NIA Project Registration and PEA Document

Date of Submission

Jul 2015

Project Reference Number

NIA_NPG_002

Project Registration

Project Title

Integrated substation Condition Monitoring (ISCM)

Project Reference Number

NIA_NPG_002

Project Licensee(s)

Northern Powergrid

Project Start

April 2015

Project Duration

5 years and 1 month

Nominated Project Contact(s)

Joseph Helm

Project Budget

£573,282.00

Summary

- Install Integrated Substation Condition Monitoring equipment to 96 11kV circuit breaker panels at seven Northern Powergrid primary sites.

- Collate data from installed equipment to a central server for a period of two years from the installation of equipment at the last site.

- Establish appropriate thresholds for alarm signals.

- Undertake analysis of the data periodically throughout the project to identify any correlation between variables or trends in circuit breaker performance.

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

The reliable operation of circuit breakers is crucial to the dependability and safety of the distribution network, where failure of a circuit breaker to function causes the next zone of protection to operate, resulting in a greater number of customers off supply and consequently a greater financial impact on the business through IIS penalties.

Northern Powergrid is committed to making greater use of asset condition and performance data to inform asset management decisions. To facilitate more accurate intervention strategies and better supported investment decisions, greater and wider use of real time monitoring and diagnostics on the distribution system is needed.

This project aims to gather circuit breaker performance and operating environment data through the use of a real time monitoring system applied to several common types of switchgear.

Method(s)

The method proposed is an Integrated Substation Condition Monitoring system (ISCM) comprising:

- Monitoring of partial discharge activity
- DC trip coil profiling including battery voltage monitoring
- Operating/breaking currents & times (I2t)
- Operating environment – temperature & humidity

The majority of sensors proposed are already used by Northern Powergrid, the key area of development is the integration of all the sensors into one system, allowing the correlation between variables to be explored and trends in circuit breaker performance to be identified.

Scope

- Install Integrated Substation Condition Monitoring equipment to 96 11kV circuit breaker panels at seven Northern Powergrid primary sites.
- Collate data from installed equipment to a central server for a period of two years from the installation of equipment at the last site.
- Establish appropriate thresholds for alarm signals.
- Undertake analysis of the data periodically throughout the project to identify any correlation between variables or trends in circuit breaker performance.

Objective(s)

Asset reports shall be produced at periodic intervals, typically each calendar month or other frequency set by the user. The content and format of reports may typically include:

- Graphical representation of pd activity on each switchboard
- Trending of pd activity with appropriate alarm thresholds for high rates of change in activity
- Summary of circuit breakers tripped and plot of dc trip current profile for each event
- Representation of the cumulative energy (I2t) interrupted by each circuit breaker
- Graphical representation correlating pd activity and environmental conditions

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project success criteria are defined as follows:

- Successful installation of circuit breaker condition monitoring equipment and partial discharge monitoring equipment at 7 substations with a total of 96 panels
- Successful collation of data from installed equipment
- Production of asset performance reports to inform Maintenance Policy and asset replacement/refurbishment decisions
- Initiation of remedial work or other intervention to improve circuit breaker performance
- Improvement of circuit breaker performance in relation to Failure on Demand, slow opening, etc.
- Prevention of an incident relating to circuit breaker failure by triggering intervention
- Trending of partial discharge for specific circuit breakers and circuit breaker by manufacturer and type
- Establish appropriate alarm thresholds for each circuit breaker type
- Demonstrate trends in dc trip coil profile for specific circuit breakers and circuit breaker by manufacturer and type
- Establish acceptable profile envelope for each circuit breaker type
- Trigger post fault maintenance by I2t measurements
- Demonstrate the relationship between environmental operating conditions and the level of partial discharge activity
- Demonstrate the relationship between environmental operating conditions and dc trip coil profile

Project Partners and External Funding

The Project is wholly NIA funded.

NPG (NIA funding £573,282)

Potential for New Learning

- Data collated will support the effective risk management of circuit breakers
- p-f intervals for specific failure modes may be more clearly understood
- The impact of operating environment on circuit breaker performance may be more clearly understood

Scale of Project

Installation of Integrated Substation Condition Monitoring equipment to 96 11kV circuit breaker panels at seven Northern Powergrid primary sites.

Technology Readiness at Start

TRL8 Active Commissioning

Technology Readiness at End

TRL9 Operations

Geographical Area

The identified sites cover five of the nine Northern Powergrid network zones:

- Hartlepool, Cleveland
- Newcastle-upon-Tyne
- Sheffield
- Hebden Bridge, West Yorkshire
- Hull
- Stannington, South Yorkshire
- Barnsley, South Yorkshire

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The design element of the project was undertaken as Part 1 during the DPCR5 period and incurred a cost of £284k. The delivery elements of the project. Part 2, are included in this proposal.

The total Part 2 Project cost is £573k of which 90% is allowable NIA expenditure (£516k).

NPG external expenditure - £520,851, NPg internal expenditure - £52,431

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)

The benefit of safely deferring asset replacement by 5 years over the nominal life of 60 years is assessed to be 0.7m p.a. to Northern Powergrid alone. If confidence in the data was such that life could be extended by 10 years, the saving would be 1.4m p.a.

Please provide a calculation of the expected benefits the Solution

The NPV shows a benefit of £3m or £5m for 5 year and 10 year life extension respectively over a period of 16 years.

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

The Method could be applied to the substation assets of all network operators.

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

The expected cost for the monitoring equipment is £50,000. This is likely to fall significantly if take-up is high.

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

All Network Licensees will be able to use the learning generated as the outcomes will be relevant to all network operators.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

This project meets the identified requirement to increase network reliability and availability.

☑ 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.

There are other systems capable of collating substation condition data, however this Method provides the ability to collate data in a single location and undertakes to analyse the information to establish trends in circuit breaker performance and identify any correlation between the variables recorded.

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

Legacy change

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

Legacy change

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

Legacy chnage

This project has been approved by a senior member of staff

☑ Yes