then, following the conclusion of this Innovation project, internal If appropriate, this will be progressed through to the live data analytics platform system to complement the existing data analysis tools.

Objectives

- Validate metering data from service providers to ensure that submitted data has not been falsified
- Develop a PoC algorithm which can be implemented as an MVP to start accepting trials for provider generated operational delivery data
- Develop the chosen algorithmic model in a suitable format and language for delivery into the existing performance monitoring systems to allow external submission trials to begin.

Success Criteria

The primary success criteria for the project will be the creation of an algorithm in line with the objectives which can reliably detect falsification in synthetic frequency Response metering data to allow trials to be conducted with participants using proposed methodologies for data derived metering.

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

The project was carried out over three phases, which were all completed satisfactorily.

Stage 1: Scoping
This stage was done through regular internal workshops with performance monitoring teams, business analysts, IT product owners, and market policy officers. NESO defined the technical requirements of the solution, including its performance and scalability. It involved:

- Outlining the 'exam question' for this engagement: the objective was to explore scenarios where units might have different baselines, making it impossible to measure service delivery from a fixed baseline submitted one hour in advance.
- Identifying data requirements – NESO catalogued the data available for each participating unit, ensuring its relevance to the method, and documented their sources for future NESO IT use. NESO discussed mechanisms to incorporate in synthetic data generation for the development and evaluation of the model. The result was a data map, illustrating the flows of data pertinent to the checks, which would ensure feasibility and utility in production.

Stage 2: Solution identification

In phase 2, the objective was to identify options to verify the legitimacy of provider-submitted data for gaming and recommend a specific solution. Several algorithmic approaches were considered, including:

- Correlation analysis between performance monitoring and operational data
- Correlation analysis between submitted baseline and ideal response
- Reviewing the extent to which performance data falls within performance bounds
- Anomaly detection to identify complex gaming behaviour

For anomaly detection, it was assumed that units not engaging in gaming would exhibit normal behaviour, while those that do would appear anomalous. Various methods were considered, such as time-series data analysis and clustering/density-based algorithms, with qualitative comparisons reflecting their benefits for large data sets.

To test these options, synthetic data was created to calibrate the solutions, distinguishing between normal and suspicious behaviour.

NESO subject matter experts established a range of normal scenarios based on historic data, such as reported frequency baselines (physical notifications), and operational metering. Gaming scenarios were also developed, reflecting plausible actions a malicious actor might take to game the system.

Stage 3: Implementation and evaluation
Following design agreement, the solution was implemented as end-to-end demonstration scripts. A synthetic data generation engine (through the use of Python coding) was built to augment the evaluation and appraisal of the model performance. The coding was transparent, with demonstrations illustrating its functioning for productionisation and delivery into NESO's final model scripts.

The project was successfully completed according to the original objectives and met all the defined success criteria.

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

There were no modifications required.

Lessons Learnt for Future Projects

Future projects could test the solutions in practice and train the models in NESO's Dynamic Response markets using historical data instead of synthetic data. This would help to inform any necessary revisions, such as weighting some checks more heavily than others and identifying thresholds where gaming is more likely, reflecting where events are confirmed or discarded. This approach could provide NESO with greater confidence in the robustness of the checks and ultimately reduce barriers for participation from units with variable baselines in its dynamic response services.

Additionally, other projects could explore applying similar techniques to other ancillary services. While different data flows and IT integration would need to be considered, the fundamental principles of gaming detection and the solutions reviewed in this project could be applicable to other services.

Future projects could also evaluate the applicability of the solution developed in this project for different use cases. The primary use case considered in this project was that of a battery providing an ancillary service while at the same time serving a variable load. Comparing the effectiveness of the solution across different use cases could help determine whether refinements are required including whether different checks should be carried out or weighted differently, for various scenarios.

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 delivered a synthetic data generation engine tool (through the use of Python coding) to flag susceptible unit behaviour to NESO. Specific features of this include:

- A data collation module for fetching and processing necessary data
- Algorithms for running gaming checks
- A metric that aggregates scores across all checks into a single value, indicating the likelihood of gaming
- Demonstrations with visualisations of checks and scores

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 following report has been published on to the Smarter Networks Portal:
Alternative Metering (Baselines) Final Report.

Planned Implementation

For the next steps in metering and baselines, the plan is to identify scenarios where alternative baselines and metering can be

applied. This involves reviewing different operational scenarios and setting clear criteria to ensure they align with project goals and regulatory standards. Once these scenarios are established, the next step is to agree on data submission requirements by determining the specific data needed for each scenario and establishing a standard format and timeline for submissions to maintain consistency and reliability. Additionally, new performance monitoring processes will be implemented, which include regular reviews and adjustments based on performance data, along with training team members to ensure effective implementation.

Regarding gaming checks, the plan is to modify the current checks to better align with project objectives and incorporate them into the performance monitoring processes. This integration aims to enhance the detection and prevention of gaming activities. Clear protocols will be established to address any issues identified through these checks, ensuring accountability and transparency throughout the process.

Net Benefit Statement

The project successfully delivered essential outputs, including the development of code that enables NESO to implement gaming checks for frequency dynamic response services. These gaming checks are essential for ensuring that the services NESO pays for meet precise service requirements, providing certainty and assurance that consumer money is being spent wisely and delivering expected value. Learnings from this project are feeding into the solution design for the new gaming checks for dynamic response services that are being delivered in Autumn 2025.

Moreover, the gaming checks developed through this project significantly contribute to a potential solution that allows co-located assets to participate in dynamic response services. This advancement is expected to enhance market competition and improve market liquidity. The increased competition is anticipated to reduce costs, ultimately benefiting end consumers by fostering a more efficient and cost-effective market environment. This comprehensive approach not only ensures value in service delivery but also optimises market operations for broader economic benefits.

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.

Standards Documents

Publicly published report on the Assessment of baseline and meter data approaches for Dynamic Response:

https://www.neso.energy/document/358141/download