

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 2025

Project Reference Number

NIA2_NESO106

Project Progress

Project Title

Volta – Qualitative Benchmarking and Impact Analysis for Future Dispatching Tools and Capabilities

Project Reference Number

NIA2_NESO106

Funding Licensee(s)

NESO - National Energy System Operator

Project Start Date

March 2025

Project Duration

0 years and 6 months

Nominated Project Contact(s)

innovation@neso.energy

Scope

WP-0 Overview and point-in-time assessment report including:

- Post-completion assessment of ADO ([NIA2_NGESO0013](#)) and ADO2 ([NIA2_NGESO0044](#))
- Point in time assessment on the Volta program 'Grand optimiser design philosophy' (NIA2_NESO107) and 'Value and feasibility analysis for input data models' (NIA2_NESO108) to understand how to future proof the work being undertaken by the Volta program
- Conversations and interviews with NESO team members and stakeholders

WP-1 Comparators report including:

- Benchmarking approach and list of comparator System Operators (SOs), input sources, and contacts
- Summary of learnings, cautions, and best practices for input data models and optimisers
- Comparative analysis of capabilities, processes, and tools used by comparator SOs
- Perspective on how challenges relevant to NESO have been faced by other SOs.
- Interpretation of findings and recommendations to take forward into the Volta program

WP-2: Scenario and impact analysis report including:

- Description of market change scenarios and the status of REMA
- Analysis of REMA and potential market changes on the Volta program
- Analysis of the potential impact of Volta program technology choices on market design
- A clear discussion of the relationship between the Volta program choices and market changes under each relevant market design

scenario

- Interpretation of opportunities and cautions and recommendations to take forward into the Volta program and potentially the REMA process

Develop a comprehensive joint roadmap, integrating insights from Volta's main internal stakeholders, including the Balancing Programme and the Future Control Room Design Team. This deliverable will involve reviewing and aligning their respective roadmaps, incorporating lessons learned from other System Operators (SOs), and prioritizing collaboration across teams. As a precursor, additional support may be required to articulate a detailed and actionable roadmap for the Future Control Team. The finalised joint roadmap will outline key milestones and strategic objectives spanning the 2025–2030 timeline.

Objectives

- Delivery of a Point-in-time assessment report including assessment of ADO and ADO2
- Documented benchmarking approach and list of System Operators (SOs), input sources and contacts, as well as a summary of learning, cautions and best practices used by other SOs
- Impact analysis looking into market change scenarios and how this will impact the wider Volta program as it moves towards maturity, as well as comparisons of capabilities, processes, and tools used by comparator System Operators (SOs).

Success Criteria

The following will be considered when assessing whether the project is successful:

- The project delivers against objectives, timescales and budgets as defined in the proposal.
- Review and validate the foundational assumptions of the Volta Program to confirm that it can meet its goals for optimised electricity dispatch and system reliability in line with NESO and REMA objectives.
- Identified insights, risks, and standards that can improve the program's adaptability and technical design, especially for interoperability.
- The project will assess the interaction between REMA's market design choices and the Volta Program's technical decisions to reveal key opportunities and constraints that can guide program alignment with Great Britain's evolving electricity market.
- Offer insights into potential standards that the Volta Program can adopt.

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 Volta – Qualitative Benchmarking and Impact Analysis for Future Dispatching Tools and Capabilities, NIA2_NESO106 ("Project") in a manner which is, as far as possible, objective, using information collected and compiled by NESO 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 NESO and the Project partners).

The Report provided is for information only and viewers of the Report should not place any reliance on any of the contents of this Report including (without limitation) any data, recommendations or conclusions and should take all appropriate steps to verify this information before acting upon it and rely on their own information. None of the Publishers nor its affiliated companies make any representations nor give any warranties or undertakings in relation to the content of the Report in relation to the quality, accuracy, completeness or fitness for purpose of such content. To the fullest extent permitted by law, the Publishers shall not be liable howsoever arising (including negligence) in respect of or in relation to any reliance on information contained in the Report

Copyright © National Energy System Operator 2025

Background information:

The Volta Benchmarking project is part of the Volta program, which aims at delivering AI solutions for the NESO Control Room to enable the energy transition by optimizing the usage of the available generation (including renewables, batteries and small generators) in a secure and economic manner.

The scope of the Volta Benchmarking project is to analyze the strategic direction and the technical solutions, planned or delivered, of other System Operators around the world that face similar challenges to NESO in order to validate the strategy of the Volta program or, if needed, adjust its direction.

Moreover, the Benchmarking project will deliver a joint roadmap for the Volta program, the OBP program (Open Balancing Platform) and the Future Control Room team to provide a coherent and synergetic direction to the NESO initiatives aimed at addressing the current and future challenges for the Control Room from different points of view.

Problem statement:

The Volta programme is a strategic initiative to modernise and optimise the electricity system balancing in GB, as an innovative

endeavour it entails the risk of proceeding in a sub-optimal direction considering all the factors that have to be taken into account, including the operational aspects, the upcoming market changes in GB, etc.

At this stage, considering that the programme has just started, it is important to compare the approach of every project with the plans of other SOs around the world that are addressing similar challenges to NESO and, in some cases, already delivered solutions. The outcome of the analysis in scope for this project is to validate the direction taken by the Volta programme and, if deemed appropriate, adjust the approach of individual projects or even the direction of some aspects of the overall programme.

Progress against stated project plan:

WP0:

During the WP0 phase, the baseline of the project has been defined, and its components have been analysed, i.e.:

- > the current vision and high-level description for the Volta program based on the documents on ADO and ADO2 that were created by Google Tapestry and IBM respectively
- >The status of the Balancing program at the end of OBP (Open Balancing Platform) program expected in 2027
- >The documentation from the Future Control Room team

The aspects of the current vision for the Volta program that will represent the focus of the Benchmarking exercise are the following:

- 1.use of adaptive machine learning models to improve and correct inputs feeding into the optimiser;
- 2.separation of energy resources into several input models based on their visibility (different types of generation, DER and demand side);
- 3.use of machine learning methods to improve demand forecasts;
- 4.use of machine learning methods to create interconnector schedule forecasts (more generally consideration of uncertainty from interconnection in the timeframe leading to dispatch);
- 5.Management of uncertainty and the use of scenarios and 'what if?' tools in the timeframes leading to dispatch;
- 6.the use of a 'time-coupled' optimiser that produces continuous forecasts of the system conditions ;
- 7.better consideration and optimisation of energy-limited assets in the timeframe leading to dispatch;
- 8.interaction between the power flow modelling and the dispatch optimizer and interaction between network topology actions and dispatch actions;; and
- 9.performance monitoring to review and improve the performance of the optimiser over time.

WP1:

The criteria used during the process to select the SOs to be engaged have been provided, the list of SOs has been agreed and the areas to be analysed have been agreed. The analysis is ongoing.

List of SOs to be engaged:

- >Ireland
- Italy
- >Norway
- >Australia
- >California
- >Netherlands
- >New Zealand
- >Texas

Areas to be analysed:

- >Overview of the power system and market design
- >Use of machine learning and AI to improve the quality of input data and requirements specifications
- >Use of scenarios & sensitivity analysis in the Scheduling & Dispatch process
- >Use of advanced optimiser engines to cope with more complex problems including:

- 1.the modelling of energy limited storage
- 2.management of different transmission system constraints (thermal, voltage, inertia, stability, etc.)
- 3.interaction with markets for energy, capacity, and system services

- >Innovation in visualisation for improved operator situational awareness and use of more automated dispatch/operator decision support tools
- >Performance monitoring and dispatch system 'self improvement'

- >Other cross-cutting issues:

- 1.Tools and procedural changes for interacting with DSO to manage embedded generation and flexible demand
- 2.Tools and procedural changes for interacting with market participants
- 3.What is forecast vs. what is controllable at different timeframes ahead of real time?
- 4.Challenges with implementation of a new dispatch system (operational challenges, issues related to users' adoption, changes in the control room roles/skillset

>Level of automation vs manual actions for redispatch

>Explainability for situational awareness (i.e. can users understand/follow the decisions from the optimizer?)

>Roles and skillset in the control room

>Robustness in case of losses in input data

>Use of ML and AI to improve the quality of input data and requirements

>Use of AI and self-learning mechanisms:

- 1.General metrics of accuracy

- 2.Available data to train ML models, resilience to step changes

>RES availability

- 1.Other innovations e.g. LIDAR

- 2.Methods/data sources for separation of transmission-connected, distribution-connected and behind the meter generation forecast

>Conventional generation

- 1.Forecasting availability/reliability

- 2.Forecasting self-dispatch outcomes

- 3.Forecasting cost

- 4.Forecasting self-dispatch outcomes

>Other dispatchable resources

- 1.Models to deal with availability for storage/energy limited assets

- 2.Models to deal with availability for DER (including how they respond to market /non-TSO incentives)

>Interconnection

- 1.Any forecasting models?

>Demand

- 1.New drivers

- 2.Interaction with user behaviour

- 3.Separation of demand from DER assets

- 4.Interaction with DSO and DSO-induced behaviour

>Reserve and response requirements

- 1.Any forecasting models?

- 2.Level of dynamic requirements

>Use of complex optimiser engines to cope with complex problems

- 1.Interaction between look-ahead forecasts/scenarios and generation merit order, forecasting the outcomes of self-dispatch decisions

- 2.Interaction with system service requirements e.g. inertia, frequency holdings (also voltage?)

- 3.Interaction with transmission constraints (including management of network reconfiguration)

- 4.Modelling energy limited storage / use of time-coupled optimisers

- 5.Interaction with DSO constraints and DSO actions

- 6.Simplifying the optimisation problem as real time approaches

- 7.Self-learning of outcome decisions/actions

- 8.Choice of solver engine

- 9.Challenges with implementation of a new system, putting the new system into production

WP2:

Yet to start, there is a dependency on the conclusion of the WP1 phase.

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

No modification required

Lessons Learnt for Future Projects

In WP0, the below points (points 7 and 8 in the progress summary above) stemmed from the discussions with NESO and will be analysed further with other SOs:

- > better consideration and optimisation of energy-limited assets in the timeframe leading to dispatch;
- > interaction between the power flow modelling and the dispatch optimizer and interaction between network topology actions and dispatch actions;

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 WP0 report defines the baseline for the analysis, i.e. the strategy of the Volta program and of the Balancing program. The overall outcomes of the project will be delivered with the upcoming WP1 and WP2 phases

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.smartemetworks.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

Foreground IPR that will be generated throughout the project include the reports included in the scope of the project, such as the benchmarking and impact analysis reports at the end of project.