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

Mar 2020

Project Reference Number

NIA_UKPN0057

Project Registration

Project Title

Circuit See

Project Reference Number

NIA_UKPN0057

Project Licensee(s)

UK Power Networks

Project Start

February 2020

Project Duration

2 years and 3 months

Nominated Project Contact(s)

John Moutafidis

Project Budget

£957,000.00

Summary

The project is designed as a two-phase project each with its own clear aims and deliverables. The ultimate aim of this project is to provide a demonstration of the fault level monitoring technology on small sections of UK Power Networks' network, to validate the commercial and technical benefits and establish a clear path to delivering a business-as-usual service as a result.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

There is a need to monitor fault levels at substations when fault levels reach 95% of the equipment's limits.

At present, UK Power Networks makes use of a software tool called PowerFactory to calculate fault levels. This value informs UK Power Networks and allows us to take corrective action where fault levels are at 95% or more in accordance with our internal standards.

According to those standards, where fault level is between 95% and 100% of switchgear rating, UK Power Networks is required to install fault level monitoring equipment at the associated primary or grid substation busbar. Once fault currents exceed 100% of equipment's rating UK Power Networks is required to seek suitable mitigation.
Installing fault level monitoring is a costly endeavour and there is an opportunity to improve the accuracy of current technology to ensure that such spend is made as efficient as possible.

Method(s)

The method proposed in the project is to implement an approach to provide continuous on-line fault level monitoring with three key components.
1. Active fault level measurement performed on the LV network of 11kV substations
2. Passive fault level measurement performed on feeders of primary substations
3. Correlation and verification techniques implemented to provide fault level monitoring across an entire radial network.

The solution provider is Reactive Technologies (RTL). The solution builds up a picture of the fault level across an entire radial network beneath a grid supply point based on machine learning techniques. Due to the active measurement approach the high frequency of measurements allows for high accuracy and for fault level to be correlated between substations. This approach allows the solution to benefit from a larger scale of deployment. The technology has been developed in a laboratory setting and is subject to patent application. The next stage of development is to trial in an operational environment.

Scope

The project is designed as a two-phase project each with its own clear aims and deliverables. The ultimate aim of this project is to provide a demonstration of the fault level monitoring technology on small sections of UK Power Networks' network, to validate the commercial and technical benefits and establish a clear path to delivering a business-as-usual service as a result.

Phase 1: Verification of RTL's fault level measurement against PowerFactory Model

The validation technique will perform a parallel running of the existing power factory model and the new measurement technique. The PowerFactory model will output calculated fault levels which can be deemed as the true fault level in this exercise. The model will also output simulated COMTRADE files to be used as inputs in RTL's method to measure fault level. A comparison of the PowerFactory calculated fault level and the RTL measured fault level will provide verification of the technique. The deliverables of the validation study will be a report providing a quantitative comparison of the PowerFactory Model and RTLs fault level monitoring method.

Phase 2: Implementation of fault level measurement in a UK Power Networks study area

Once the phase 1 method has been validated, the main aim for phase 2 is to demonstrate that the RTL fault level monitoring method can be deployed to measure fault level in the field.

The main deliverable for phase 2 is proof of concept demonstration for a fully automatable approach to correlate and interpret fault level across the study area using continuous live monitoring. RTL will deliver a report to UK Power Networks which will detail the input data, assumptions, correlation and statistical analysis methodology. Supporting calculations will be included and the results will be presented clearly and concisely in an agreed format.

Lastly there will be wider dissemination of the trial results, Foreground IP generated and replication strategies aligned to the NIA governance.

Objective(s)

The project aims to demonstrate and trial the RTL solution in order to prove that it is an accurate, scalable and cost effective model of deploying fault level monitoring at sites where fault levels have exceeded 95% allowable limit, as estimated by PowerFactory.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Aligning with the objectives the project will be considered successful when it showcases

- How accurate the RTL solution is in calculating fault levels.
- How effective the correlation and verification techniques are.
- How the system could be deployed in a DNO network.
- A methodology to approximate the cost of deployment.

Project Partners and External Funding

No external funding has been granted for this project.

Potential for New Learning

As part of this project, it is expected to learn the accuracy of RTL's solution. Moreover, learning will be generated during the installation phase which includes both practical terms but also the technicalities of deploying the solution. Lastly, the best way to strategically deploy the solution to the network to achieve maximum efficiency at lowest cost can be determined at the end of the project.
All this learning will be disseminated through the NIA official reports, the UKPN Innovation website and other industry events.

Scale of Project

The scale of the project is the minimum required to successfully prove the solution.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

In the area covered by Eastern Power Networks, London Power Networks and South Eastern Power Networks.

Revenue Allowed for the RIIO Settlement

There was no revenue allowance in RIIO-ED1 for this activity.

Indicative Total NIA Project Expenditure

£861,300.00

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 new solution could potentially defer substation upgrade works triggered by fault level constraints. The fault levels on our network are calculated with the use of desktop studies and the PowerFactory software. However these calculations are always in the conservative range due to the limitation of the software. We have made the assumption that RTL's real time fault monitoring solution could help defer reinforcement by one year on twenty percent of our fault level constrained substations. Additionally fault level constraints require operational switching to be done at nights when fault levels are low. This operational switching could be avoided if we had a more accurate view of the fault levels. Finally avoiding operational switching at night reduces the possibility of safety incidents.

Please provide a calculation of the expected benefits the Solution

The main financial benefit for this project is occurring because of the deferral of substation reinforcements due to the release of fault level capacity. Additionally some labour costs for operational switching can be avoided. The base cost of reinforcement for a substation is roughly £3,000k. Assuming that the solution can defer reinforcement for two years on one out of three substation that the solution is applied then the Method cost in present value would be £2,975k. Therefore a benefit of £25k per substation. We have more than a hundred fault level constraint substation. If we apply the method to fifty of them, with the above assumption we get a benefit of £1,250k.

There are additional benefits from avoiding switching operations by field operatives to lower fault levels. This switching is commonly done at night when fault levels are low. As such there are also safety benefits from not putting people to work at night-time. Further value can be extracted in the future from further network insight that these devices can provide.

UK Power Networks has three licence areas. Assuming that other DNOs networks are in similar fault level capacity and using the number of licence areas as the rough indicator of percentage share of the entire network by UK Power Networks, then deployment of the method in the fourteen licence areas of GB could provide a £5,800k financial benefit.

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

The solution is replicable across GB.

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

The proposed commercial model by the manufacturer is a subscription-based model for the provision of the services. We estimate that deployment cost would be in the range of £1m per licence area. The ongoing costs depend on the number of substations that need to be monitored.

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

We will share the results of the trials so other Network Licensees can develop the confidence to use the system in their network. Other Network Licensees can then use the same solution to monitor the fault level constrained substations and decide how to manage them.

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.

There is another project to solve the same problem but follows a different method – see below for reasons for completing this project.

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

The proposed solution is first of its kind and was not previously available in the market

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

The equipment is unproven in GB, hence carries significant risk for BAU deployment. As such, it is appropriate for the project to be funded via innovation allowance.

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

The project can only be undertaken as an innovation pilot given the operational risks associated with the deployment of an unproven solution in network operations. As noted in the NIA guidance, certain projects are speculative in nature and yield uncertain commercial returns. This is the case for with this project. There is a commercial risk that the solution developed as part of the project is not adopted by the stakeholders involved following the trial period. This could be due to the fact that the solution has not reached the level of maturity required for business-as-usual application. This risk is being mitigated against through early engagement with stakeholders and ensuring requirements are clearly defined and documented. If the project is successful, it will have proven a number of technical solutions and business processes which will improve customer service.

This project has been approved by a senior member of staff

☑ Yes