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

Apr 2015

Project Reference Number

NIA_SSEPD_0006

Project Registration

Project Title

Impact of Electrolysers on the Distribution Network

Project Reference Number

NIA_SSEPD_0006

Project Licensee(s)

Scottish and Southern Electricity Networks Distribution

Project Start

October 2013

Project Duration

2 years and 7 months

Nominated Project Contact(s)

SSEN Future Networks Team

Project Budget

£165,000.00

Summary

Scope: To design and test an operational system for the safe, efficient operation of an electrolyser connected to the distribution network and establish a commercial framework for carrying out trials. To allow us to assess impacts of a large scale electrolyser on the network and produce a technical design for the ANM system which will allow a full range of trials to be undertaken.

Third Party Collaborators

Aberdeen City Council

BOC

Henderson Loggie

KPMG

Smarter Grid Solutions

University of Strathclyde

Nominated Contact Email Address(es)

fnp.pmo@sse.com

Problem Being Solved

The primary problem addressed is the increased network investment required to accommodate additional demand from the potential future volume of electrolysers connected to the network. We anticipate they will have a cumulative impact similar to EVs but with more focus on the HV network. A UK Government study (UKH2Mobility) anticipates this could add up to 350MW of new demand by 2030.

Based on current estimates from DECC/Ofgem Smart Grid Forum Work Stream 3 transform model, this could result in over £160m of network reinforcement. This increase in the number of electrolysers, while presenting a demand growth challenge in its own right, is likely to appear alongside other disruptive low carbon technologies e.g. heat pumps. The use of electrolysers to provide a network service could be a method of managing some of the challenges posed by these other devices.

Problem 1 - There is limited understanding on the technical characteristics of a hydrogen electrolyser and the factors that will influence their potential location.
Problem 2 - There is limited information on the actual performance of electrolyser systems and their impact on the electrical network, in particular their likely demand profiles.
Problem 3 There in no information on the ability of an electrolyser to act as controllable demand to allow comparison with other methods of demand management.
Problem 4 - There is no information on the contractual or technical integration of the electrolyser equipment with the electrical network in order to mitigate its unmanaged potential impact i.e. to understand the extent to which electrolysers have the potential to offer a service to the network operator to help manage and alleviate other network constraints

Method(s)

Both technical and commercial methods will apply learning gained elsewhere e.g. from SHEPD's Orkney smart grid, and from the NINES project on Shetland. We will also engage with other DNOs and appropriate experts in this area to learn from their experiences.

Method 1 - Working with the Electrolyser Operator to investigate applicable codes, standards and regulations which need to be factored into the siting decision. Electrical and constraint modelling to identify network impact based on manufacturer-stated characteristics. Consultation with internal and external parties relating to consenting process to capture learning from site identification and consenting process.
Method 2 - Analytical comparison of a variety of scenarios for the connection and running of the electrolyser will be used to understand the impact on the electricity distribution network. Trials will be undertaken to monitor and assess the electrolyser's response to real and simulated network conditions. Investigation and summation of applicable learning from past projects and various suppliers to quantify the expected performance and value of the network service.
Method 3 - Develop further operational scenarios using ANM system to investigate how the impact of electrolysers on the electricity network can be minimised.
Method 4 - Evaluate trial results to assess what potential electrolysers have to provide other network services.

Scope

Scope: To design and test an operational system for the safe, efficient operation of an electrolyser connected to the distribution network and establish a commercial framework for carrying out trials. To allow us to assess impacts of a large scale electrolyser on the network and produce a technical design for the ANM system which will allow a full range of trials to be undertaken.

Objective(s)

Objectives:
1) demonstrate and understand safe and efficient connection and operation of electrolysers and their impact on the system;
2) develop operational strategies to minimise the potential impact of electrolysers on the network;
3) identify the potential to provide other network services.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Success Criteria 1: Development of operational practices and commercial arrangements to support the system implementation and operation.
Success Criteria 2: Identification of the extent to which an electrolyser can be controlled to minimise its impact on the network and if it can be used as a tool to manage issues caused by other disruptive technologies.
Success Criteria 3: Production and dissemination of learning around the expected operation of electrolysers, their impact on the network and strategies to deal with any impact.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The size of the proposed electrolyser is 1MW and the proposed connection arrangement represents a reasonable representation of the likely scale for the future growth of distributed hydrogen production based on the UKH2Mobility Study. It is sized to have sufficient capacity by 2015 to produce the required hydrogen for ten buses to be operated in Aberdeen City centre but with a higher degree of operational flexibility to allow the full range of planned electricity distribution network trials to be evaluated. This will allow a fuller exploration of the potential impact of the technology on the electrical network.

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

An important part of the project is to identify a suitable site where electrolyser technology could be deployed. This will focus on the SHEPD network area. In particular, there is an identified hydrogen demand (secured through the external funding) for ten fuel cell buses operating in Aberdeen city centre and the site will be optimised to meet this demand. The location chosen will provide a safe environment such that the trials can be carried out without any detrimental impact on customers or security of supply.

Revenue Allowed for the RIIO Settlement

At this stage no saving on expenditure can be expected during project implementation.

Indicative Total NIA Project Expenditure

The Tier 1 project originally had an approved budget of £753,000. No additional funds are required to complete the project. The project is transferring from LCNF Tier 1 to NIA on account of delays beyond the control of SHEPD. Total (2015-16 NIA) = £165,000 of which 90% (£148,500) is allowable NIA Expenditure

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 the Problem is solved Network Operators will be potentially able to offer a type of managed connection for electrolysers, whilst still fulfilling their commercial obligations, and avoid costly network reinforcement.

Please provide a calculation of the expected benefits the Solution

The baseline reinforcement NPV cost to the DNO would be £194,000 over 10 years and the NPV cost by offering the managed connection would be £140,000. Therefore, there would be a saving of £54,000 to the DNO.

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

The analysis assumes that 25% of sites could be enabled through a managed connection and that this would equate to 142 sites throughout the UK.

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

It is anticipated that the managed connection could be facilitated through the use of an Active Network Management system at an estimated cost of £240,000 per site.

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

☐ 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

UKH2Mobility identifies that the rollout of the hydrogen fuel cell electric vehicles will be focused in areas of high car ownership, population and proximity to major roads and that 51% of the hydrogen demand will be met by electrolysers. The impact of electrolysers will potentially be seen across all License Network areas by 2030.

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.

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