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_NGESO046

Project Progress

Project Title

STARTZ (Stability Requirements Calculation Toward Net-Zero)

Project Reference Number

NIA2_NGESO046

Project Start Date

March 2023

Project Duration

1 year and 6 months

Nominated Project Contact(s)

Tatiana Assis, Shurooque Baloch

Scope

Decarbonisation is bringing technical challenges that include the management of potential stability issues caused by the reduction in inertia and short circuit levels. In order to overcome potential stability problems while keeping economic and secure operation, NOA Stability Pathfinder projects have been looking to find and procure alternative sources of stability support.

One key aspect to the NOA Stability Pathfinder project or any other future stability services procurement process is the calculation of future system stability needs. Overestimation or underestimation of system needs potentially represents, respectively, unnecessary costs for consumers or system vulnerability with increased risk of blackouts.
The current methodology to calculate the system stability needs is based on several assumptions, criteria and simplifications that should be revised and improved following network evolving and energy landscape transition. Also, since a number of future generation and demand dispatches are considered, a higher level of automation in the calculation process is required.

This project will review the current methods of calculating system stability and identify areas of improvement, performing the analysis on a sufficiently granular representation of the active and passive network components in the GB system. Bases on this analysis, It will apply automation and other necessary methods (machine learning) to manage additional computational burden of using detailed network representation.

Objectives

The existing tool to compute system needs is a standalone process and is not integrated with any of the NOA tools or ETYS models. The calculations are based on empirical formulas. At the same time, the year-round analysis computes hourly generation and demand dispatches to identify the amount and the location of the services that need to be procured. These dispatches have a temporal

variation which is captured through a time series analysis. The current tool is, however, not able to consider spatial uncertainty for inertia assessment, as the model is a lumped representation of the GB system. This project, therefore, seeks to achieve three main objectives:

1. Review the current methods of calculating system stability needs and identify areas of improvement.
2. Perform the analysis on a sufficiently granular representation of the active and passive network components in the GB system.
3. Implement automation and other necessary methods (machine learning) to manage additional computational burden of using detailed network representation.

Success Criteria

The project will be considered successful if the following criteria are met:

- Creation of an improved methodology and associated new tools which will interface with the detailed DIgSILENT Powerfactory model of the GB system to allow year-round calculating of system stability needs.
- Development of the ability to perform granular calculations of year-round system stability needs by implementing a set of automation and machine learning techniques.
- Validation of the new tool's output against accurate outputs from DIgSILENT Powerfactory and the measured values from ESO operation.
- Dissemination and training for learnings and tools developed in the project.

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 STARTZ NIA2_NESO046 ("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).

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The project comprises three work packages (WPs), each consisting of 5–10 main tasks/deliverables.
WP1, which includes reviews of current methods used by NESO and the WP report, has been successfully completed, despite a few months' delay caused by enhanced security checks and data-sharing arrangements following the legal separation from National Grid (now NGESO). Please refer to the previous progress report for further details.
WP2 focuses on receiving and understanding scenario data, the (reduced) Electricity Ten Year Statement (ETYS) model, data processing with feature engineering and clustering, analysis tool development, system needs calculation, and tests on PowerFactory. WP2 has completed most tasks, including the WP2 report and a workshop held at NESO Faraday House on 14 May 2025. Completion of WP2 is expected by the end of May 2025, with WP3 commencing in June. There is a delay of a few months from the original schedule due to human resource changes within the project partner organisation.

WP3 is scheduled to start in June 2025 following the completion of WP2. It will include scoring and comparing results between the current and developed approaches, defining the output file format and tool interface, training, handover, and the WP3 report. The current plan is to complete WP3 by the end of September 2025.

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

Due to the nature of the project, some of the data and PowerFactory models that needed to be shared with the project partner, TNEI, were classified as confidential. As a result, NESO had to upgrade security protocols and data-sharing mechanisms within the contract before any data or information could be shared. This caused a delay of several months in delivering WP1.

In addition, further delays of a few months occurred during WP2 due to staff changes within the project partner organisation.

A reduced ETYS PowerFactory model was shared with the project partner. This excluded confidential data, including commercial and

third-party information, as well as sensitive but useful metadata. As a result, additional tasks were required to process and map the necessary data into the ETYS model. Further work will likely be needed to adapt the developed tools and code for integration into NESO's production environment, due to differences between the shared and internal models.

Lessons Learnt for Future Projects

Plan for data, model, and information sharing across the entire project lifecycle, and agree early on a suitable approach and format for exchanging data and models between project partners.
Allow sufficient time for security clearance procedures and data-sharing checks, as these can introduce delays.
Develop a mitigation or contingency plan to address potential human resource changes during the project, particularly within partner organisations.

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

WP1, WP2, WP3 Reports
The WP1 report summarises current methods for calculating inertia, short circuit, and voltage management requirements in the GB system. It includes a review of various indices from literature for scenario-based, year-round analysis, noting that not all indices are suitable for this project. To support the selection of the most appropriate indices, the report provides a qualitative comparison and recommendations for implementation in WP2. It also explains unsupervised machine learning methods, such as clustering algorithms, which help address non-convergence issues in load flow solutions and are critical to the project's success.

The WP2 report will detail the development of the PowerFactory automation framework used to interface with the GB system model. This framework enables ESO to analyse half-hourly scenarios using data from the market dispatch simulator for system needs assessment. The report will cover the framework's architecture, the machine learning approach for load flow convergence, indices for system needs calculation, and a scoring system for final index selection.

Key deliverables from WP1 and WP2 include:

A comprehensive literature review of indices for inertia and short circuit calculation
DIgSILENT PowerFactory automation framework
A machine learning approach to resolve network convergence issues
A voltage profiling algorithm
A system needs assessment for half-hourly scenarios

Additional outcomes:
Workshop presentations and discussions (a workshop was held in May 2025 with the project team and NESO stakeholders)
Developed tools and code for future NESO applications (a prototype tool was demonstrated during the May 2025 workshop)
Supporting documentation, including a user manual, step-by-step guide, and training materials (to be delivered in WP3)
Research papers and publications, including a paper on the initial work on the machine learning algorithm for network convergence, accepted for presentation at CIGRE Paris 2024

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 foreground IPR is expected to be generated during the project:

An improved methodology and new tools that will interface with the detailed DIgSILENT Powerfactory model of the GB system, enabling year-round calculation of system stability needs.

Training materials for the learnings and tools developed in the project.