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

Sep 2018

Project Reference Number

NIA_SGN0134

Project Registration

Project Title

Feasibility study into 2% hydrogen blending at St Fergus and H2 pipeline and hub at Aberdeen

Project Reference Number

NIA_SGN0134

Project Licensee(s)

SGN

Project Start

October 2018

Project Duration

0 years and 10 months

Nominated Project Contact(s)

Phil Bradwell, Innovation Project Manager

Project Budget

£175,000.00

Summary

The UK government has committed to reducing greenhouse gas emissions by 80% of 1990 levels by 2050. The government's plans identify the need for low or no carbon heat as being essential for meet this target.

SGN are involved in a variety of Environmental and low carbon projects. The findings from this project will provide beneficial information to ongoing SGN projects such as H100, as well as providing a greater understanding of the impact of hydrogen blending on the NTS and GDN's.

The outcomes from this project will be a number of reports that can be used to demonstrate the feasibility of injecting hydrogen into the transmission system.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

The UK government has committed to reducing greenhouse gas emissions by 80% of 1990 levels by 2050. The government's plans identify the need for low or no carbon heat as being essential for meet this target. One of the options currently being considered is the possibility of blending 2% hydrogen at the St Fergus reception terminal, capturing the carbon and storing it offshore in a depleted Gas field (ACORN CCS). This feasibility study will develop an understanding of the issues associated with the injection of 2% hydrogen into NTS and the technoeconomic case for constructing a hydrogen pipeline between St Fergus and Aberdeen with the creation of a hydrogen at Aberdeen that would supply hydrogen for heat (Blended & 100%) and for transport.

SGN are involved in a variety of Environmental and low carbon projects with this project supporting some of those whilst also examining the concept and feasibility of several hydrogen blending options at St Fergus and Aberdeen. This work program has various strands and work packages within the overall study which will seek to identify and resolve issues associated with Advanced Steam Methane Reforming, H2 Injection and blending, Carbon Capture & Storage and the feasibility of a hydrogen pipeline and hub from St Fergus to Aberdeen. The findings from this project will provide beneficial information to ongoing SGN projects such as H100, as well as providing a greater understanding of the impact of hydrogen blending on the NTS and GDN's.

This project aligns to the future of gas, future of heat and decarbonisation aspects within SGN's Energy futures Strategy.

Method(s)

A feasibility study that will examine the technical and commercial issues associated with hydrogen production using SMR at the St Fergus site, and the storage of the CO2 produced through the SMR process offshore utilising the proposed ACORN CCS reservoir, it will also assess possibility of blending and injecting the hydrogen produced (2% by volume) into the NTS at the same site, the aim being to understand the impact of hydrogen on the NTS, appliances and end users.

SGN have completed a variety of projects that demonstrate the possibility of injecting different gas qualities into the NTS. The completed NIC project "Opening up the Gas Market (OGM)" successfully demonstrated the capability of widening the gas Wobbe Index (WI) within our network. This project proved that gas that meets the European Association for Streamlining of Energy Exchange (EASEE) gas specification, but sits outside of the characteristics specified within the Gas Safety Management Regulations (GSMR), can be distributed and utilised safely and efficiently within GB gas network.

The outcomes from this project will be a number of reports that can be used to demonstrate the feasibility of injecting hydrogen into the transmission system, the commercial and technical viability of CCS using ACORN, a technoeconomic study into the viability of a H2 transmission pipeline from St Fergus to Aberdeen and the creation of a hydrogen hub at the latter.

Scope

This project will aim to build upon existing knowledge of hydrogen generation, CO2 storage, H2 injection into the NTS and will build knowledge and understanding in the following areas;

- An examination and analysis of hydrogen production at St Fergus using SMR to enable detailed understanding of the complexities of design, construction and operation to include a costing exercise that will estimate CAPEX & OPEX associated with construction and operation.
- The project will also scrutinise and examine the issues surrounding the blending and injection of 2% Hydrogen into the NTS, it will identify technical issues associated with materials, cost in terms of operation and capacity reduction associated with the new blend.
- An investigation into the ACORN CCS proposal and its overall viability from a technoeconomic viewpoint and its applicability to this project.
- The feasibility of constructing a H2 pipeline from St Fergus to Aberdeen and the creation of a commercially viable hydrogen hub at Aberdeen.
- Impact on end users in terms of perception and cost

Objective(s)

The objectives of this project are to:

- Outline the possibility of using advanced SMR hydrogen production at St Fergus. And to discuss the technology and safety requirements for the transportation and storage of CO2 from SMR.
- Identify the planning consents and environmental permits that would be required. This will also outline the health and safety related aspects of plant development as well as identification of relevant key HSE regulations.
- Describe the introduction of hydrogen into the NTS and the implications for the wider gas network, including interconnectors, storage, Liquified Natural Gas (LNG) etc.
- Highlight the impact on the network, including materials, instrumentation, hazardous areas etc. It will also assess the end user impacts such as appliances, in particularly safety apparatus including oxygen depletion systems (ODS) and various other sensors.
- Development of an emission performance chart for hydrogen production.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria are as follows:

- Detailed reports for publication.
- Detailed evidence supporting Hydrogen injection at St Fergus.
- Stimulation of Hydrogen supply chain.
- Initial proof of concept.
- Plans for future commercial viability.
- Commercial methodology for demonstration.
- Roadmap to Hydrogen network blending demonstration.

Project Partners and External Funding

The project will be led by Pale Blue Dot Energy (PBDE) and supported by subcontract partner ERM.

Potential for New Learning

The project is expected to develop the following new learning for Network Licensees:

- A detailed assessment of the viability of H2 injection at St Fergus
- An investigation into the ACORN CCS proposal and its overall viability from a technoeconomic viewpoint and its applicability to this project
- Develop better understanding of hydrogen generation through SMR.
- Develop better understanding of hydrogen blending and injection.
- Assessment of the impact of hydrogen on the NTS.
- Viability of a H2 Transmission pipeline from St Fergus to Aberdeen and the commerciality of H2 hub at Aberdeen.

Scale of Project

A feasibility study that will examine the technical and commercial issues associated with hydrogen production using SMR at the St Fergus site, and the storage of the CO2 produced through the SMR process offshore utilising the proposed ACORN CCS reservoir, it will also assess possibility of blending and injecting the hydrogen produced (2% by volume) into the NTS, the aim being to understand the impact of hydrogen on the NTS appliances and end users

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

This project will be focused on SGNs network and the NTS, but the outputs and methods can be shared with all the GDNs.

Revenue Allowed for the RIIO Settlement

This is a feasibility study, the outcomes being a number of reports that can be used to the demonstrate the feasibility of injecting hydrogen into the NTS, the commercial and technical viability of CCS using ACORN, a technoeconomic study into the viability of a H2 transmission pipeline from St Fergus to Aberdeen and the creation of a hydrogen hub at the latter

Indicative Total NIA Project Expenditure

The total project expenditure is £175,000.

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)

This project is at a low TRL and it is therefore not possible to provide an accurate estimate of the potential saving to customers at this stage.

The overall concept of hydrogen injection is estimated to have a substantial saving, both financial and environmental.

Please provide a calculation of the expected benefits the Solution

N/A

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

The potential outcomes of this project are applicable across GDN's. All the Network Licensees are aiming to reduce carbon emissions.

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

N/A

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 learning gained from this project aims to inform Network Licensees of the potential benefits of injecting 2% hydrogen into the NTS.

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.

All GDNs are aware of, and are participating in, a variety of research projects relating to hydrogen. Some elements of this project may overlap but will have different objectives and outputs.

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

Hydrogen generation and injection is a new area of research being looked at within the GB industry. With increased focus on reducing carbon emission, research on innovative techniques to help reduce carbon emissions is being carried out.

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

This project aims to address long term issues of reduce carbon emissions, and assist UK in meeting the UK 2015 CO2 reduction target.

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 NIA project has a low TRL and involves carrying out a conceptual study. This project is applicable to all the GDN's where the learning can be shared between the networks.

This project has been approved by a senior member of staff

☑ Yes