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

Sep 2016

Project Reference Number

NIA_SPEN0013

Project Registration

Project Title

Interoperable LV Automation – Stage 1

Project Reference Number

NIA_SPEN0013

Project Licensee(s)

SP Energy Networks Distribution

Project Start

September 2016

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Andy Wilcox, SPEN Senior Project Engineer, NP&R; Geoff Murphy, SPEN Lead Engineer, NP&R

Project Budget

£106,839.00

Summary

This is Stage 1 of an intended two stage NIA project, the first stage is to design, develop and trial a prototype LV automation solution and this is achieved through the 5 phases outlined below:

- **Phase 1 – Production of a Functional Design Specification**
- **Phase 2 – Production of a Concept Design in 3D CAD with Design Calculations**
- **Phase 3 – Benchtop Prototype Demonstration**
- **Phase 4 – Prototype Testing**
- **Phase 5 – Onsite Testing**

If all phases are successful and the prototypes are proven to offer the performance benefits expected of them, then SPEN will proceed with a Stage 2 project to run a pilot demonstration of the technology to thoroughly evaluate its performance and the benefits it delivers.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Meshed LV networks are common place within SP Energy Networks (predominantly SPM), whilst these network provide greater

utilisation of network assets and a more secure supply for customers they do have some associated issues:

- Meshed LV networks require greater discipline and control to ensure the running arrangements are kept within the design and operational parameters
- They typically operate at higher fault level than radial networks due to interconnection of multiple secondary transformers
- HV automation schemes are reliant on the control of LV interconnections, the present approach to achieve this is through potentially costly network reconfigurations and subsequent control measures to ensure that the new running arrangements are maintained

LV Automation has the potential to provide a solution for the long term management of meshed networks, however, in order to do so there are a number of key requirements that need to be developed.

Method(s)

This project aims to develop and trial a prototype LV automation device for deployment on meshed networks. The device will be designed to:

- Autonomously and remotely un-mesh and re-mesh the network
- Provide customer service improvements through fault re-closing (designed for higher network fault level)
- Interoperate with existing and emerging fault location solutions
- Interoperate with HV automation schemes
- Provide real time visibility of the LV network configuration
- Fit all types of LV boards
- Keep deployment costs to a minimum with a targeted price per LV circuit board way of <£2,000

Scope

This is Stage 1 of an intended two stage NIA project, the first stage is to design, develop and trial a prototype LV automation solution and this is achieved through the 5 phases outlined below:

- **Phase 1 – Production of a Functional Design Specification**
- **Phase 2 – Production of a Concept Design in 3D CAD with Design Calculations**
- **Phase 3 – Benchtop Prototype Demonstration**
- **Phase 4 – Prototype Testing**
- **Phase 5 – Onsite Testing**

If all phases are successful and the prototypes are proven to offer the performance benefits expected of them, then SPEN will proceed with a Stage 2 project to run a pilot demonstration of the technology to thoroughly evaluate its performance and the benefits it delivers.

Objective(s)

Each discrete Phase has an objective:

- **Phase 1 – Production of a Functional Design Specification**

  As the title suggests, this phase looks to produce a Functional Design Specification (FDS) for the new LV automation solution that is designed to meet the requirements outlined in the Method section.

- **Phase 2 – Production of a Concept Design in 3D CAD with Design Calculations**

  As per title, with the resulting Concept Design being assessed by SPEN to approve its feasibility.

- **Phase 3 – Benchtop Prototype Demonstration**

  Demonstration of the physical performance of the prototype.

- **Phase 4 – Prototype Testing**

  Lab testing of the performance of x3 prototypes to ensure they are ready for field testing.

- **Phase 5 – Onsite Testing**

  Limited network trial of the prototypes to assess the suitability of their design and performance

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Each discrete Phase has a Success Criteria:

- **Phase 1 – Production of a Functional Design Specification**

  This phase will be successful if a feasible FDS can be agreed upon and published that provides the functionality required from the new LV automation solution

- **Phase 2 – Production of a Concept Design in 3D CAD with Design Calculations**

  This phase will be successful if SPEN signs off on the Design work and agrees to take this proposal to Phase 3

- **Phase 3 – Benchtop Prototype Demonstration**

  This will be a success if the initial prototype can successfully demonstrate its performance and functionality

- **Phase 4 – Prototype Testing**

  This will be a success if the prototypes pass the tests proposed in order to assess the solutions suitability for field trials

- **Phase 5 – Onsite Testing**

  This will be a success if the prototypes are able to demonstrate their full range of functions and stability on a live network

The continuation of the project will be reviewed at the end of each phase. If it is not feasible to continue to the next phase the project will be drawn to a close at the end of the previous phase.

At the end of Phase 5 SPEN and the project collaborators will discuss what is required in order to proceed to Stage 2.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Stage 1 of the project only considers a limited field trial of 3 units. Should it be a success then Stage 2 will look to deploy the units on a larger scale.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

TBC, but field trials likely to be within SPM licence area.

Revenue Allowed for the RIIO Settlement

NA

Indicative Total NIA Project Expenditure

97838.5

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:

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)

SPEN have estimated that replacing existing LV fuses with a device to autonomously un-mesh and re-mesh the network could save upwards of £3,000 per LV circuit as opposed to traditional reinforcement methods.

Please provide a calculation of the expected benefits the Solution

Base Cost

The simplest method available to un-mesh an LV circuit is to just remove fuses at one end of the circuit and in many instances this may work satisfactorily, however experience has shown that this approach often leads to other network issues such as voltage sag and thermal limits being exceeded.

The traditional approach to overcome these network issues has been to:

1. Install an LV link box at a strategic network point and remove the links, cost £5,000
2. Overlay all or part of the circuit with a cable of greater thermal capacity, cost circa £85 per metre.

    For two sub-stations 300 metres apart cost = 300 x £85 = £25,500

    For two sub-stations 500 metres apart cost = 500 x £85 = £42,500

Method Cost

The proposed solution is targeted to cost <£2,000 per LV circuit.

Base Cost – Method Cost

For (1) where network conditions dictate that simply removing fuses at one end of an LV circuit is not feasible then the minimum saving for the link box option is:

Cost of Link Box – Cost of Automation Device

£5,000 - £2,000 = **£3,000 per circuit**

For (2) where network conditions dictate that a cable overlay will be necessary to facilitate un-meshing then the savings will start from **£20,000 per circuit**.

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

The technology could be rolled-out across all Network License areas in the UK, whilst the solution is designed for meshed networks its functionality is equally applicable to radial networks.

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

If successful further work will be required to advance the TRL and generate a detailed understanding of the total costs to roll out this technology to UK operators, but it is expected that the unit cost will be <£2,000 per LV circuit. If each licence area were each to purchase 100 sets the rollout cost is £280,000.

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

LV automation is starting to become adopted more readily by UK DNOs, however, at this time the technology has not been developed or trialled to any great extent to benefit meshed HV and LV networks. This project will inform UK DNOs of the role LV automation can have in facilitating greater meshing on networks. A number of DNO innovation projects have already considered the conversion of traditional networks to meshed networks.

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

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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.

n/a

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

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes