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

Mar 2023

Project Reference Number

NIA_SSEN_0066

Project Registration

Project Title

Power Supply for Pole Mounted LV Monitoring Devices where no Neutral is Present.

Project Reference Number

NIA_SSEN_0066

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

March 2023

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Tim Sammon, Innovation Delivery Manager at SSEN

Project Budget

£75,500.00

Summary

Monitoring the loading of GMT transformers within LV networks has become a BAU activity, however around 50% of the transformer fleet is pole mounted and trials of PMT LV Monitoring have commenced. A problem has arisen in deriving the 230V power supply required to operate the monitors. In several of the trial sites the neutral was not available to be connected to as it remains at height at pole top level, having not been taken down the pole adjacent to the fuse carriers. Due to the HV clearance zone, gaining access to the neutral in these situations requires a different skill set to that available when utilising normal linespersons. This project will look to develop a different methodology to derive this 230V supply.

Preceding Projects

NIA_SSEPD_0027 - Low Cost LV Substation Monitoring

Third Party Collaborators

Eneida

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

A net zero future promises reduced greenhouse gas emissions driven by a shift towards electrification. Electricity networks are expanding to allow the connection of wind and solar power generation to the distribution network together with increasing penetration of EV chargers and heat pumps. The additional stresses this brings to the distribution network has instigated the development of LV Monitoring equipment installed on the 400V outgoing side of ground mounted transformers to give virtually real time information on currents and voltages. This roll out has been successful on GMT locations.

SSEN however, has around 50% of its transformer fleet as pole mounted (circa 50,000 units) and the development of pole mounted monitors for these sites is being carried out without NIA assistance. Monitors are powered by a single phase 230V supply derived from a single monitored network phase and the neutral conductor.
During pole mounted monitoring installations trials, an unexpected problem was encountered. The neutral conductor had not been taken down the pole adjacent to the outgoing fuse carriers but had been taken at pole top level to the next pole.
This unexpected problem has implications for SSEN vulnerable customers many who live in remote rural areas and are at higher risk of fuel poverty. Without the development of pole mounted monitoring, these families will be derived of the benefits that monitoring of the low voltage network can bring, in the transition to net-zero. e.g., ability to participate in flexibility markets.
This project will attempt to find a solution and develop a prototype power supply unit for use where the neutral is not available, avoiding the need for specialist 11kV hot glove teams being required for this BAU activity.

Method(s)

The project is initially a research project followed by a real-world trial to deliver a 230V power supply at pole top level to power the LV Monitoring equipment.
It is intended that an easy to deploy solution will be developed capable of interconnecting via plug and pay terminals to the pole top monitor. It is envisaged the power supply unit will be mounted adjacent to the monitor which will be above the climbing guard.

Scope

Stage 1 Investigation as to the potential methods of deriving 230v power supply where no neutral is present including:
• Small solar panel
• CT clamp round the phase to harvest power, that would not require access to the substation LV neutral
• Phase to phase connection with no neutral in the case of multi-phase units
• Phase to HV earth through an isolating transformer or surge protector
• Battery (and combination of above)
• Install at the first pole out alongside the LV Neutral earth
• CT clamp round the phase to keep a capacitor topped up, basically parasitic power source.
This investigative phase shall produce a short report as to the disadvantages and benefits of the potential solutions. The report will identify a solution which will be taken forward and lead to the development of 2/3 prototypes.
Stage 2 Develop a prototype using the solution identified in Stage 1 and deploy this to live pole top monitoring situations.
As detailed in section 3.2, the project has the potential to deliver up to £4.522m in financial benefits to GB distribution customers based on monitoring of pole top transformers which would otherwise not be practical or cost effective to undertake an installation.

Objective(s)

Stage 1:
Literature review and research to determine the most appropriate method to obtain the 230V supply where the neutral is not accessible..
Stage 2:
Prototype development and testing of the selected solution in a pole top environment with monitoring equipment adjacent.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable.

Success Criteria

Minimum success criteria (Must and should)
Measure
Must be applicable to all manufacturers of pole top monitoring equipment
Successful deployment of protype units providing 230V to adjacent monitoring equipment.
Must be durable and resilient to environmental conditions
Evaluation of real environment testing to validate performance
Desirable criteria (Could)
Measure
Easy to use
Evaluation of real environment testing results via feedback

Project Partners and External Funding

Eneida

Rua Pedro Nunes
Edificio IPN E,3030-199,
Coimbra,
Portugal

Potential for New Learning

Network Operators hope to learn of an innovative method of providing a 230V supply to pole top equipment where no neutral is present. This technology would be applicable to other situations where the same problem exists.
The learning will be disseminated through the publication of NIA reports and opportunities will be taken to present to stakeholders such as other DNO's.

Scale of Project

This project is designed to develop learning, the scale of the project is sufficient to understand the specific issues associated with deriving a 230V supply where no neutral is present. The scale will allow application to several locations which will each have a unique existing physical installation of equipment. It might be the case that the solution is more practical in some locations over others. The project will demonstrate if 230V power supply unit is possible in the real-world environment and if it is successful, the solution is easily scalable. This research project is sufficient in scale to inform future decisions on the application of 230V power supply equipment in pole top applications where no neutral is present.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

The project will be undertaken across the following licence areas:
Scottish Hydro Electric Power Distribution
Southern Electric Power Distribution

Revenue Allowed for the RIIO Settlement

No revenue was allowed for this activity.

Indicative Total NIA Project Expenditure

The total expenditure expected from the project is £75,500
SSEN £15,500
Eneida £60,000
90% of which is allowable NIA Expenditure (£67,950).

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:

N/A

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

The percentage incidence of vulnerable customers is higher in rural locations with an increased incidence of fuel poverty. Increasing the locations where pole mounted monitoring can be installed will enhance the service that can be offered to our customers.

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)

The cost benefit analysis submitted within SSEN ED2 submission gives a cost of around £1,426 for a basic LV Monitoring install, averaging over ground and pole mounts.
However, a large proportion of our transformer family are of the pole mount variety-with ratings rating from 16kVa to 200kVa serving anything from single occupancy dwellings to 200 customers.
Without the development of pole mounted monitoring these families will be derived of the benefits that monitoring of the low voltage network can bring in the transition to net-zero. e.g., ability to participate in flexibility markets.
There are around 50,000 overhead transformers within SSEN, both North and South Regions, and our ED2 plans were to monitor around 20% of them, around 10,000 units. Approximately 20% of them supply less than three customers. Experience gained from the linespersons operating in the field indicates that those with less than three customers are most likely to have the neutral on the first pole out, inhibiting the installation of PMT LV Monitoring installation.
There will be a total of around 5,000 customers from our records who would otherwise be part of our monitoring programme. They will be disadvantaged by not having access to all the benefits the net-zero transition can bring due to their supply arrangements.
The base solution for these customers would be to drop a cable from the first pole out where a neutral is available and run a cable back to the base of the transformer pole fitting an appropriate enclosure to house a ground mounted monitoring unit. This incurs the additional cost, cabling, and IP rated enclosure and the additional cost of the ground mounted monitor as opposed to a pole mounted type. Cabling back to the transformer pole is a requirement of our operational personnel who would not want the monitor detached from the transformer.
The average cost of £1,426 in the ED2 submission covered installs across both pole and ground mounted installations. Ground mounted units are around £200 more expensive (£1,626) due to the additional outgoing ways that can be accommodated.
Consequently, the base case pole mounted installation with no neutral present is £4,400 comprising:
GMT Monitor unit
IP rated enclosure
70m of tracking and cable
With an estimated 2,000 PMT installs without a neutral present on the pole:
Base cost 2,000 * £4,400 =£8,800,000
The method case will be around (3,000 * £1,226) + (3,000 * £200) (anticipated cost of power supply unit) = £4,278,000

Please provide a calculation of the expected benefits the Solution

Project assumptions
Note that the Net Present Value(NPV) base cost of LV Monitoring is negative. The benefits or costs arising statement below is taken from the recent ED2 submission.
The NPV is heavily affected by the fact that LV monitoring is an enabler to a large range of other services and investments facilitating flexibility products, asset management, new connections and system control and operation. The benefits of those enabled investments are captured elsewhere in our RIIO-ED2 Business Plan (such as Load-Related Plan Build and Strategy (Annex 10.1) and Appendix F, DSO Strategy (Annex 11.1)). To avoid any double counting of benefits, they are not included here.

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

It is expected that the project will be equally applicable to all 14 DNO licence areas. Assuming benefits will be constant for all licence areas.

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

At this stage of the research project a method cost has not been calculated for roll out across the UK bearing in mind the benefits paragraph quoted in Project Assumptions.

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):

- [x] 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 new learning generated by this project can be applied and is of relevance to all Electricity Distribution Network Licensees as all DNO's have some measure of pole mounted transformers.

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?

- [x] 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.

There is currently no other project looking at this particular problem.

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

Ground mounted L V Monitoring has now become a business as usual activity for DNO's. They are only beginning to move into the trialling of pole mounted versions. The problem this project is attempting to solve has consequently not been encountered before.

Relevant Foreground IPR

The Relevant Foreground IPR will be knowledge and reporting. The project will conform to the default IPR position under the NIA governance.

Data Access Details

For information on how to request data gathered as part of this project see Network Innovation Competition (NIC) and Network Innovation Allowance (NIA) Data Sharing Procedure at https://ssen-innovation.co.uk/wp-content/uploads/2022/04/Network-Innovation-Competition-NIC-and-Network-Innovation-Allowance-NIA-Data-Sharing-Procedure-PR-NET-ENG-020.pdf

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

There are significant unknowns about how the feasibility developing a product of this nature will evolve. Consequently, this NIA project will undertake research and real-world trials to de-risk a potential BaU deployment.

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

The current operational risks and unknowns of this technology would stop the project being undertaken without the support of NIA.

This project has been approved by a senior member of staff

☑ Yes