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

Jan 2020

Project Reference

NIA_UKPN0055

Project Registration

Project Title

Arc Aid

Project Reference

NIA_UKPN0055

Project Licensee(s)

UK Power Networks

Project Start

February 2020

Project Duration

2 years and 7 months

Nominated Project Contact(s)

Benjamin Gabb, Romina Arefin

Project Budget

£571,000.00

Summary

This project will trial a new type of fault indicator (Metrysense 5000) which will help locate faults in a shorter time compared to a full line patrol, therefore reducing operational costs, the number of customers off supply and Customer Minutes Lost (CMLs). This will also decrease the time a live conductor could potentially be on the ground, and therefore will reduce the risk to members of the public.

Metrysense 5000 is a fault indicator suitable for the arc suppression coil network arrangement, which can offer detailed information to a DNO's control centre on the fault location. This has been used successfully in other countries for similar network configurations but at higher voltage levels. This technology has never been tested in the United Kingdom.
Metrysense 5000 will send real time data once integrated into UK Power Networks' and WPD's SCADA system. As part of the project, the fault indicator will be tested first at the Power Networks Demonstration Centre (PNDC) in a simulated network environment. If the testing is successful, it will be followed by training of operational staff, integration into the SCADA system, equipment installation and commissioning across five 11kV feeders in EPN and 10 33kV feeders from a Bulk Supply Point (BSP) in the South West.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Certain 11kV networks in Eastern Power Networks (EPN) and 33kV networks in the South West have arc suppression coil (ASC)

earthing configurations (also known as Peterson coils) to allow these lines to remain energised in the event of a fault on a single phase conductor for up to two hours. This network configuration can pose a potential hazard to the public through personal contact and the presence of step potential. The possibility of arcing can pose another serious risk to the public and to staff.
This network configuration makes it very difficult to locate faults as linesmen are required to patrol several miles of area in order to find the dropped conductor resulting in high operational costs. Common devices used for fault locations on lines can only operate on solidly earthed networks and not on ASC earthing configurations. This increases the risk of public exposure to a potentially live line as well as the strain imposed on the other 'active' lines reducing the assets' lifetime.
In addition to a potential hazard, networks with ASC earthing configuration are more prone to faults than other parts of the network, particularly during a storm, as they are often located in rural areas. A fault indicator suitable for ASC arrangements could help DNOs locate and resolve a fault faster than a full line patrol, reducing operational costs and improving safety, ultimately providing a better service to our customers.

Method(s)

This project will trial a new type of fault indicator (Metrysense 5000) which will help locate faults in a shorter time compared to a full line patrol, therefore reducing operational costs, number of customers being off supply and Customer Minutes Lost (CMLs). This will also decrease the time a life conductor is on the ground, and teherfore increase public safety.
Metrysense 5000 is a fault indicator suitable for the arc suppression coil network arrangement, which can offer detailed information to a DNO's control centre on the fault location. This has been used successfully in other countries for similar network configurations but at higher voltage levels. This technology has never been tested in the United Kingdom.
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October 2020

This project required an extension to mitigate the impacts of the COVID-19 related lockdown. As such the duration of the project was increased by three months and will now end in October 2021.

Scope

The scope of the project is to:
1. Procure the equipment required for the testing at the PNDC and for the network trial
2. Test the Metrysense 5000 fault indicator at the PNDC in conditions that replicate the network
3. Analyse the results from the PNDC trial to assess if the technology is suitable
4. Train staff in the installation of these units
5. Install units in EPN
6. Install units in South West
7. Integrate the sensors into UK Power Networks' and Western Power distribution's control and SCADA system
8. Collect data in the trial area
9. If the trial successfully confirm the expected benefits, the business case (i.e. Cost Benefit Analysis- CBA) will be updated based on the project findings and create a new standard and procedure for the implementation of the technology into the business
10. Plan the adoption of this new type of fault indicator as Business as Usual (BaU) solution

October 2020

In order to fulfill the project objectives the following changes in scope were implemented:
- The testing method at PNDC was updated to be real time digital simulation (RTDS) as it offers more conclusive findings and better quality data remotely and does not require physical witnessing which is problematic during this pandemic
- An additional phase of cybersecurity testing (Western Power Distribution)

The budget was updated to account for these additional and/or revised deliverables.

November 2021

The project requires extension and additional budget as the SCADA and control integration is more complex than initially envisioned. This budget and time will allow the following additional scope:
• Relay installation and commissioning

• SCADA systems integration and testing (the initial integration was only a symbol and alarm, this is in addition to that)
• PowerOn full integration with migration from supplier's platform

Objective(s)

The project aims to:
- Trial the Metrysense 5000 fault indicator
- Demonstrate how this unit can be utilised to improve the fault location in case of ASC earthing configurations, therefore helping to keep Peterson coils network arrangements commissioned safely
- Analyse how reliable, robust and cost effective the new protection/monitoring system is
- Demonstrate how operational costs and CMLs can be reduced on trial feeders if the technology is successful
- Assess the safety improvement following the deployment of the units

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be considered successful if:
- The units can be evaluated for fault location in 11kV and 33kV ASC networks
- An assessment of the real benefits delivered by METRYSENSE 5000 fault indicator when installed on the network has been carried out to provide the evidence required to decide whether the solution should be implemented more widely or not.

Project Partners and External Funding

• Metrycom: project supplier (procurement of the Metrysense 5000 fault indicator)
• Power Network Demonstration Centre: project supplier (testing the equipment at the PNDC facilities)
• Western Power Distribution

Potential for New Learning

This project will provide insight in how UK Power Networks and Western Power Distribution can continue to operate arc suppression coils while reducing fault location and interruption time and reducing the potential hazard. The data gathered will also help the industry understand cross-country faults, its wider implications and how they can be prevented. Reports will be created at the end of each testing phase, i.e. the simulated environement testing and the live feeder trial. This will be available to all DNOs and will be shared with the members of the Energy Networks Association relay and protection working group.

Scale of Project

This project will be in EPN and the South West. It would be difficult to draw reliable conclusions and collect enough data for fewer sites. This is the minimum amount required to make the findings significant for both the 11kV and 33kV networks.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be carried out in a rural network in Eastern Power Networks license area of UK Power Networks and in South West for the Western Power Distribution's trial.

Revenue Allowed for the RIIO Settlement

UK Power Networks and WPD did not include expenditure relating to the development of sensors for arc suppression coil earthing networks in our RIIO-ED1 business plan submission.

Indicative Total NIA Project Expenditure

The project delivery costs are: - UK Power Networks: £216,000 of which £194,400 is NIA expenditure (90%) - Western Power distribution: £175,000 of which £157,500 is NIA expenditure (90%) October 2021: -UK Power Networks requested an additional: £15,000 of which £13,500 is NIA expenditure (90%) -Western Power Distribution requested an additional: £35,000 of which £31,500

is NIA expenditure (90%) November 2021 - UK Power Networks is requesting an additional £125,000 of which £112,500 (90%) is 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)

Although the same units will be deployed for both EPN and South West the integration and operation in the 11kV and 33kV network will differ and as such the financial benefits will have to be worked out separately. Based on these differences the below estimates of benefits were obtained per DNO.

UK Power Networks
UK Power Networks is expecting a saving of £363,000 per year following deployment across 17 feeders. This figure includes savings obtained from reduction of CMLs and reduction of patrol time following a fault.

Western Power Distribution
Western Power Distribution is expecting a saving of £257,500 per year following deployment across a single BSP with a total potential benefit of £4,635,000 if installed across 18 BSPs.

Please provide a calculation of the expected benefits the Solution

UK Power Networks The installation of the Metrycom units on individual feeders will allow UK Power Networks' operational engineers to locate faults in a shorter time reducing CMLs, reducing the need of patrols while decreasing the safety risk for both staff and the public. UK Power Networks has estimated the benefits to be around £281,910 within RIIO-ED1 based on a conservative assumption on how long the solution will last for (expected Base Cost £5,920, expected Method Cost from line patrol £1,480, expected benefits from CML returns £277,470).

Western Power Distribution
Utilising the Metrycom devices placed throughout the 33kV circuits from a BSP, around 18 sets (3 monitors), at strategic points focussed on the spurs and tee points of the system will provide the accurate location of earth faults on the network. This will minimise both the time to identify the location of the fault and minimise the number of customer disconnected for the presence of a fault. As an example, if a fault on the 33kV network previously disconnected 12,000 customers and now disconnected 2,000 due to the increased fault location monitoring a saving in customer interruptions (CI) and customer minutes lost (CML) alone would be in the region of £70,000. Where this could happen throughout the same network five times the annual saving would be £357,500 (expected Base case cost £10,000, expected Method cost £2,500, expected Method CI and CML benefit £350,000).

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

Eastern Power Network and the South West are the only GB networks with a similar extent of ASC earthing configuration (others in very small numbers are present in West Midlands and some other networks). This means 2/14 network areas are expected to benefit the most from this solution (14%). However, other licensee areas with some ASC earthing configuration can also utilise this solution.

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

The total rollout cost will depend on the application.
If the MetryCom devices are rolled out on the 33kV network, the cost will come to £100,000 per BSP coming to a total of £1,800,000 for 18 BSPs.
If they are rolled out on the 11kV network instead, this is expected to cost £265,000 in total across 34 feeders with similar performance.
If each licensee follows the rollout based on their own network application, the total cost comes to £94,000 for UK Power Networks and £1,800,000 for Western Power Distribution to a total of £1,894,000.

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):

- [x] 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).
- [x] 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

n/a

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

- [x] Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- [x] 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.

Many other suppliers offer overhead line sensors capable of operating on solidly earthed networks but MetryCom is the only one that offers a sensor capable of operating on a Peterson coil network.

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

This solution is innovative as no other fault location sensors used in GB has been specifically designed to operate on Peterson Coils. This will be the first trial of its sort in the UK which will help utilise Peterson coils in a safer and more effective way. These units also have never been used in and 11kV or 33kV arrangement.
This has not been tried before because such market solution has been identified only recently through a supplier that brought the new technology to UK Power Networks' attention.

Relevant Foreground IPR

This Section is not to be completed until we receive IPR guidelines from Ofgem

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

This technology has never been tested in the UK and as such it imposes a high risk as a Business as usual investment.
There is currently no solutions specifically deisgned to operate in this earthing configuration tested on the UK network at 11kV and/or 33kV.
In section 3.2 of the NIA Governance document, the DNOs are encouraged to pursue different types of Methods and Solutions.
The development of sensors for ASC networks, and the associated benefits, is an area that has not received a great amount of attention from any Innovation stimulus.

Due to the risk involved in the project and not fully knowing whether the benefits can be delivered across the licencee areas, these activities would not form part of business as usual activities. In order to progress an innovative project which carries significant risk in implementation, additional innovation funding is required as a stimulus.

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 due to the operational and technical risks of deploying an unproven solution to our network.
The technology readiness level is low as it is untested at 11kV and 33kV. This poses a series of risks around the new sensors' technical operability.

It is vital that the product is trialled first with the support from NIA funding. Without any testing and trialling on the UK network it is not possible to collect the required evidence to assess if the solution delivers the expected financial benefits for the GB distribution network.

Until this is proven, there is a commercial risk in investing in this technology. The benefits and costs are captured in section 2c of this document.

This project has been approved by a senior member of staff

☑ Yes