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 2014

Project Reference Number

NIA_SPT_1310

Project Registration

Project Title

Shunt Reactor Switching Innovation Study

Project Reference Number

NIA_SPT_1310

Project Licensee(s)

SP Energy Networks Transmission

Project Start

March 2014

Project Duration

0 years and 5 months

Nominated Project Contact(s)

James Yu (Future Networks Manager)

Project Budget

£48,000.00

Summary

Initially, the focus of the project will be on the switching of 33kV rated shunt reactors (based on the cost and existing experimental facilities), but other voltage levels may be considered.

Third Party Collaborators

Energy Innovation Centre

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Scottish Power Energy Networks (SPEN) propose to undertake an innovative research project to investigate whether standard switchgear can be used to switch shunt reactors, or whether specialised switchgear or switchgear of a higher rating is required. If it is found that higher rated switchgear is necessary, it will be determined if a more economical solution would be to modify standard switchgear by means of shunt capacitors, surge arrestors or snubber circuits.

The similar technical principle will be similar between distribution (33kV or 11kV) as the transmission connected shunt reactor (at 132kV).

Method(s)

The work for this study will be broken down into a set of discrete tasks divided into two study phases as listed below.

Phase 1

- Literature survey into shunt reactor switching
- Liaise with manufacturers and SPT Asset Management to define factory test data currently available
- Investigate current SPEN systems, simulate various items of equipment, designs and connections
- Investigate practical mitigation techniques

Phase 2

- Measure shunt reactor characteristics

Practical testing of a vacuum circuit breaker and reactor combination

Scope

Initially, the focus of the project will be on the switching of 33kV rated shunt reactors (based on the cost and existing experimental facilities), but other voltage levels may be considered.

Objective(s)

Develop guidelines for reactor switching transient recovery voltage (TRV) simulations at 33kV (and other voltages)

Make recommendations for circuit breaker rating and mitigation options for inclusion in a company policy document.

If the outcomes are useful, there could be the possibility of extending the project to cover higher voltages and series reactors.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

This project will be deemed successful if a more economical solution is determined for reactor switching.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is primarily focused on 33kV circuit breaker solutions with associated computer simulation and laboratory-based tests. However the principle will be deployed at transmission level with appropriate improvements.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

SPT transmission network

Revenue Allowed for the RIIO Settlement

There are 9 shunt reactors to be replaced during RIIO-T1 which equates to a cost of £576k for 9 x 132kV circuit breakers (circa £64k).

Indicative Total NIA Project Expenditure

The total NIA expenditure is expected to be £48,000.

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:

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)

It is difficult to put a definite figure on the overall potential cost savings that may be identified as a result of this innovation study.

In isolation, the best case cost savings would be if it is identified that a 33kV circuit breaker (circa £20k) can be used for the shunt reactor switching as opposed to existing shunt reactor installation designs which have a 132kV circuit breakers (circa £64k).

As there are 9 shunt reactors to be replaced during RIIO-T1 this would equate to a 9 x £44k = £396k savings to the RIIO-T1 programme, however other design factors may be identified in the study, i.e. the need for a CVT to be included in the design and that all shunt reactors should be cable connected may also be an eventual requirement. These other design factors may reduce the savings hence why a definite cost savings figure is difficult to be deduced at this stage.

In addition, the results of this study may, potentially, lead to optimisation of procurement specifications.

Please provide a calculation of the expected benefits the Solution

N/A at this stage.

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

N/A at this stage.

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

N/A at this stage as this work will determine appropriate circuit breaker rating and mitigation options.

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 generated from this study will inform Network Licenses on cost effective shunt reactor tripping options.

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

- [x] Yes