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 2018

Project Reference Number

NIA_SPEN_1802

Project Registration

Project Title

SIARA - System Integrity and Restorative Actions

Project Reference Number

NIA_SPEN_1802

Project Licensee(s)

SP Energy Networks Distribution

Project Start

May 2018

Project Duration

1 year and 4 months

Nominated Project Contact(s)

Priyanka Mohapatra

Project Budget

£350,000.00

Summary

Project SIARA (System Integrity And Restorative Actions) will explore the feasibility of deploying wide area protection and control (WAPC) in SPT network using routable R-GOOSE

Third Party Collaborators

UK Grid Solutions Ltd

University of Strathclyde

Vodafone Limited

Nominated Contact Email Address(es)

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Problem Being Solved

As the generation profile has and will considerably change in SP Transmission (SPT) area during the period of 2021-2030 with no coal or nuclear generation connected and with a significant penetration of renewables, the challenges of maintaining system security, integrity and restoring system in event of loss of generation will be different to as it stands today. Resilience is becoming a key factor and key concern without dispatchable and with significantly lower levels of controllable generation in Scotland. There will be requirements for new Wide Area Protection and Control (WAPC) schemes in different parts of SPT network to maintain balance between generation and demand and if required shed generation and/or load to maintain system integrity.

SPT is currently in discussion with GB System Operator (GBSO) to extend the current suite of SIP and RA schemes to cover wider network in future. WAPC will play a major role in maintaining system resilience with strong economic drivers.

Method(s)

Wide Area Protection and Control (WAPC) are deployed to protect the integrity of the power grid or strategic portions of the grid. Unlike conventional (mainly local) protection, WAPC are installed to achieve System Integrity Protection Schemes (SIPS), special protection schemes, Remedial Action Schemes (RAS) or backup protection to conventional protection systems, such as wide area differential protection using synchrophasors. WAPC can be implemented among substations (distributed) or between substations and control centre (centralized). The backbone of the WAPC scheme is networking infrastructure and engine is a protocol to exchange information over Wide Area Network (WAN). The major communication infrastructure considerations for WAPC system are:

- Highspeed message delivery (short delays over WAN);
- Network bandwidth requirement (i.e. optimum information/dataset and data rate);
- Cyber security;
- Availability/Redundancy;
- Compliance to international standardized protocols. IEC Technical Report (TR) 61850-90-5:2012 provides communication protocol for synchrophasors (Routable- Sampled Values or R-SV) and event-driven GOOSE1 (Routable-GOOSE or R-GOOSE) with embedded cybersecurity into protocol over WAN.

SIARA will explore use of high-speed and secure R-GOOSE for WAPC applications, and deploy a piggy-back trial at Strathaven.

Scope

Project SIARA (System Integrity and Restorative Actions) will explore the feasibility of deploying wide area protection and control (WAPC) in SPT network using routable GOOSE (R-GOOSE). SIARA will aim to explore use of R-GOOSE and partly replicate existing SPT-NGET interconnector control scheme through a piggy back/parallel trial to demonstrate feasibility of use of R-GOOSE over wide area network (WAN) and highlight the communication, time-synchronisation and other infrastructure requirements for future roll-out of R-GOOSE.

As the complexity of the existing schemes may need to evolve in future to include analog measurements for power flow calculation in addition to protection and plant statuses, SIARA will also analyse availability and latency aspects of including analog measurements in the controller logic thus providing insight into the reliability of use of analog measurements in future and the resulting impact on time of operation in future schemes.

The research component of the project will focus on assessing need of additional WAPC schemes taking into account future changes to SPT network, connected generation, future energy systems and power flow across the boundaries to NGET and SSEN. The aim of this research will be to assess feasibility of deploying WAPC across SPT and extending it into wider network areas to monitor and control under pre-defined system scenarios and perform dynamic system integrity and restorative actions upon onset of cascading events to avoid complete system blackout.

Project SIARA is the next step to project VISOR (Visualisation of real-time system dynamics using enhanced monitoring) and project FITNESS (Future Intelligent Transmission Network System) which have already explored the feasibility of wide are monitoring, digital substations and PTP time synchronisation. Project SIARA will be pilot demonstration of wide area protection scheme based on IEC61850-90-5 and R-GOOSE.

Objective(s)

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Reliability and availability analysis of R-GOOSE/R-SV
Feasibility Analysis into extending WAPC schemes into other parts of SPT network based on future SIP/RA schemes
Technical specification and Roadmap development for WAPC schemes including:
Communication network specifications
Application and IED functional specifications
Redundancy requirements to maintain reliability and availability
Feasibility of use of R-GOOSE and aforementioned technical and communication specifications for wider Active Network Management Schemes.

Success Criteria

Successful demonstration of R-GOOSE transmission over wide area network

Meeting time requirements for tripping schemes

Successful transfer of R-SVs over wide area network

Project Partners and External Funding

TBC

Potential for New Learning

Risk management for maintaining system integrity and avoiding blackouts.
A successful outcome of this project would enable more cost effective modernisation of the SPT-NGET interconnection schemes which are currently limited to use of IEC61850-8-1 GOOSE within the substation and use of multiplexers using C37.94 over WAN with R-GOOSE over WAN, thus reducing the number of IEDs and protocol converters required in the scheme and simplifying the scheme architectures in future.
The project will generate learning regarding increased efficiency, reduction in number of IEDs and thus saving considerable amount of footprint for modernisation of current and for future schemes.
Improvement in scheme performance through use of R-GOOSE. WAPC schemes are extremely time critical and the successful outcome of the project should prove that R-GOOSE delivers improved efficiency and reliability.
Upon successful demonstration SIARA will highlight requirements for communication infrastructure and cyber security measure for wide scale roll-out of WAPC schemes based on R-GOOSE.

Scale of Project

Pilot demonstration at 3 substations

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

South of Scotland

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£350,000

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)

To be Determined through Project

Please provide a calculation of the expected benefits the Solution

To be Determined through Project

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

The method is replicable at all operation tripping schemes across Britain.

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

To be Determined through Project

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 learnings will inform activities for all transmission operators as the issues are common to all transmission operators.

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 no current application of R-GOOSE technology in GB, this technology is unproven.

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 R-GOOSE and R-SV technology sending fast control signals directly over Wide area network has not be tried in GB before.

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 TRL level of the technology is low and the communication requirements for this technology is not well defined and thus warrants a trial.

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 technology aims to replace a system critical system integrity scheme and warrants a piggy back trial for low TRL nature of the technology to be proven before full scale deployment.

This project has been approved by a senior member of staff

☑ Yes