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

Sep 2018

Project Reference Number

NIA_UKPN0042

Project Registration

Project Title

Storm Joint

Project Reference Number

NIA_UKPN0042

Project Licensee(s)

UK Power Networks

Project Start

October 2018

Project Duration

2 years and 2 months

Nominated Project Contact(s)

Boris-Emanuel Yazadzhiyan

Project Budget

£188,586.00

Summary

Storms are known to cause a large volume of faults on electricity networks, many of which affect the high voltage (HV) overhead line (OHL) network. This results in area specific outages, which potentially leaves customers vulnerable and without electricity until a mobile generator can be connected, or repairs are carried out and the network is made safe. Due to the nature of overhead faults, currently only a select set of personnel (linesmen) are qualified to restore the network. Typically large parts of the network is affected under a storm situation, leaving the customers without electricity until trained resource becomes available to attend their area.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

Storms are known to cause a large volume of faults on electricity networks, many of which affect the high voltage (HV) overhead line (OHL) network. This results in area specific outages, which potentially leaves customers vulnerable and without electricity until a mobile generator can be connected, or repairs are carried out and the network is made safe. Due to the nature of overhead faults, currently only a select set of personnel (linesmen) are qualified to restore the network. Typically large parts of the network is affected under a storm situation, leaving the customers without electricity until trained resource becomes available to attend their area.

Method(s)

In order to minimise the impact storms have on customers, a new temporary overhead line repair process that can be performed fully from the ground is to be trialled as part of the Storm Joint technical project.

The new method involves using a specialist joint in combination with a pulley system to reconnect and lift the damaged conductors. First, one side of the broken conductor is extended to ensure that both ends can be pushed through the specialist joint. A pulley arrangement is then connected to both sides of the joint using OHL accessories like preforms and snap shackles. Finally, the rope connected to each pulley system is pulled on by a person which gradually lifts the conductor back to its original place. Using extendable OHL tools all excess conductor is cut off and both pulley systems are taken down.
Additionally, testing, isolation and earthing the circuit will be achieved from the ground through the use of insulated extendable rods. This could allow any Storm Joint trained operational staff to restore customer supplies during a storm.

Scope

The project aims to improve the storm recovery process and provide an alternative (cheaper) solution to deploying mobile generators as a temporary solution to restore electricity to customers. In order to minimise the disruption to normal business activities the trial will take place in the EPN area, however if successful could apply to all OHL networks.

Objective(s)

- The procedure, risk assessment, and user guidance will be created prior to BAU transition
- Bespoke training course and video will be developed to ensure the repairs can be done during a storm
- All of the trial equipment will be procured in time to allow training
- Repair process will be optimised throughout the trial
- Trial delivery strategy will be set up

o Optimal storage location for equipment

o Maintenance and inspection of equipment

o Communication between Dispatch, Control, Emergency Planning and new repair teams

- Repair process effectiveness will be evaluated and considered for BAU

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The delivery of the following outcomes will be considered when assessing whether the project has been successful:

- A new overhead line repair process, which is optimised (during trial) and suitable for use during storms. If during trials it is established the repair method is unsuitable for use during storms, appropriate improvements will be attempted. However, if that proves unfeasible the project will be terminated and all learnings will be collected and used to inform future projects.
- Availability of equipment for an adequate storm response in EPN area.
- Repair method and components, which uphold the UK Power Networks safety requirements.
- A comprehensive training course for the new repair process is developed.
- A robust implementation plan is in place to ensure:
o The teams are available during storms.
o The faults repaired via this process are later repaired with a permanent solution.
o The benefits gained through the use of the new process are tracked

Project Partners and External Funding

No external funding
No envisioned project partners as entire new repair process is internal and only component equipment is externally bought

Potential for New Learning

The main expected learnings will provide insight to:

- Difficulty of execution of new repair process during storm recovery
- The practical limitations of the new repair process (i.e. – not suitable if conductor is broken near the pole)
- Potential improvements to repair methods (less equipment / resource)
- Optimal location of the equipment kits and specialist teams to ensure adequate network coverage
- Measure of UK Power Networks` storm response performance when the new repair method is used:

o CML (despite exemption)

o Company reputation

o Avoided cost whenever new method is used instead of deploying a generator

Learning dissemination:

- The training course, video and a summary of the repair process will be shared internally to UK Power Networks.
- Trial results will be shared as learnings to network operators with a suitable communication method (event, newsletter, etc).
- If deemed necessary, more awareness for the new storm response strategy may be raised through publications.

Scale of Project

A compromise between achieving a good area coverage and minimal disruption to the business was achieved by scaling the project to be trailed in the EPN area. Therefore, the trial aims to procure enough equipment and train sufficient personnel to be able to test the new repair method on any storm of a large magnitude that occurs in EPN once training has finished. Following completion the project can be quickly scaled up to provide sufficient network coverage across SPN. This is because the training course and user material developed during the trial will be applicable to other networks.

If the project was smaller scale there would be less teams trained to use the new repair process. This would delay the dispatch time whenever a storm occurs and that would make using this temporary repair method less suitable than a permanent repair

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project is to be deployed in EPN as that is the area with most overhead lines in UK Power Networks.

Revenue Allowed for the RIIO Settlement

No revenue has been allowed specifically for the improvement of the storm response strategy for the Eastern Power Network.

Indicative Total NIA Project Expenditure

£188,586 is the total expenditure which is expected to be incurred.

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)

Using historic results, it is assumed that three storms will occur in the next 5 five years – two in EPN (338 HV faults) and one and SPN (112 HV faults) – BAU adoption: Base costs – Method costs = £ 38.08k

It should be noted, the new OHL repair solution will be considered for use outside of storms when it allows faster conductor repair at comparable cost to the conventional method of repairing a broken OHL.

Please provide a calculation of the expected benefits the Solution

Base cost – the cost of connecting a generator and the cost of conventional repair of a broken overhead line.
Assuming:

- Historic storm occurrences are indicative of the potential number of HV faults in EPN (338 HV overhead line faults)
- Four linesmen repair one broken overhead line for roughly 45 minutes
- In order to compare the base cost and the method cost, the cost of repairing the same number of faults was used (5% of all HV faults during storm)
- A generator is used until HV fault is repaired by conventional means after linesmen are available. For this CBA it is assumed that generator is used for six hours.

Number of linesmen * hourly rate * duration of repair + material costs = cost of conventional repair = £ 523.77 per repair

Cost of generator delivery and deployment + cost of generator fuel + cost of generator decommissioning = £ 1421.33 per repair

Base cost = £ 1,945.10 per repair or £ 32.87k per storm. For an assumed storm in 2018/19 = £ 31.8k NPV and for one in 2020/21 = £ 29.7k NPV.

Method cost – the cost of the new repair method.

Assuming:

- Each new repair team consists of three operational staff. For this CBA - one SAP and two fitters were used
- New repair process takes roughly three hours
- 5% of faulty circuits can be repaired six to 24 hours quicker (depending on storm size) by new method during a storm. For this CBA 6 hours are assumed.

((No. SAPs * hourly rate + No. craftsmen * hourly rate) * duration of repair) + cost of conventional repair = Method cost = £ 912.99 per repair or £ 15.43k per storm. For an assumed storm in 2018/19 = £ 14.9k NPV and for in 2020/21 = £ 13.9k NPV.

Assuming two storms occur before the end of the RIIO-ED1 period (one in 2018/19 and one in 2020/21),
NPV cost-benefit comparison: Base cost – (Method cost – Benefits) = £ 32.62k

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

- The underlying problem of large volume of faults during storms is shared across all DNOs, therefore, the new repair method can be used by all GB license areas (excluding London Power Networks plc).

- It is assumed that 10 teams per DNO license will provide reasonable storm coverage. Licensees with larger rural areas like EPN may need more teams, while smaller ones like SPN may need less.

Scaling factor = Number of licensees which can utilise new repair method * Number of teams per license

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

GB Cost = Scaling factor * cost of equipment per team = 110 * 9604.5 = £ 1056.5k
It should be noted that the cost above does not account for cheaper unit costs due to higher equipment volumes

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 Distribution Network Operators have overhead lines which are affected by severe weather. The learnings produced by this project will allow all network operators to improve their storm readiness by the adoption of the new repair method.

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.

UK Power Networks is not aware of any innovation project allowing broken overhead lines to be repaired from the ground using a specialist joint and a pulley system.

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 specialist joint which enables the repair of the overhead line from the ground was specially developed for this project and as such is novel technology.

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

Due to the risks involved in the project which is focused on exceptional events (storms) and not fully knowing whether the benefits can be delivered across our licence areas, these activities would not form part of our business as usual activities.

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 impact of the operational risks this project poses is a deterrent of business funding. In order to progress this innovative project which carries significant risk in implementation, additional innovation funding is required as a stimulus.

This project has been approved by a senior member of staff

☑ Yes