

## NIA Project Registration and PEA Document

### Date of Submission

Dec 2025

### Project Reference Number

NIA2\_NESO122

## Project Registration

### Project Title

Control-room Operation Measurement of Passive and Active System Strength (COMPASS)

### Project Reference Number

NIA2\_NESO122

### Project Licensee(s)

National Energy System Operator

### Project Start

December 2025

### Project Duration

0 years and 11 months

### Nominated Project Contact(s)

Innovation@neso.energy

### Project Budget

£500,000.00

## Summary

The approach being used to achieve the project's goals is to simultaneously install system measuring equipment while evaluating the system strength methodology using simulation model.

Currently, system strength-based metrics, such as SCL (Short Circuit Level) and SCR (Short Circuit Ratio), use offline models combined with plant information to assess the stability and performance of both plant and system. This project will go one step further and use system measurements that are obtained using passive (events that happen on the system) and active (system will be perturbed by injecting a signal) measurements to develop a comprehensive view of system strength in the small and large signal domains.

## Preceding Projects

NIA2\_NGESO020 - Strength to Connect

## Third Party Collaborators

Reactive Technologies Ltd

## Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

## Problem Being Solved

As the GB electricity system moves towards the 2030 goal of zero carbon operation, there is a requirement to accelerate the amount of renewable generation on the system. The fastest growing share of this generation is wind and solar generation, and batteries, and most of these use inverters for power conversion which present a challenge for the grid in its current state, as they delivery no inertia and also contribute to Sub/Super-Synchronous Oscillations (SSOs) on the electricity system, increasing the chance of instability. NESO has used measures like Short Circuit Level (SCL) and Short Circuit Ratio (SCR), as well as quantifying system inertia through new methods of power system analysis, however, this created an incomplete picture. System strength is a measure that could incorporate different elements to understand how robust the system is operating given the increased share of inverter-based resources being connected on the generation side. A problem NESO faces here is the lack of understanding and visibility of system strength, as this measure is still debated and yet to be fully understood on how it could impact operation of the system.

## Method(s)

This project will be delivered through the following Work Packages (WP):

### WP1: Project Alignment

Establish a common understanding of the project delivery approach, aligning NESO's expectations with the proposed activities. For this work, the initiation and setup phases will ensure that the work to be delivered is planned effectively in coordination with other stakeholders, such as Transmission Operators where modulators would need to be installed..

Kick-off meeting, action plan, and high-level solution design will be provided as an output to this work package.

### WP2: Measurement Panel Delivery

Equipment deployment (measurement panels) and deployment acceptance testing and commissioning. This work will ensure all the measurement panels are set up and commissioned to the correct communication protocols for NESO's uses and to be able to ingest the data properly into the existing platform NESO uses. The supplier will maintain ownership of the equipment and deliver the measurement and calculation service for NESO.

Deployment planning, equipment procurement, installation, commissioning will be the outcomes of this work package.

### WP3: Modulator Selection and Data Collection

Select and configure an existing asset for use as a modulator. This will involve selecting a modulator that is already installed on the system that is suitably located for understanding the impact of control operations and system events to correlate system strength measures to occurrences on the system. The commissioning work will involve setting up the data transfer and analysis protocols to enable the project activities.

### WP4: Service Enablement

Enable active system strength service and provide training to NESO staff while using the offline calculations for system strength on NESO's side to investigate the accuracy of the measure provided by the supplier. Small power pulses will be sent throughout the grid, and data will be collected for micro voltage events in the order of 0.01% - 0.02%, which do not affect the normal operation of the grid to estimate the active system strength.

### WP5: Service Monitoring, Analysis and Validation

Monitor and maintain the performance of the system strength service and support comparative analysis for service accuracy, business case and practicality.

After a 12-month period, a report will be provided on observed Short Circuit Ratio (SCR) levels and likely Critical SCR level based on the 12 months of measurement data. Includes supporting comparative analytics including updated technical report.

In line with the ENA's ENIP document, the risk rating is scored 5.

TRL Steps = 1 (2 TRL Steps)

Cost = 2 (£500,000)

Suppliers = 1 (1 supplier)

Data Assumptions = 2 (medium – assumptions known but will be defined in project)

Total = 6 (Low)

## Scope

The Project will be delivered through a series of work packages, including project kick-off, offline assessment, System Strength equipment deployment, and modulator assessment.

The project scope includes the following activities:

- Installation of measuring/injecting equipment

- Offline methodology to determine system strength based on measured values
- System strength categorisation

The following is considered out of scope for the project:

- Implementation of the methodology into the ENCC's BAU to provide operational decisions

## Objective(s)

The objectives highlighted for this project are:

- Establish a common understanding of the Project delivery approach.
- Deploy System Strength measurement panels in the selected substations to capture high-speed measurements.
- Provide a report that undertakes an offline evaluation for System Strength categorisation and methodology.

## Consumer Vulnerability Impact Assessment (RIO-2 Projects Only)

This project will not negatively affect customers in vulnerable positions.

## Success Criteria

The project can be deemed successful if:

- If passive and active system measurements are obtained, align with the current methodology used within NESO, and can be used in real time
- A valid methodology is developed translating the measurements into system strength values

## Project Partners and External Funding

Partner: Reactive Technologies Limited

No external funding.

## Potential for New Learning

This project aims to build a better understanding of the measure of system strength and what it means for the GB electricity system. This will include actions and effects of things that take place on the network and how this will impact system strength as well as correlations with other measures such as Short-Circuit Level (SCL) and Short-Circuit Ratio (SCR).

Additional learning may also be surrounding the impact that synchronous generators vs Inverter based resources have on system strength and what role they play.

At the end of a project, the project learning, including recommended next steps will be available on the ENA Smarter Networks Portal.

## Scale of Project

The project spans 10 months with one project partner.

This project is medium scale in application and potential outcome. There are significant benefits to be derived from the learning should the hypothesis of system strength being a useful metric in the context of increasing Inverter-Based Resources on the electricity system, but also benefits of knowing that this isn't a useful theme to pursue should that hypothesis not be supported by evidence of project activities.

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL6 Large Scale

## Geographical Area

Great Britain

**Revenue Allowed for the RIIO Settlement**

N/A

**Indicative Total NIA Project Expenditure**

£500,000

## Project Eligibility Assessment Part 1

There are slightly differing requirements for RIIO-1 and RIIO-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RIIO-2 / RIIO-1).

### Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations (Please complete sections 3.1.1 and 3.1.2 for RIIO-2 projects only)

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

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

The project, should it be successful, will provide a measure that may be used to better understand system stability, particularly with more inverter-based resources on the GB electricity system. This will provide greater operational confidence in the use of inverter-based resources, allowing for greater proliferation into the generation mix.

#### **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 (RIIO-1 projects only)**

N/A

#### **Please provide a calculation of the expected benefits the Solution**

This is a research project, and the understanding of the potential benefit is still being understood

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

System strength is not a well understood concept, but this project aims to understand it. Given the locality of inertia and rate of change of frequency events, it is expected that system strength will follow a similar pattern. It is also expected that measurement units can be expanded to many more areas across the GB system, which could help to provide greater situational awareness. The amount of sensors in an area required to find a clear picture of system strength effects is not known, and this will be investigated to understand better how local the effects are.

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

This project aims to deploy units across 3 sites initially, with a cost of approximately £120,000 per site. Due to the locality of the measure not being known, it is uncertain how many measurement units would need to be deployed to get a clear picture of the whole system down to the correct granularity, but this aspect will be investigated during the project.

### Requirement 3 / 1

Involve Research, Development or Demonstration

A RIIO-1 NIA Project 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

#### RIIO-2 Projects

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**

A better understanding of system strength will be a new learning which will be disseminated across networks for them to use in their operations and help to manage the stability of the system.

##### **Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)**

N/A

##### **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.

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

Investigations have been done into similar projects (listed below), and it was determined that this work will not lead to duplication.

- [10129395 -SYSMET – System Strength Measurement and Evaluation \(SSEN\) SIF Alpha - Round 3](#) – this project is looking at small signal stability and only using active measures, whereas this project will be looking at system-wide impacts using both passive and active measures

- [NIA2\\_NGESO020 - Strength to Connect](#) - this project is a predecessor to the System Strength Measurement and Evaluation, which will take the learning and understand whether an online/live measure of system strength can be derived from system data, taking forwards the previous work from Strength to Connect, which developed an offline measure.

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

N/A

#### Additional Governance And Document Upload

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

Previously, system strength has been evaluated using offline tools and metrics that estimate the behaviour of the system, such as the

short circuit current. The novelty of this project proposal is the use of real-time system measurements to evaluate the system strength based on actual system dynamics.

## Relevant Foreground IPR

A validated online measure for system strength.

## 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:

1. A request for information via the Smarter Networks Portal at <https://smarter.energynetworks.org>, to contact select a project and click 'Contact Lead Network'. National Energy System Operator already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
2. Via our Innovation website at <https://www.neso.energy/about/innovation>
3. Via our managed mailbox [innovation@neso.energy](mailto:innovation@neso.energy)

Details on the terms on which such data will be made available by National Energy System Operator can be found on our website: [Data Sharing Approach | National Energy System Operator](#).

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

The proposed System Strength evaluation method may not be at a suitable development stage to be incorporated into business use at project completion. Due to this risk, the activity was not deemed suitable for BAU activities.

## 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

This project is high risk in that the methodologies and metrics being investigated are not well known and understood. Due to this risk, public funding was deemed appropriate. Because the topic of the project is relevant to network licensees, and the learnings will be useful for transmission system operations and potentially distribution system operators, NIA funding was determined as the funding route.

## This project has been approved by a senior member of staff

Yes