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NIA Project Registration and PEA Document

Date of Submission

Oct 2021

Project Reference Number

NIA_WPD_060

Project Registration

Project Title

Pre-Fix

Project Reference Number

NIA_WPD_060

Project Licensee(s)

National Grid Electricity Distribution

Project Start

October 2021

Project Duration

2 years and 4 months

Nominated Project Contact(s)

Paul Morris

Project Budget

£1,840,963.00

Summary

Pre-Fix will develop and demonstrate a Common Disturbance Information Platform (C-DIP), allowing equipment from different vendors to be utilised for pre-fault detection and more accurate fault location on HV overhead line and underground cable circuits. The outputs from this project are expected to deliver game-changing performance benefits for the operation of distribution systems across GB in RIIO-ED2 and beyond.

Problem Being Solved

Whilst significant developments and advances have taken place at LV for fault detection and location, at present WPD does not have a distance-to-fault or distance-to-pre-fault solution for HV networks.

Any solutions that do exist in the current marketplace are tied into specific vendors (hardware and software platforms) and their Distribution Management Systems (DMSs). It is not financially or practically viable for WPD to make use of such systems without embarking on a potential replacement programme for PowerOn itself.

Even if a platform were available, as it is vendor-specific, it would not allow data from multiple devices at multiple locations to be brought together to extra information in a coordinated and corroborative way. Therefore, the development of such a platform is required and, for game-changing performance in RIIO-ED2, the way to BaU adoption needs to be paved in RIIO-ED1 via development and demonstration.

It is likely that WPD's supply chain will eventually offer bespoke devices that are dedicated to pre-fault management only. From experience to date, the use of bespoke or additional devices tend to have the following disadvantages:

- Each vendor tends to have its own platform and user interface for a device. This can be a barrier to scaling up technology for use within standard operational procedures whilst retaining competition in the supply base.
- Because each vendor tends to have its own platform, it is hard to co-ordinate signals from diverse devices as a means to improve knowledge about the location or urgency of the defect.
- The use of additional or bespoke devices for pre-fault capability means that the unit cost rate to deliver pre-fault capability on a

circuit will rise. In comparison, customers would be better served if an adequate pre-fault capability can be delivered using devices that have more than one business case.

Developing a HV pre-fault intervention capability that can be managed at scale will be of significant benefit to customers.

Method(s)

Over an 28-month project duration, Pre-Fix will deliver a roadmap that will help embed the benefits of pre-fault and disturbance information into operational processes. This project will be delivered using the following work packages:

WP1 Specification: This work package records the requirements that must be delivered from all of the systems to be developed within this project.

WP2 Design/Development: This work package conducts the deeper design requirement to deliver WP1, including design documentation and operational protocols, which will explain: (i) Deployment and application guidelines; (ii) Design and setting documentation (for permanent fit devices); and (iii) Communication philosophy and requirements.

WP3 Build and Install: This work package constructs the systems required to deliver the functionality, installs the trial infrastructure and tests ahead of trial.

WP4 Testing: This work package tests the components and system ahead of trials.

WP5 Trial: This work package conducts a system trial prove the system requirements in an operational context.

WP6 Learning and dissemination: This work packages will encapsulate learning into a manner that could enable further progress towards operational exploitation by WPD and other DNOs.

Scope

This project seeks to overcome the barriers to wide-spread HV pre-fault capability represented by vendor tie in and proprietary software.

This project will utilise HV pre-fault capture capable devices from different manufacturers to demonstrate how they can all contribute into common data platform. This project will also demonstrate how certain existing network devices such as power quality monitors, protection relays and LV monitors might also help contribute to HV pre-fault detection in addition to their basic functions. This project will also show how consistent operational dashboards and reports can be developed from this platform to enable a consistent policy driven approach to be implemented across an organisation. Key activities that will be carried out during the project include:

- Use of trial data from other DNO's to inform platform design and support testing.
- Architecture specification for the common information platform.
- Interoperability specification and setting of pre-fault gathering devices.
- Design of common operational user interfaces.
- Live trial of devices, platform and reports.

Objective(s)

The objectives of this project are to:

- Develop and validate a process to enable pre-fault capable devices from different manufacturers to contribute information onto the same platform.
- Develop and validate process's to enable pre-fault information to be drawn out of this platform.
- Develop and validate standard reports that enable a consistent and effective pre-fault policy driven decision making to be made in an operational environment.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A

Success Criteria

- Demonstration of how to gather and then utilise data from existing WPD specification equipment in the pre-fault data chain, devices to include protection relays and power quality monitors.
- Demonstration of how pre-fault information from diverse devices can be gathered into a central location.

- An application guide for how, where and when to deploy different pre-fault equipment.
- A user interface to present pre-fault data in a manner that is useful, consistent and meaningful to operational users.
- A prototype operational protocol for how to leverage technical application into operational outcomes.

Project Partners and External Funding

Nortech Management Limited (Providing systems integration, monitoring equipment and software development services).

Prior to registration, Nortech provided in-kind financial contributions, supporting WPD with devising the project scope and solution architecture. In addition, Nortech funded itself to reach ISO 27001 (Information Security Management Systems) accreditation and compliance with WPD's Cyber Security requirements. During the project, Nortech will provide further in-kind contributions through cyber security assessment reviews, algorithm development quality assurance and support with integration of the solution into WPD's BaU systems and processes.

Nortech is ideally placed as a project partner since iHost is an integral part of WPD's SCADA estate and already acts as a unifying platform for power quality monitors and LV substation monitors supplied by other vendors.

Potential for New Learning

This project has a high potential to deliver new learning with regard to:

- How to co-ordinate diverse pre-fault capture devices to provide useful data and consequential knowledge.
- How to use the consequential knowledge to drive a pre-fault policy at scale.

Pre-Fix will generate the following specific learning that can be used by network licensees:

1. How to leverage extra value from typical specification protection relays and standard monitoring equipment to contribute to the management of pre-faults.
2. What additional features need to be included in future equipment procurement specifications to obtain the capability explored within this project.
3. A protocol explaining how to translate pre-fault measurements into useful operational information. This might include interpretation of time to fail on a circuit or how to interpret information from multiple sources to inform the defect location.
4. How to avoid vendor lock-in in the pre-fault equipment supply chain.
5. How to achieve an effective HV pre-fault capability that is economic at scale.

Learning will be disseminated through WPD's proven mechanisms. This includes (but is not limited to):

- Reports
- Workshops
- Innovation Showcase events
- Regular website updates
- Documentation shared via the ENA's Smarter Networks Portal
- Publications at national and international conferences

Scale of Project

To prove the viability of the Common Disturbance Information Platform (C-DIP) and its user interface, pre-fault capture devices will be rolled out across 20 primary substations. These locations and the scale are justified based on needing to capture sufficient pre-fault incidents within the project timescales to prove the system and the business processes.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The equipment trials will be focused on Coventry city centre (WPD West Midlands Licence Area) to investigate urban use cases and Dartmoor (WPD's South West Licence Area) to investigate rural use cases on the HV pre-fault platform. These areas have been selected due to the expected volume of faults and the high level of engagement from incumbent Distribution Managers in the Pre-Fix project proposition.

Revenue Allowed for the RIIO Settlement

This project ends on the cusp of RIIO-ED1 closedown; hence, no revenue savings are expected in RIIO-ED1.

Indicative Total NIA Project Expenditure

WPD contribution: £184,096

Funding from NIA: £1,656,866

Total Project Cost: £1,840,964

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)

If Pre-Fix was able to enable regular pro-active intervention, then at least £630 of operation costs would be saved per fault. This would be in addition to the avoided costs of an unplanned outage to customers. Over the last three years, the average value per HV unplanned outage in terms of CI and CML was £8000 (although this is a highly skewed distribution so the mean average can be problematic in this context). Many feeders will also have more than one unplanned outage in a reporting period also.

Please provide a calculation of the expected benefits the Solution

A CBA has been conducted that considered the effect of a Pre-fault capability upon the last three years of all WPD unplanned HV outages.

- The Baseline costs were: At least £7.4M per year in avoidable customer disruption and at least £3.4M per year in avoidable OpEx.
- The method cost will vary between £15k to £35k per primary substation, which will cost a total of between £20M to £48M across four electricity licences.

There is little reliable evidence that demonstrates the likely range of efficacy rate for pro-active fault management. Therefore, a sensitivity study has been undertaken to explore the financial outcomes for customers under different efficacy rates.

- Under best case efficacy rate of 80% with a unit cost of £15k per substation, then the customers will save £50M over 15 years.
- At an efficacy rate of 65% and a unit cost of £40k per primary substation, then customers will save £5.7M over 15 years.

It is important to understand that the Pre-Fix solution puts a downward pressure on unit prices due to being able to use a variety of devices, some of which already have alternative uses on the power system. This value-for-money market mechanism is not necessarily feasible using proprietary systems.

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

Because this method seeks to provide a common interoperability framework, it is inherently scalable across DNOs.

Because this project formalises interoperability specifications it will also ensure the various supply chains into DNOs can all start to offer devices that are capable of reporting into a common pre-fault platform (i.e. pre-fault sensitive auto-reclosers or ground mounted switchgear).

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

At this stage of development, it is anticipated that the costs explained in section 3.2.2 could be scaled on a unit basis for roll out across the other GB DNOs.

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

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

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.

Although other DNO's have investigated HV pre-fault detection, to date there is no framework or single Common Disturbance Information Platform that enables cross-compatibility of pre-fault sensitivity or overcomes vender tie in within the existing the supply chain. This project seeks to address this limitation.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Project Pre-Fix seeks to establish a fully interoperable pre-fault supply chain as a means to ensure scalability of the capability, by enabling diverse devices and manufacturers to all contribute information as a means to reducing the unit cost of roll out.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is innovative as it seeks to enable pre-fault sensitive devices from different manufacturers to all contribute into a common platform. This feature will mean that DNOs will be able to establish a pre-fault supply chain that enables multi use devices to contribute pre-fault data, meaning that cost benefit balance for the pre-fault capability will become more robust.

This project will also be innovative as it will address the procedural and operational aspects of building HV pre-fault capability at scale based on technical evidence.

Relevant Foreground IPR

Project Pre-Fix will generate the following relevant foreground IPR:

- Specifications for device compatibility with the Pre-Fault platform
- Device setting and configurations for contribution onto the Pre-Fault platform
- Functional specifications for the Pre-Fault platform and underlying modules
- Pre-fault platform implementation
- Data and learning reports
- Data visualisation and dashboards support Pre-Fault network policies

The Common Disturbance Information Platform software developed in this project will be made available to other GB DNOs without an additional licence fee.

Data Access Details

To further Pre-fault research by other DNO's, Pre-fault evolution data and waveforms will be made available on request. This data will be made available in a suitable format such as COMTRADE files.

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

WPD considers that the common platform solution in Pre-Fix will provide greater benefits to customers than adopting an approach that will result in device vendor tie in. To deliver this vision the Pre-Fix project will require a multi-system integration exercise and then system learning exercise before it can be fully rolled-out into BAU. This represents more delivery and exploitation risk than simply attempting to integrate an existing manufacturer's proprietary system into an existing DNO information system.

To fund a HV pre-fault project from BAU revenue, WPD would seek to pursue a minimum cost and minimum risk approach, which would likely result in a vendor tie in solution. This would likely limit the extent of financially viable roll out areas. By having access to innovation funding, an outcome can be delivered at a lower unit rate of installation, ensuring that more customers will experience the benefit of proactive HV interventions.

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

This project can only be undertaken with the support of the NIA as:

- It requires development of a capability that is not commensurate with minimum cost and minimum risk procurement philosophy.
- To achieve the vision of interoperable pre-fault sensitive devices, the DNO sector needs to lead the supply chain away from vendor tie in platforms. Achieving this goal will also enable the DNO to procure devices that can serve other functions in addition to pre-fault reporting.
- To be able to establish a set of operational policies that enable a pre-fault capability, the DNO will need to trial this platform to discover and refine its performance before rolling it out in to operational functions.

This project has been approved by a senior member of staff

Yes