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.

NIA Project Registration and PEA Document

Date of Submission

Apr 2025

Project Reference Number

NIA_SSEN_0080

Project Registration

Project Title

Voltmetric

Project Reference Number

NIA_SSEN_0080

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

April 2025

Project Duration

1 year and 7 months

Nominated Project Contact(s)

fnp.pmo@sse.com

Project Budget

£996,000.00

Summary

This project will explore combining and analysing data from Smart Meters and LV monitors with information from the HV and EHV networks and DFES to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies to improve strategic network investment.

Preceding Projects

ENWLT204 - Customer Load Active System Services (CLASS)

NIA_NPG_032 - Boston Spa Energy Efficiency Trial

NIA_SSEN_0069 - Low Voltage Power Quality (LVPQ)

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

Background and Problem

Scottish and Southern Electricity Networks Distribution (SSEN) have always managed its networks with the aim of accommodating the maximum amount of demand possible while remaining within the Statutory Limits specified in the ESQCR at the consumers' terminals.

However, more recently, the connection of renewable generation and other Low Carbon Technologies, such as electric vehicle (EV) chargers, has started to cause issues with maintaining distribution voltages within the statutory limits. New approaches to both voltage

and power quality management are required before the forecast proliferation of these devices cause significant problems on the network.

Innovation projects and deployments in the last decade have explored a range of techniques and resulting policies which can be applied to managing voltage to deliver specific benefits including:

- Reactive Support for the NESO
- Maximising the ability to connect Low Carbon Technologies and generation to the network
- Voltage derived demand response for ESO markets
- Minimisation of losses on the network
- Minimisation of losses in customers' properties

These policies have benefits but potentially conflict with each other meaning they cannot be delivered concurrently in the same location. Project QUEST, led by ENWL, is working on how these objectives can be built into an overall voltage management policy.

Voltage management is also closely linked with management of power quality, especially on networks with high penetrations of LCT and renewable generation. In many cases voltage and power quality issues are leading indicators that issues will arise relating to exceeding limits especially on the lower voltage network.

Opportunity

The increased availability of more granular network data from LV monitoring devices, smart meters and other sensors gives the opportunity to understand voltage and power quality at scale across the network for the first time.

This project will explore the analysis of these datasets, with information from the HV and EHV networks and DFES, to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies via network strategic investment planning

The project aims to learn from and build on the existing health and load indices which provide a standardised methodology for the assessment of network assets, and a common and calibrated means of quantifying the value of a load and condition-based investment. A Health Index is a method used to assess the condition and criticality of assets consistently across the industry. It provides a common view of asset health, allowing comparison with similar assets. Applied uniformly by all DNOs, it offers clarity to stakeholders and regulators and helps DNOs prioritise investment in network health.

In the same way that health and load Indices provide a means of measuring the need for and impact of large volume investments, this project will create an Index, considering both Voltage and Power Quality, allowing similar assessments to be made for investment to improve voltage and power quality

Benefit

When combined with the cost of the interventions that are driving this performance, the Voltage and Power Quality index will allow whole system investment decisions to be made in an informed manner across a large population of sites in the same way that Load and Health indices currently do. This should facilitate further LCT connections by allowing networks to make proactive interventions to avoid voltage driven constraints.

Method(s)

This project will:

- Identify the data required to determine a Voltage and Power Quality index:
  - Understand the methodologies used for LI and HI to inform the construction of a VI methodology
  - Consider data relating to connectivity, load flow, smart meter, network monitoring and power quality

- Implement a data collection method and frequency:
  - Considerations given to use of both historical and real-time data
  - Data sets that would be reasonable for all DNOs to be able to access with the appropriate investment e.g. Smart Meter Voltage data, LV monitoring, Tap Changer Status information etc

- Determine the calculation method(s) of voltage indices for a variety of scenarios:
  - Scenarios may include networks under different conditions

- Perform the calculations of indices at an appropriate frequency and granularity

- Consider and assess the impact (performance and cost) of applying different network interventions

- Run test cases to verify the approach:
  - At different network locations
  - For different network types (e.g. rural/urban, high/low embedded generation, high/low load)

- Review the impact that the Voltage and Power Quality index have in relation to the existing Load index and Health index

- Revise, update and provide a verified design for a Voltage and Power Quality index

Data Quality Statement (DQS): -

The project will be delivered under the NIA framework in line with Ofgem, ENA and SSEN internal policies. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored in our internal systems with appropriate backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Measurement Quality Statement (MQS): -

The methodology used in this project will be subject to supplier quality assurance regimes and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and assessments will also be clearly documented in the relevant deliverables and final project report made available for review.

Scope

The project will identify a new methodology for the identification of a Voltage and Power Quality index that could be applicable for use by all DNOs and could be recognised by Ofgem as a basis for regulatory investment. The Voltage and Power Quality Index should:

- Allow regulators and network operators visibility to compare the relative performance of networks in relation to Voltage and Power Quality Management

- Be applicable at all Distribution levels, from EHV to LV.

The benefit calculation is based on the National Infrastructure Commission - Report Electricity-Distribution-Networks-report-21-Feb-2025.pdf. Cumulative profile of load related expenditure from now up to 2050 from the core scenarios in the national modelling shows around £37-£50 billion of investment in the distribution network is required to ensure the efficient transition to net zero.

The CBA is based on 0.25% deferment of the load related expenditure detailed in the NIC report. The net benefit is valued at £5.4m in RIIO-ED3 for GB. It should be noted that one of focus of the project is to refine and further develop the benefits use case.

Objective(s)

The project objective is to develop a Voltage and Power Quality index to be used as an investment driver and to:

- Define an industry standard following engagement with ENA, on the reporting and visualisation of Voltage and Power Quality index that is applicable and could be used by all DNOs

- Synergise with existing Load and Health indices

- Define consumer improvements Ensure the model is applicable across our industry by engaging early in the design stage with another DNO

- Engage with Ofgem to demonstrate that provision of a voltage indexing model could identify areas of the network where voltage performance could be improved with investment for the benefit of customers

- Enable DNOs to move to an approach where Voltage and Power Quality is managed in a more active manner, applying the most appropriate voltage policy on a spatio-temporal and real time basis

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project will identify opportunities to improve power quality, reduce costs and improve reliability for all network consumers including

those in vulnerable situations. Please see the results dashboard.

Success Criteria

For the project to be considered a success it will have defined a Voltage and Power Quality index that is replicable and supported by SSEN Distribution along with full consultation and engagement with all DNOs, Ofgem and ENA. This approach will de risk and enable the success of the future approval and rollout of an index.

Project Partners and External Funding

Not applicable

Potential for New Learning

All learning will be captured and disseminated through industry events and NIA closure reports.

New learnings will include a Voltage and Power Quality Index that can be applied consistently as a standard used by all DNOs and provide stakeholders and Regulators with clarity of prioritisation of network investment.

Scale of Project

The project scale has been kept as small as reasonably practicable in terms of developing a voltage index that could be used by other DNOs. Also, the scale of the project in terms of duration has been carefully considered to allow for the creation and sharing of the outputs to help inform RIIO-ED3 which will maximise the potential benefits. To help us ensure we achieve this we will engage early with another DNO so that we can identify improvements on the applicability of the proposed voltage index model across our industry, which will then be applied across GB.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

As the project intends to create a new Voltage and Power Quality methodology the first phase of the project will have no trial sites in the distribution network. However, as the Voltage and Power Quality index evolves consideration will be given to running trials to verify the accuracy and suitability of the method, using either/both SEPD and SHEPD licence areas.

Revenue Allowed for the RIIO Settlement

No revenue has been provided in the RIIO-ED2 allowance for this work.

Indicative Total NIA Project Expenditure

The total project expenditure is expected to be £996,000

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:

This project is aimed at helping to facilitate a just transition to a low carbon energy system.

Whole system investment decisions made in an informed manner will allow further LCT connections by allowing networks to make interventions to avoid voltage driven constraints.

How the Project has potential to benefit consumer in vulnerable situations:

Not applicable

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)

Not applicable as this is not a RIIO-1 project

Please provide a calculation of the expected benefits the Solution

The benefit calculation is based on the National Infrastructure Commission - Report Electricity-Distribution-Networks-report-21-Feb-2025.pdf

Cumulative profile of load related expenditure from now up to 2050 from the core scenarios in the national modelling shows around £37-£50 billion of investment in the distribution network is required to ensure the efficient transition to net zero.

The option chosen for the CBA is based on 0.25% deferment of load related expenditure, which is valued at £5.4m in RIIO-ED3 for GB. It should be noted that one focus of the project is to refine and further develop the benefits use case.

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

Aim is to replicate the method across all GB DNO licensees' systems.

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

Data requirements will differ for each DNO. An estimate of the roll out costs will be provided as part of the project outcomes.

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

The learning that will be generated could be used by all DNO licensees to better understand how well their networks are performing and this will enable them to manage and deliver targeted investments based on the voltage and power quality of their networks.

Regulatory investment resulting from this new metric could ensure improved customer experience in being able to operate their LCT equipment without voltage or power quality issues.

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

Not applicable.

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.

Work has been done to date under other innovation projects, e.g. ENWL delivering QUEST and CLASS (more broadly to develop a voltage management policy) and our project is leveraging the learning outcomes from these projects. In addition, this project will be leveraging the learnings from the ongoing BEET project by Northern Powergrid.

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

Not applicable as no other project to date has sought to develop a Voltage and Power Quality index to use as an investment driver.

Additional Governance And Document Upload

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

The increased availability of more granular network data from LV monitoring devices, smart meters and other sensors gives the opportunity to understand voltage and power quality at scale across the network for the first time.

This project will explore analysis of this data with information from the HV and EHV networks and DFES to produce an index of voltage and power quality health, and how this could be used to inform the deployment of voltage and power quality management techniques and policies via network strategic investment planning.

Relevant Foreground IPR

The project will generate a new engineering voltage and power quality index methodology. As this is intended to benefit all DNOs, should their deployment be justified, the methods will be freely available to all DNOs as part of the dissemination activities.

It is unlikely that any Background IPR will be required to use the new models.

Data Access Details

For information how to request data gathered in the course of this project, see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://ssen-innovation.co.uk/innovation-strategy/

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

No BaU funding exists for this type of work. The problem is only beginning to emerge as more LCTs connect to the network. The methodologies being considered in the project have yet to be fully proven and their suitability has never been fully demonstrated.

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 requires collaboration between DNOs and the industry to be successful, as well as performing trials on a DNO network. Therefore, the funding provided via NIA is suited for this type of project for it to progress into BaU. The methodology being considered is yet to be proven.

This project has been approved by a senior member of staff

☑ Yes