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

Feb 2023

Project Reference Number

NIA_SPEN_0082

Project Registration

Project Title

Switchgear Requirements for Future Networks

Project Reference Number

NIA_SPEN_0082

Project Licensee(s)

SP Energy Networks Distribution

Project Start

March 2023

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Andrew McDiarmid

Project Budget

£350,000.00

Summary

This project will develop models to monitor what the duty on network switchgear will be under future network scenarios, allowing the development of methods for minimising this while allowing the net zero transition to be met.

Third Party Collaborators

Energy Innovation Centre

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

In the future, networks expect greater feeder lengths, more use of reactors, reactive power services, and other technologies which influence power flows in the network. This will present a change to the design and operational parameters of the networks. When coupled with increases to the frequency of switching activities, are likely to present much more onerous switching and fault interruption duties on switchgear. As such, the parameters used to inform legacy switchgear design and testing regimens may no longer be appropriate to support the development of the networks of the future.

Method(s)

To facilitate new switchgear and asset connections onto constrained networks and to offer the network services of the future, Network Designers need guidance on the factors which must be considered to allow the responsible deployment of technologies or network configuration controls to achieving these aims. A review of the technical specification for switchgear used in associated applications

and practical measures that can be taken to facilitate network development is required to ensure the safe operation of the distribution network.

The project is mapped into four core modules, each focussing on a different aspect of the development of the network of the future;

- Fault level Mitigation
- Passive Network Management – Voltage and Reactive Power Reduction
- Active Network Management – Power Flow Management and Reactive power Services
- Network Topology and Operation Evolution to facilitate customer connections.

A project partner will be selected to analyse the impact of new technologies and services of the future on networks and, where required, to develop network models to study the duty on switchgear for these core modules. In addition, all guidance current available via other research projects/papers, international standards and manufacturers guidance should be evaluated to formulate robust recommendations on the required cases.

This project will in addition identify practical and economic means of minimising the duty requirements when enabling network evolution, and create guidance associated to this for network development.

Scope

The Project will be carried out over 4 stages:

- Stage 1 – Preparation phase – map out the standard applications cases for all the technologies and services under review in representative network arrangements (onerous conditions).
- Stage 2 – Gap analysis–review all network publications and where guidance of application deployment could be developed and areas where there is insufficient knowledge of applications impact (where network modelling is required)
- Stage 3 – Modelling and Network Studies – build models to assess impact of technologies and services introduction where impact cannot be sufficiently quantified
- Stage 4 – Guidance Development and knowledge dissemination– Develop network designer guidance based on outputs from all available industry work on future network development and fundamental research work to cover all required applications.

Objective(s)

For each module, the project partner will:

- Assess the new duties that switchgear must meet (if no other mitigating actions are taken) to accommodate the networks of the future
- Establish a practical and economic means of minimizing the duty requirements of distribution switchgear whilst enabling networks key to net zero networks transition
- Develop means of matching equipment with suitable performance to meet these minimal duties requirements

The project will include specific investigation of the switchgear duty requirements associated with a number of particular topologies. For each of these topologies the project will identify; Firstly, the risks associated with continuing to use “standard” ENA assessed (current and legacy) switchgear and taking no mitigating actions for each category. And secondly, possible mitigation measure reduce risk to a level where “standard” switchgear can be used (if any are identified as part of the project). In all cases where it is identified that “standard” switchgear cannot be used, specify the additional type tests necessary to ensure that equipment provided is of adequate performance.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the amount of disruptions to them in the home. Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

The project will be considered successful if these criteria are met:

- Delivery of an analysis of the impact future technologies will have on the electrical network.
- Delivery of Guidance documents for network designers on how these technologies can be responsibly introduced and implemented.

Project Partners and External Funding

Project partners will include a number of other electricity distribution network operators.

Potential for New Learning

The new learnings from this project will be on the impact of new emerging technologies on the network, and on the duties imposed on switchgear. These learnings will be compiled into guidance documents on how networks can have these new technologies and services utilised safely and responsibly as they transition towards net zero. These guidance documents will be disseminated amongst the network operators, and will be shown in webinars as a form of briefing session.

Scale of Project

This project will cover large-scale research activities, with the development of new models where required.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL9 Operations

Geographical Area

This project is based on research, modelling and computer simulations. Models to developed to be reflective of electricity networks arrangements across the UK.

Revenue Allowed for the RIIO Settlement

None

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:

This project has the potential to facilitate the energy system transition through enabling the use of higher levels of distributed generation and reactive power technologies, by reducing the potential for mismatches of duty and capability of switchgear equipment.

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)

N/A

Please provide a calculation of the expected benefits the Solution

A calculation cannot be provided as this project will carry out research and desktop analysis. However, the guidance produced by this project will facilitate the connection of new network technologies and services, and facilitate new network connections with reduced requirements for reinforcement.

Additionally the project aims to help mitigate potential problems that might be caused by excessive duties being placed on network equipment as new technologies and services are introduced. There are examples of equipment damage and network interruptions due to mismatches of network design and equipment duty capability historically would might become more prevalent as networks evolve.

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

The guidance produced through this project will be able to be used by all Network operators.

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

As the project will give guidance documents as an output, this will not have a significant rollout cost.

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 Guidance developed will be able to be used by all network licensees, as all network licensees will be affected by new reactive power technologies, and the increased uptake of distributed generation.

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.

A search of existing projects has shown no unnecessary duplication will take place in the course of this project, to the best of our knowledge, but learning will be taken from all related research activities both with UK and in the wider industry.

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 is innovative as this large-scale study of the effects of future technology on the GB network has not been carried out previously, and there has not been holistic guidance on the safe and responsible integration of such technologies produced for network designers.

Relevant Foreground IPR

N/A

Data Access Details

The SP Energy Networks Data Sharing Policy can be found here.

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

The project is being created collaboratively between a number of network operators across the industry, and is contributing to the research for Transition to a low carbon future; as such, along with the scale of the studies required, innovation funding is appropriate for this.

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 studies will identify a number of risks across networks in the UK license area – in order to mitigate these risks and integrate new technologies and services safely, a study of this scale is necessary.

If individual network licensees created guidance individually, there would be a disparity between how reactive power technologies and distributed generation would be connected and managed across the country. This introduces risk to the customer as they may be faced with different requirements and standards to connect in different areas. Unified guidance will reduce this risk by ensuring all network licensees have consistency.

This project has been approved by a senior member of staff

☑ Yes