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

Dec 2015

Project Reference Number

NIA_ENWL012

Project Registration

Project Title

Investigation of Switchgear Ratings

Project Reference Number

NIA_ENWL012

Project Licensee(s)

Electricity North West

Project Start

December 2015

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Electricity North West Innovation Team

Project Budget

£300,000.00

Summary

This project will conduct a series of investigative fault withstand tests to enable the assignment of new short circuit ratings which can be applied to devices based on the network location and protection operating time.

Third Party Collaborators

KEMA

Long Controls

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

Historically DNO networks are designed to cater for unidirectional power flow, predictable fault current paths and predictable fault current levels. Due to government CO2 targets there is an increasing amount of generation being connected to the network at all voltage levels resulting in bidirectional power flows, unpredictable fault current paths and higher fault current levels.
These generators provide an additional infeed to the network and under fault conditions this infeed will contribute to the level of fault current causing an increase which in some conditions may be quite significant. This results in more areas of the network running close to or possibly beyond the designed fault current rating.
Existing innovation projects, including the Electricity North West Second Tier Project Respond, are investigating methods of controlling this fault level and are particularly focussed on the 11kV primary substation circuit breakers.
Network operators have a significant population of 11kV (and other high voltage) distribution switchgear such as Ring Main Units etc which will be expected to carry this increased fault current without damage. This equipment has a manufacturer's assigned rating which declares the level of current it can safely carry for 3 seconds. In practice equipment will only be exposed to fault currents for a

much shorter period of time owing to fast operation of protection to clear the fault.
Further it is important to note that the fault current diminishes the further away from the primary substation source. Given these factors it would be beneficial to calculate the fault level headroom based on the equipment location on the network and the local protection operating times.
As part of the preparation work for Respond Electricity North West tested a small sample of the distribution switchgear population which successfully demonstrated its capability to carry this increased fault currents for a shorter period of time.
Building on this earlier work it is the intention of this project to develop a short circuit (fault withstand) performance “envelope” for a range of the more commonly used distribution switchgear variants. This will allow “tailored” replacement decisions based on the actual fault levels at the equipment location and the actual capability of the equipment.

Method(s)

This project will conduct a series of investigative short circuit tests at an independent testing station to create a short circuit performance “envelope” detailing maximum levels of current at a range of times up to 3 seconds on a range of distribution switchgear. The fault level performance levels will be further informed by the age and condition of the equipment.
Electricity North West will use standard fault level calculation software to understand the actual fault level the distribution switchgear will be exposed to.
From the tests and the fault level calculations Electricity North West will then be able to assess the correct Fault Level headroom and target the fault level reinforcement programme more effectively.

Scope

This project will conduct a series of investigative fault withstand tests to enable the assignment of new short circuit ratings which can be applied to devices based on the network location and protection operating time.

Objective(s)

1. Carry out a series of investigative short circuit tests at an independent test station on a range of commonly used distribution switchgear and publish revised fault level ratings where appropriate.
2. Calculate the actual fault level at distribution substations and the level of typical attenuation.
3. Assess the available fault level headroom.
4. Publish a report outlining the details of the investigations and the potential for application of revised ratings.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Completion of the short circuit tests and reports.
2. Table of actual fault levels at distribution substations
3. Table of actual fault level headroom.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project will cover the legacy distribution switchgear on the Electricity North West network.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL9 Operations

Geographical Area

North West of England

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

300000

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)

£1-10M depending on the test results and subsequent deferred reinforcement.

Please provide a calculation of the expected benefits the Solution

The base cost is the cost to replace the distribution switchgear due to fault level issues in RIIO-ED1.
For the method the testing is one-off type testing this cost will be spread across the switchgear population to be replaced.
For each individual site a fault level calculation will be carried out and a reassessment of the fault level headroom using the test results. This would be a planning engineer's time for approximately half a day.
The benefit is then
(Replacement cost – (proportion of testing cost +half a day planning engineer's time)) x number of units to be replaced in RIIO-ED1.
As we will be conducting more targeted replacement programmes it will result in less unplanned disruptive work in the street. This can result in Environmental (and possibly Carbon) benefits due to the reduction in machinery and materials used.

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

The test results from this project can be applied to all switchgear of that variant. For those not tested in this project other Network Operators can apply the methodology used to reassess the ratings of other switchgear variants. Therefore the learning from this project could be applied to all DNO distribution switchgear

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

The rollout costs will depend on the switchgear variants used by the Network Operator. For those networks with switchgear similar to Electricity North West there will be no rollout cost.

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 short circuit performance envelope produced by this project will enable DNOs to assign more appropriate ratings to their distribution switchgear potentially avoiding the need for replacement. For those switchgear types not tested in the project Network Operators can use the methodology in the project to conduct the testing and subsequently assign new ratings.

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

In Electricity North West's innovation strategy the core principle is to maximise the use of existing assets via innovative solutions to deliver greater value for customers.

This project will allow the assignment of more realistic ratings to distribution switchgear resulting in a more efficient and targeted fault level replacement programme.

☑ 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