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

Jun 2015

Project Reference Number

NIA_SSEPD_0010

Project Registration

Project Title

Mobile Generation Re-Sync at 11kV and 33kV

Project Reference Number

NIA_SSEPD_0010

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

June 2015

Project Duration

1 year and 11 months

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£120,000.00

Summary

The pole mounted CB to be used is an Intellirupter from S&C Electric, along with a custom designed frame which will be provided to allow it to be installed underneath live ABSs from ground level. Final connections to the overhead line will be made with the line still energized, using hot stick techniques and live line connectors. The CB has an integrated disconnecting switch which can be observed to be open during connection and disconnection operations which along with suitable parking bars for live line connectors, removes the need to incorporate earth switches either side of the CB to make it safe during the erection and removal process. The CB also has capacitive voltage sensing transducers on both sides of the CB and on all phases which can be used to ensure that the phase rotation is the same on both sides of the circuit breaker, prior to starting the synchronising process.

The CB will be connected in parallel with the open ABS and then transmit the relevant data on voltage and frequency from both sides of the CB and the phase angle difference between the two sides to a lap top computer using a wireless communications link. This will present the user with a simplified synchroscope and allow the user to give directions to the operators of the generating units to speed up or slow down the generators and to adjust the voltage on the islanded network to provide the right conditions to allow the island network to be re-synchronised back on to the main network.

When conditions are correct then the lap top will be used to provide a close instruction to the CB via the wireless link. When the CB is closed the ABS can then safely be closed and the CB removed from the circuit using live line techniques from ground level.

This will mean that customer supplies do not need to be interrupted to connect or disconnect temporary generation.

Third Party Collaborators

UK Grid Solutions Ltd

Heddle Construction

Horizon

S&C Electric

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

Due to the desire to improve customer service, SSEPD is increasing our use of temporary mobile generation to allow work to be carried out on the Distribution networks without interrupting supplies to customers. The current state of the art allows a DNO to connect a generator, start it up and supply customers with power from the generator before switching off the section of the electricity network which needs to be made dead and connected to earth to allow essential work to be safely carried out. The temporary generation is connected to the network using a technique called synchronising and takes place across a circuit breaker which is supplied as part of the generation installation. This means that at the start of the work the generators can be synchronised with the main network and a portion of the network can be supplied by generation without interrupting supplies to customers. However, at the end of the work, a short interruption is required to allow reconnection of the isolated network section to the rest of the Distribution network as there is currently no provision for synchronising across the switch which has been used to disconnect the network section. This causes inconvenience to customers and often results in running generation longer than necessary so that the customer interruption is carried out at a pre-arranged time as notified to the customers which will have been set to make due allowance for potential variations in the time taken to carry out the work. This also incurs greater fuel consumption and higher carbon dioxide emissions than are strictly necessary.

Method(s)

A mobile, trailer mounted Circuit Breaker (CB) has been developed and trialed in SSEPD under a previous IFI project which has successfully proven the concept but the methodology needs further development to ensure that it is fit for purpose.

It is proposed to develop a technical methodology utilising the installation of a 33kV pole mounted CB using live line techniques which can be used at all distribution voltages from 11kV to 33kV on poles with Air Break Switches (ABS. The ASBS can be either underslung or pole top mounted, with either hook stick operation or with a conventional manual handle at ground level. The same CB can be used for both 33kV and 11kV voltages used on SSEPDs Distribution network. The use of a single device gives considerable operational flexibility especially in the more difficult to reach areas of SHEPDs territory in the Highlands and Islands where single circuits are often deployed due to the long circuit lengths and low customer numbers in sparsely populated areas.

Scope

The pole mounted CB to be used is an Intellirupter from S&C Electric, along with a custom designed frame which will be provided to allow it to be installed underneath live ABSs from ground level. Final connections to the overhead line will be made with the line still energized, using hot stick techniques and live line connectors. The CB has an integrated disconnecting switch which can be observed to be open during connection and disconnection operations which along with suitable parking bars for live line connectors, removes the need to incorporate earth switches either side of the CB to make it safe during the erection and removal process. The CB also has capacitive voltage sensing transducers on both sides of the CB and on all phases which can be used to ensure that the phase rotation is the same on both sides of the circuit breaker, prior to starting the synchronising process.

The CB will be connected in parallel with the open ABS and then transmit the relevant data on voltage and frequency from both sides of the CB and the phase angle difference between the two sides to a lap top computer using a wireless communications link. This will present the user with a simplified synchroscope and allow the user to give directions to the operators of the generating units to speed up or slow down the generators and to adjust the voltage on the islanded network to provide the right conditions to allow the island network to be re-synchronised back on to the main network.

When conditions are correct then the lap top will be used to provide a close instruction to the CB via the wireless link. When the CB is closed the ABS can then safely be closed and the CB removed from the circuit using live line techniques from ground level.

This will mean that customer supplies do not need to be interrupted to connect or disconnect temporary generation.

Objective(s)

Prove that the system is safe to install and remove.
Carry out a successful re-synchronising operation on the 11kV and 33kV distribution network

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Determine the technical and operational viability of the proposed methodology
Quantify the savings in CIs and CHLs which could be saved by the use of this technique
Determine the commercial viability of applying this methodology across the SHEPD and SEPD license areas.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

One physical unit is the least which can be considered and the use of a 33kV CB provides flexibility to operate at both 11kV and 33kV allowing the technique to be proven at different voltages. An 11kV only scheme could have been developed but the cost savings would have been less than £8k and would have resulted in customers on 33kV circuits not being able to enjoy the same level of service as those on 11kV circuits.

Technology Readiness at Start

TRL8 Active Commissioning

Technology Readiness at End

TRL9 Operations

Geographical Area

There is no specific geographical area identified and site trials will be undertaken as the opportunity arises on suitable work sites in the SHEPD license area.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The indicative Total NIA Project Expenditure is £120,000 90% of which (£108,000) is Allowable NIA Expenditure

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)

Estimated savings per device are £38k per annum.

Please provide a calculation of the expected benefits the Solution

The present procedure includes an interruption in customers' supplies to allow the disconnection of temporary generator which causes an estimated average of 30 minutes of lost supply per instance. The proposed process incurs no CHLs or CIs.
It is considered that no additional labour costs are incurred to operate this device as often staff have to wait around at the end of a planned period of work until the pre arranged time to interrupt customers arrives.
A small saving in fuel consumption of the generators and a small saving in corresponding CO2 emissions will result.
Based on a saving of 2000 CIs and 1000 CHL per year over 40 different jobs (average 50 customers kept on with generation per job) and with a fuel cost saving of 25p per kWh based on restoration one hour earlier than would have been the case otherwise gives a saving of £38,400 per year.

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

This system could be used on any overhead high voltage network from 11kV to 33kV and with slight modifications a device to cover 6.6kV to 22kV overhead networks could be provided. This would enable the method to be used by all UK DNOs.

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

The appropriate number of devices for Each DNO will depend upon factors such as their geographic territory, network topology and use of temporary generation.
However, it is considered reasonable to estimate that this could be in the range of 2 to 10 devices per DNO Area. Taking an average of 5 would give a total of 70 units in GB at an indicative cost of £70k per device to produce a total cost in the order of £4.9million.

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

It will improve customer service for any UK DNO using temporary generation to maintain supplies during planned work or to restore supplies following a fault.

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