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

Jul 2020

Project Reference Number

NIA_UKPN0062

Project Registration

Project Title

Radio Teleprotection

Project Reference Number

NIA_UKPN0062

Project Licensee(s)

UK Power Networks

Project Start

August 2020

Project Duration

3 years and 1 month

Nominated Project Contact(s)

David Jeyakumar

Project Budget

£438,000.00

Summary

There are recent developments in VHF (very high frequency) and UHF (ultra high frequency) radio equipment and spectrum plans which may allow non-LoS radio to be used for modern teleprotection. The key is to identify radios with suitable characteristics and compatible spectrum plans.

Nominated Contact Email Address(es)

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Problem Being Solved

The cost of fibre-optic teleprotection can often prohibit customer connections. Microwave radio is an alternative low-cost option, but limited to line-of-sight (LoS) applications only (no hills, buildings, or tall trees), whereas non-LoS radios have not previously met requirements for modern teleprotection services.

Method(s)

There are recent developments in VHF (very high frequency) and UHF (ultra high frequency) radio equipment and spectrum plans which may allow non-LoS radio to be used for modern teleprotection. The key is to identify radios with suitable characteristics and compatible spectrum plans. Whilst the intention is to use existing equipment and spectrum on the market, the arrangement and configuration of the equipment and spectrum will be new and innovative. It will bring together existing components in a new way to meet this specific need.

The method is technical, and is as follows:

· Stage 1 – Identify candidate technical solutions

Confirm the feasibility of using current UHF and/or VHF radios on licenced spectrum to operate on non-Line of Sight paths while remaining compliant with modern protection service requirements.

· Stage 2 – Bench tests

Carry out bench tests to validate the performance of the radios under laboratory conditions.

· Stage 3 – Field Trials and Monitoring

Run an trial – install at least 3 links using the identified radio technology, in three locations. Monitor the radio using remote data collectors, and produce reports of performance to identify seasonal degradation or other phenomena.

· Stage 4 – Benefits Assessment and BAU Incorporation

Carry out Benefits Assessment, understand where and when the solution can be applied, produce and update the required engineering documents, engage with business users to ensure they are updated on the solution, and identify sourcing strategy for the radio solution.

· Stage 5 – Decommissioning

Removal of un-used hardware to minimise maintenance burden and reduce likelihood of hazards developing on site.

At the end of the first and second stages, a stage review is planned to ensure the solution is suitable before progressing.

Scope

1. Stage 1 – Identify candidate technical solutions

Identify theoretically suitable radio equipment and spectrum plans, including:

- Performance against relevant ENA Technical Specifications;
- Summary of limitations and failure modes; and
- Review of spectrum plans and predicted availability.

2. Stage 2 – Bench Test

Verify performance of radio system in laboratory environment, focussing on:

- Performance against relevant ENA Technical Specifications.

3. Stage 3 – Field Trials and Monitoring

Verify the radios for teleprotection by installing trial links to determine:

- Actual availability; and
- Variation of performance over seasons and across installation scenarios.

4. Stage 4 –BAU incorporation

- Benefits case;
- New engineering standards and update of existing standards;
- Workshops to share information and updates with business users; and
- Outline strategy to source and install the radio solution as BAU.

5. Stage 5 – Decommissioning

Remove and safety store or dispose of any un-used hardware to minimise mantainance burden and to prevent hazards developing over time.

Objective(s)

The objectives are:

1. to have a cost-effective radio system approved for use on the electricity network for teleprotection, in scenarios where the other solutions (optical fibre and microwave radio) are expensive or impractical; and

2. to fully understand the constraints and limitations of the radio system (e.g. availability and risks, including risk and value analyses) in order to fully inform the policy on where such radio solution can be utilised.

The outcomes will be:

1. reduced customer connections costs resulting in increase in low carbon generation; and

2. reduced cost of pilot cable asset replacement for network operators.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

UHF/VHF radio system trialled and approved for use for teleprotection on the electricity distribution network.

Project Partners and External Funding

Joint Radio Company (JRC)

Potential for New Learning

Reports to be produced:

· Stage 1: Radio Equipment and Spectrum Report – Theoretical capabilities and limitations of modern non-LoS (UHF and VHF) radios for teleprotection, including long-term spectrum proposal.

· Stage 2: Bench Test report – Performance of the radio(s) for teleprotection in bench tests.

· Stage 3: Trial Report – Performance of the radio(s) for teleprotection in the field environment.

Stage 4: Benefits assessment – Benefits assessment with full details of cost, risks, and benefits to inform approval as a BAU solution for customer connections and asset replacement.

Scale of Project

Project will consider multiple options for radio and spectrum for all stages (preliminary evaluation, bench test, field trials). Limiting options could result in a missed opportunity or not meeting the success criteria.
Similarly, at least three trial links are envisaged to cover radio path scenarios (e.g. clear path, cluttered path, obstructed path) in order to comprehensively understand applicability of solution across environments.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

Field trials in Eastern Power Networks and South Eastern Power Networks licences of UK Power Networks.

Revenue Allowed for the RIIO Settlement

Benefits will be mainly reduced customer connections costs, and will materalise in RIIO-ED2 once the trial is complete. Hence, no savings under the RIIO-ED1 settlement.

Indicative Total NIA Project Expenditure

£438,000

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)

£744,000 of savings per annum, to UK Power Networks' Connecting Customers (based on current connection charging arrangements).
Assumptions: 3 schemes per year in UK Power Networks.

Please provide a calculation of the expected benefits the Solution

Expected financial benefit of demonstration project - £239,000.

Assumptions:
· Base cost is for optical fibre installation for 33kV tee off / looped connection.
Expect demonstration project in 2023.

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

This analysis/research is relevant to all DNOs. The radio solution, if successful, is replicable across GB DNOs.

Sites per year in UK Power Networks = 3 (EPN and SPN)
Site volume assumption: Estimated volume of 33kV connections where fibre is too costly.

Scaling factor for GB wide = 6.5 times.
Scaling factor assumption: equal benefit across all DNOs, i.e. divided by 2 for UK Power Networks SPN+EPN and multiplied by 13 for all DNOs. LPN is excluded due to urban area and limited DG.

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

Estimated method cost across GB = £6.6 million (total over Reg Year 2023 to 2028).

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 identified solution can be deployed for customer connections and asset replacement schemes both in UK Power Networks and elsewhere in the GB.
One consideration is the availability of suitable spectrum as this varies across the GB. However, UHF and VHF are considered less-in-demand than higher frequencies, and therefore suitable free spectrum is likely to be available GB-wide.

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

Commercial Solutions for Easier Customer Access to Network – A protection-compliant UHF or VHF radio solution will reduce the cost of connections, enabling more renewable energy to connect.

Network Operational Improvements – Where UK Power Networks' copper pilot cables have failed beyond economical repair, a protection-compliant UHF or VHF radio solution will provide a cost-effective replacement.
Improve Connection Performance – A protection-compliant UHF or VHF radio will be more cost-effective and has fewer planning issues compared to optical fibre. Therefore, it will help reduce the cost of connections and provide more certainty in delivery.
☑ 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.

No similar work identified in GB. The outputs of this project will be disseminated to all GB DNOs.

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 project has not been tried before as DNOs have tended to use optical-fibre and LoS microwave radio capabilities for teleprotection, whereas low-frequency radio has largely been utilised for telemetry and monitoring. However, there are recent developments in VHF and UHF radio equipment and spectrum plans which could allow non-LoS radio to be used for modern teleprotection. This NIA project seeks to review the UHF/VHF equipment and spectrum domains to identify if compliant teleprotection can be achieved by non-LoS radio, thereby providing a cost-effective alternative to optical fibre and microwave radio.

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

This NIA project is required to validate the technology and to demonstrate it in a working environment, providing all the data needed to determine it’s suitability for live operational teleprotection.

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

Technical risks: • Suitable radio technologies may not be identified; • Spectrum may not be suitable for the radios, e.g. insufficient channels; • Radio system may meet data-rate requirement, but fail in other respects, e.g. propagation delay; • The radio system is compliant, but no suitable multiplexer systems are available or can be developed in time to interface to the protection relays; and • 5G is being considered in other projects for teleprotection, and may be more viable than UHF/VHF. Commercial and regulatory risks: • Spectrum from Ofcom may not be long-term viable, e.g. subject to interest from mobile operators. The above risks will be managed by having a review at the end of Stages 1 (Product Research) and 2 (Bench Test).

This project has been approved by a senior member of staff

☑ Yes