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

Jul 2017

Project Reference Number

NIA_NPG_017

Project Registration

Project Title

Integrel – Baseline Implementation

Project Reference Number

NIA_NPG_017

Project Licensee(s)

Northern Powergrid

Project Start

July 2017

Project Duration

5 years and 1 month

Nominated Project Contact(s)

Chris Goodhand, Innovation Manager (01977 605641)

Project Budget

£400,000.00

Summary

The project includes the assessing the possibility of integration of technology subcomponents – including generation, electricity to hydrogen conversion and storage alongside determining the optimal operational configurations under various scenarios and determining the accompanying economic case.

Nominated Contact Email Address(es)

yourpowergrid@northernpowergrid.com

Problem Being Solved

In the UK heat has benefitted from the embedded storage capacity of the gas system.

The move to electrical heating in support of the general decarbonisation of the energy system risks losing this.

A similar issue with transportation may also arise with the trend towards electric vehicles. Storage in the liquid fuels supply chain would no longer be available and the burden would fall on the electricity network.

Technologies exist to transfer energy from the electricity system to the gas system, and vice versa, and also to store energy in either medium.

To date no study has yet examined the practicality and economic considerations involved in the integration of such technologies into a practical system which may offer the possibility of optimisation at the whole energy system level.

Method(s)

This project aims to test the technical and economic feasibility of a whole energy system approach to the issue of low carbon heating.

To achieve this we will use the newly developed Northern Gas/CESI facility at Low Thornley (See NGN's project Integrel Phase 1, ref

NIA_NGN_208) and will test methods of transferring energy between vectors. Specifically this will include an electricity network connected battery electrical storage system, an electrolyser capable of bidirectional conversion of electricity to hydrogen, connected to an injection point into the gas network. A refuelling/transportation point will also be included.

The electrical storage will be equipment re-used from the Customer Led Network Revolution project previously undertaken by Northern Powergrid. The GUS control system, also developed as part of the CLNR project will be further developed and its suitability for cross-vector control will be tested.

Scope

The project includes the assessing the possibility of integration of technology subcomponents – including generation, electricity to hydrogen conversion and storage alongside determining the optimal operational configurations under various scenarios and determining the accompanying economic case.

Objective(s)

The project will assess the technical viability of a cross-vector integrated energy system, specifically including:

- Gas to Electricity conversion
- Electricity to Gas conversion
- Energy storage
- Gas storage

The project will assess the technical viability of a suitable control system for such an integrated system.

The project will assess costs and forecast benefits to establish a level of economic viability for such an integrated system.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

A successful project will provide positive or negative assessment of the objectives laid in in the previous section : can the identified technologies be used together and in what combinations, is there an economic case for doing so and could our GUS system be successfully applied to control this.

Project Partners and External Funding

CESI/University of Newcastle, £100k

Potential for New Learning

The project will provide new learning in the practical technical development of cross-vector systems and the economics of their operation. Although some theoretical works has been undertaken no prior learning on the real-world application of such systems, as applied to the GB energy system, appears to have been developed.

The project also seeks to determine the economically optimum combination of energy mediation, storage option and discharge route for the technologies applied

The project will also provide additional insight into the further application of a control system originally developed as part of the CLNR project.

Scale of Project

The project is a single system implementation, including single subcomponents of generation, storage and energy mediation technology, confined to a single geographic site.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The project will be undertaken at Low Thornley, close to Newcastle. This site is an ex British Gas test facility and currently houses Northern Gas Network's DSO datacentre.

The site has an 11kV electricity connection, 1MW of standby generation and a 38 bar pressure reduction station and associated test facilities.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£300,000

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)

The project seeks to assess this. By optimising the combination of current networks with new technologies savings could be substantial, allowing the economically lowest level of network reinforcement and new assets to be utilized. The potential scale of this is not known but the project aims to provide this information.

Please provide a calculation of the expected benefits the Solution

Not required. Project currently at TRL 3 – " Active research and development is initiated. This includes analytical and laboratory studies to physically validate analytical predictions or models of separate elements of the technology. Examples include components that are not yet integrated or representative but operate in a standalone basis. (ie Low System Readiness Level, SRL)"

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

The nature of the proposed method is that it is entirely replicable across the whole of the GB energy network both electricity and gas.

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

Roll-out costs will depend on the final cost benefit case for the most economic, situation dependent, technology combinations and configurations.

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

All Network Licensees will be able to use the learning generated. All DNOs networks overlap with gas distribution and the issues surrounding cross-vector management of energy are common to all.

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

The Northern Powergrid innovation strategy specifically details the need to prepare the network for low carbon implementation. This project specifically addresses that need. Additionally the strategy outlines our need to improve network planning and operations to support low carbon technology options which this also supports.

☑ 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.

SSE and National grid have an ESPSRC project entitled “Multi Vector Energy Distribution System Modelling and Optimisation With Integrated Demand Side Response”. This project is due to complete in the late summer of 2017. While this activity is focused on cross-vector issues it is primarily a desktop study aimed at developing a statistical model for combined gas and electricity systems at the distribution level that can efficiently simulate the interactions across the energy vector under severe uncertainties.

The EPSRC project may inform the current work which is more concerned with the building of a real-world system and verifying the practicality of doing so.

The project will use the facility developed by the Integrel project which has been registered by Northern Gas Networks. It is envisaged that parts of the two projects will run in parallel and actively collaborate.

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