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NIA Project Registration and PEA Document

Date of Submission

Oct 2015

Project Reference Number

NIA_ENWL011

Project Registration

Project Title

Enhanced Voltage Control

Project Reference Number

NIA_ENWL011

Project Licensee(s)

Electricity North West

Project Start

November 2015

Project Duration

3 years and 5 months

Nominated Project Contact(s)

Electricity North West Innovation Team

Project Budget

£800,000.00

Summary

This project will define the technical requirements to allow a GB rollout of the CLASS learning. The project will also provide new AVC settings for generator connections and investigate a technical solution to enable the offering of voltage managed connections for generators.

Preceding Projects

ENWLT204 - Customer Load Active System Services (CLASS)

Third Party Collaborators

Fundamentals

Nominated Contact Email Address(es)

innovation@enwl.co.uk

Problem Being Solved

The LCNF Second Tier project, CLASS, has now reached a conclusion and has proved there is a relationship between voltage and demand which can be exploited to reduce peak demand and assist with balancing generation.

Although CLASS provided a fit for purpose technical solution it is recognised that other solutions more appropriate for business as usual rollout and the services required could be available.

Part A of this project will further develop the technical solutions to meet the required CLASS functionality. These technical solutions could include local and / or centralised solutions.

Separately, the government targets for reduction in CO2 emissions and the use of renewable energy has led to a significant increase in large scale generation connected to the 11kV and 33kV distribution networks. This increase in generation has resulted in difficulties

controlling the voltages supplied to customers. Voltage control is normally carried out using on-load tapchangers fitted to 33/11kV transformers and fixed tapchangers on distribution transformers and this arrangement has proved sufficient for the passive networks operated by DNOs for many years. The connection of generation can lead to extreme conditions such as maximum demand, minimum generation which results in low volts and minimum demand, maximum generation which results in high volts. To add to the complexity each of these conditions could occur simultaneously on different feeders from the same transformer.

Part B of this project will devise and apply new settings which can cater for this increase in generation.

Part C of this project will investigate the technical feasibility of a solution to offer new generators a “voltage managed” connection which will help to solve the voltage issues described above.

Method(s)

The project consists of 3 parts.

Part A – Alternate Technical Solution for BaU Deployment of CLASS

This part of the project will investigate the different possible solutions to deliver the functional requirements requested by a separately developed commercial framework. The preferred solution will be trialled at two sites on the Electricity North West network to perfect the installation requirements. The output will be a suite of documents to allow the purchase, installation and commissioning of the technical solution.

Part B – Advanced AVC settings for Generation

This part of the project will review and amend Electricity North West's voltage control policy to devise new settings for generator connections. These new settings will investigate the practicalities of both local and centralised application and the use of functions such as Load Drop Compensation. These new settings will also need to be aligned with the CLASS functionalities as defined in Part A. The new settings will be trialled at a number of primary substations on the Electricity North West network. To confirm the correct operation of the new settings measurements will be taken on the network close to customers to ensure there is no adverse impact on the voltage.

Part C – Technical Solution for Voltage Managed Connections

This part of the project will investigate the technologies required to enable a Network Operator to offer a new generator a voltage managed connection. The output of this part will be a functional specification for the technical solution.

Scope

This project will define the technical requirements to allow a GB rollout of the CLASS learning. The project will also provide new AVC settings for generator connections and investigate a technical solution to enable the offering of voltage managed connections for generators.

Objective(s)

- Devise appropriate technical solutions to meet functional requirements for CLASS.
- Trial technical solutions as necessary on the Electricity North West network.
- Produce relevant documentation to allow future installations.
- Devise new settings for generator connections.
- Application of new settings at a number of primary substations on the Electricity North West network.
- Develop a functional specification for a technical solution to enable the offering of voltage managed connection.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Successful trial of the business as usual technical solution for CLASS.
2. All relevant documents produced to allow purchase, installation and commissioning of the technical solution.
3. Settings devised for generator connections.
4. Successful trial of new settings for generator connections on a number of primary substations.
5. New voltage control policy incorporating the new settings.
6. New functional specification for a technical solution to enable the offering of voltage managed connection.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project will cover the 33kV and 11kV networks of Electricity North West.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL9 Operations

Geographical Area

North West of England

Revenue Allowed for the RII Settlement

Zero

Indicative Total NIA Project Expenditure

£800,000

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)

£537,000 per primary substation

Please provide a calculation of the expected benefits the Solution

The new technical solution for CLASS will be deployed to defer the need to reinforce a primary substation.

The financial saving can then be calculated as

Cost of Reinforcement – Cost to deploy new CLASS technical solution.

Additionally this project can provide benefits to both customers and Network Operators in other areas:

The functionality of the CLASS solution allows Network Operators to provide services to National Grid which will help with system balancing.

The elements of the project looking and new AVC settings and solutions for voltage managed contracts will allow Network Operators to offer cheaper connection contracts and facilitate the increase in renewable generation required to meet the Carbon Plan.

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

CLASS methodology could be deployed at all primary substations on the GB network. In Electricity North West we have 410 suitable substations. Assuming all other Network Operators have a similar number then the CLASS method could be deployed at 5740 sites.

The methodology for calculating the alternative settings for generator connections and the technical solution for voltage managed connections can be applied to any generation connection on the 11kV network.

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

In Electricity North West we have 410 primary substations. Assuming all other DNOs have a similar number there is 5740 substations at which is it possible to deploy CLASS.

The cost of deploying CLASS at one primary substation is £23k.

Assuming we deploy CLASS at all GB sites the total cost to GB would be £23k x 5740 = £132.02M.

The alternative settings for generator connections and technical solution for voltage managed connections will not result in a cost to GB

but rather manifest as a saving to the generator in the form of reduced reinforcement costs associated with the new connection.

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

Electricity North West will produce and make available the relevant specifications, installation procedures, commissioning procedures and settings policy to implementation the CLASS functionality and cater for new generation applications.

Electricity North West aims to liaise with the other Network Licensees to ensure the business as usual solutions meet, as far as is reasonably practicable, their requirements.

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

This project directly addresses the heart of our innovation strategy by "maximising the use of existing assets". Through the use of both the CLASS functionality and the advanced AVC settings for generation we can create the necessary voltage headroom to allow connections without the need for costly and time consuming reinforcement.

- 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.

n/a

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

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

Yes