Date of Submission

May 2021

NIA Project Registration and PEA Document

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.

Project Registration

Project Title

Low Cost LV Substation Monitoring

Project Reference

NIA_SSEPD_0027

Project Licensee(s)

Scottish Hydro Electric Power Distribution and Southern Electric Power Distribution

Project Start Date

March 2016

Project Duration

2 years and 9 months

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£1,233,000.00

Nominated Contact Email Address(es)

futurenetworks@sse.com

Problem(s)

Within the SHEPD and SEPD licence areas there are large numbers of 11Kv/415v secondary substations (around 100,000). Only a few of these secondary substations have any form of monitoring of the voltage and current values at the feeders or phases level.

While the commercial market has a number of suitable and readily available monitoring devices, they are expensive to procure and install. Based on learning from the recent, LCNF tier 2 project - New Thames Valley Vision (NTVV) project, typical costs are around £3,600 per substation.

If this voltage and current data was available at a lower cost it would be useful for operational decisions, network planning and customer service use as outlined below:

Operational Decisions

Records of “maximum” or “minimum” values would be easily assessed for significant periods (days, weeks, months, and possibly even years). This would be helpful in building a “big picture” view of the network performance to support decisions such as the suitability of back-feeds or generator sizing for planned works.

Operational users usually have to strike a balance between seeking more accurate information (e.g. going to site to take readings of current or voltage) and relying on experience, intuition and judgement. The quicker they can access real trustworthy information (from monitoring equipment) the more likely they are to follow the more objective approach to decision making.

Network Planning

Accurate and detailed historic loading information from monitoring, particularly maximum and mean currents can be used by planners to respond to requests from customers for new and increased capacity connections.

Planners have to strike a balance between seeking site based readings and employing more expedient heuristic techniques.

Power quality information such as voltage harmonic content can be drawn upon to assist in initial decision making e.g. permitting a particular load to be connected. This data will also assist in assessing the consequences of actions such as permitting a connection. The monitoring system provides good quality information of “before” and “after” that can be used to objectively inform commercial and technical discussions with customers.

Customer Service

Enquiries from customers are diverse, including requests for new connections, concerns about their own service (load or voltage), or concerns about the performance of the network. The availability of comprehensive periodic data can allow DNOs to respond objectively. If a network performance issue is identified, this can be addressed in an informed manner, in line with other agreed procedures.

Speed of response is crucial in meeting customers’ expectations and in complying with agreed procedures. Having access to a database that already contains the relevant periodic data is much quicker than visiting site for each request, deploying localised monitoring equipment for a week, then returning to site to recover the equipment, and downloading the data. By the installation of low cost monitoring devices consequential savings will be realised in the LV network by the deferment of a portion of the planned £38.7M reinforcement cost.

The proposal is to develop a system that can be fitted quickly, by a suitably trained competent person, and that will cost substantially less when purchased in the bulk quantities that SHEPD and SEPD are expected to require.

Method(s)

This is a technical method to develop and test a quantity of low cost devices from different manufacturers which will measure voltage and current at the outgoing feeders from a number of secondary substations.

A representative number of devices from each manufacturer will be trialled.

Data will be transmitted via the GPRS network from each substation to a central data centre where it will be available to the network planners and other relevant licensee staff.

Scope

To develop and test a representative quantity of low cost substation monitoring devices from a number of different manufacturers. These will be deployed in a selection of secondary substations and their measurements integrated with a central data centre using GPRS communications. This will be in order to allow informed decisions to be made by network planners and other staff with respect to operational decisions, network planning and customer service

Objectives(s)

The aim of this project is to reduce the cost of LV monitoring to make it economically viable to fit LV monitoring devices in large volumes to the secondary substations.
The cost of an existing LV monitoring system using figures obtained from the NTVV project is approximately £3,600 per substation
This project aims to procure the basic communications unit for a target price in the region of £30 to £40.However, the biggest cost associated with the present methodology is the current measurement device e.g. 24 for a six way feeder pillar. Taking both these into account, it is intended that the project will deliver complete systems which can be procured for a figure in the region of £500 with the potential to lower costs if economies of scale can be achieved by purchasing the current measuring devices in sufficiently large quantities.
The data parameters delivered will be similar to those obtained in the New Thames Valley Vision project. We expect a lower level of accuracy but still sufficiently accurate to determine the benefits which low cost monitoring of a large section of LV network can bring in terms of customer service, network planning and operational decisions.

The data will also assist us in reporting asset health, criticality and monetised risk in line with the Common Methodology required by Ofgem.

Demand clusters could be identified from the data together with the potential to identify pre-fault indications allowing early intervention.

Success Criteria

This project will be deemed successful if it can determine the technical and financial viability of low cost substation LV monitoring equipment in comparison with traditional higher cost equipment.

Technology Readiness Level at Start

TRL 3

Technology Readiness Level at Completion

TRL 9

Project Partners and External Funding

N/A

Potential for New Learning

As a result of this project, there is potential to understand the viability of low cost monitoring equipment for operational decision making and future integration into BaU.

Scale of Project

To gain the necessary learning from the project, the sample size has to be big enough to provide sufficient data for the identified applications.
The project will therefore monitor a number of 11kV rings derived from Distribution networks in Dundee, Elgin and Aberdeen.

Geographical Area

Trials will be performed within the SHEPD licence area.

Revenue Allowed for in the RIIO Settlement

Within the RIIO ED1 settlement SHEPD and SEPD identified a figure of £38.7M for L V cable asset replacement.

Indicative Total NIA Project Expenditure

The indicative Total NIA Project Expenditure is £1,233,000, 90% (£1,109,700) of which is Allowable NIA Expenditure.

Project Eligibility Assessment

Specific Requirements 1

1a. A 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 the GB the Network Licensee must justify repeating it as part of a Project) equipment (including control and communications systems and software)	X
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 Licensee's System	X
A specific novel commercial arrangement	

Specific Requirements 2

2a. Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Please explain how the learning that will be generated could be used by relevant Network Licenses.

The problem of visibility of the low voltage network is a common issue for all UK DNOs. Conventional equipment is available but at a cost which is prohibitive for large scale roll out. Should the low cost equipment give sufficient accuracy and reliability, it would be available as an option for use by any DNO .
All outputs and project reports will be shared with the OTHER DNO's to enable informed choices to be made.

Please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the Project.

N/A

2b. Is the default IPR position being applied?

Yes X

2c. Has the Potential to Deliver Net Financial Benefits to Customers?

Yes X

Please provide an estimate of the saving if the Problem is solved.

The saving which LV network monitoring could unlock on the basis of deferral of underground cable reinforcement within SSEPD'S areas is £12.6M . based on the RIIO-ED1 submission. The projected increase in Electrical Vehicle (EV) uptake and other low carbon technologies is the main driver to arrive at this figure.

In order to benefit from these smart savings i.e. intelligent allocation of smart technology (such as energy storage units) which lead to deferment of conventional reinforcement, there needs to be sufficient network monitoring equipment in place on the LV network. This is because visibility of the LV network is needed in order to identify areas where smart technology can be implemented. Along with network modelling (that requires network monitoring) these two technologies can identify optimum locations for smart technology investment leading to significant savings. These savings are consequential and not directly attributed to LV monitoring (or modelling) but are made available by the use of these technologies.

Please provide a calculation of the expected financial benefits of a Development or Demonstration Project (not required for Research Projects). (Base Cost - Method Cost, Against Agreed Baseline).

Base Cost =£1,203,000

Method Cost =£498,000

Net Financial benefit = Base cost – Method cost

Accordingly the project net financial benefit is calculated at £705,000.

Please provide an estimate of how replicable the Method is across GB in terms of the number of sites, the sort of site the method could be applied to, or the percentage of the Network Licensees system where it could be rolled-out.

This methodology could be applied by all UK DNOs. It is estimated that there are around 500,000 secondary substations within the UK. The availability of a method that can provide actual data at low cost would be invaluable.

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

Production of the units in bulk quantities would enable competitive costs to be obtained allowing the UK LV network asset base to be suitably equipped.

2d. Does not Lead to Unnecessary Duplication

Yes X

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

While other monitoring projects have been carried out these have all used conventional technology which currently has a much higher cost. The learning from SEPD's New Thames Valley Vision project has been analysed and used to inform the requirements for this project.
The Tier 1 WPD/UKPN project -LV Current Sensor Technology Evaluation evaluated similar concepts to the NTVV project but again used conventional higher cost equipment.

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

While other monitoring projects have been carried out these have all used conventional technology at much higher cost. This project will trial new innovative technologies to achieve a much lower cost product.

Additional Governance Requirements

Please identify

X

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

ii) Please identify why the Network Licensee will not fund such a Project as part of its business as usual activities

iii) Please identify why the Project can only be undertaken with the support of the NIA, including reference to the specific risks (eg commercial, technical, operational or regulatory) associated with the Project