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

May 2017

Project Reference Number

NIA_NGN_210

Project Registration

Project Title

H21 - Keighley and Spadeadam designs

Project Reference Number

NIA_NGN_210

Project Licensee(s)

Northern Gas Networks

Project Start

May 2017

Project Duration

1 year and 0 months

Nominated Project Contact(s)

NGN - Dan Sadler Cadent - Lorna Millington

Project Budget

£357,333.00

Summary

1. Undertake the design (and subsequently tender the build) which will be required to enable modifications to the Keighley site which will facilitate the experimental testing plan for phase 1a) background testing of the 2017 H21 NIC bid (See ISP)
2. Undertake the design (and subsequently tender the build) which will be required to enable modifications to the Spadeadam site which will facilitate the experimental testing plan for phase 1b) background testing of the 2017 H21 NIC bid (See ISP)
3. To obtain design approval form DNVGL (akin to a G17 procedure) for the designs
4. To obtain design approval form the HSL that the final design should meet the objectives of the experimental testing plan.

Preceding Projects

NIA_NGN_225 - H21 – Field Trials Design

Third Party Collaborators

National Physical Laboratory

Element Energy

DNV

Design House

Health & Safety Laboratory

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

The H21 – Leeds City Gate Project assessed the feasibility of converting a major city's gas network from natural gas to hydrogen. The project demonstrated the feasibility of the hydrogen conversion concept, developed detailed cost estimates for the conversion of the Leeds area and an estimate of the costs for an incremental roll out of hydrogen conversion nationwide.

The H21 Leeds city gate project identified (Section 10) the next steps required to move this concept towards a policy decision through a series of strategic projects aimed at filling critical evidence gaps, this was referred to as the 'H21 roadmap'.

To execute this H21 roadmap will requirement a combination of large scale NIC type projects, a government led program of research and a suite of smaller NIA projects. These projects will ensure the UK gas networks will understand the impact of hydrogen conversion in four key areas:

1. Application and impact of new equipment within the network. This will ensure a future conversion to hydrogen comprises the optimised selection of assets utilising the best technologies from around the world in the interests of gas customers.
2. Transportation of a different form of gas, i.e. 100% hydrogen on existing licensee assets
3. Operation of the network and its configuration when transporting 100% hydrogen.
4. The commercial impact of a hydrogen conversion and the alterations required to current commercial practices across the gas industry e.g energy efficiency losses across hydrogen production assets, different leakage model impacts etc.

Method(s)

The project will be broken down into several stages, some of which can be conducted concurrently:

- Identification of assets for Keighley site tests: an 'appropriate' range of assets which need to be tested are currently being determined by the H21 NIC bid team, these will be incorporated into the Keighley site design.
- Spadeadam site: a range of different leakage scenarios is being determined by the H21 NIC bid team as well as potential sources of ignition. Once finalised these will be incorporated into the spadeadam design.
- Working with the experimental testing plan developed as part of the H21 NIC bid submission design the site modifications required to facilitate:
- ◦ a range of static pressure tests (predominantly focusing on LP but including some MP and IP) and flow tests to obtain quantifiable differentials in background leakage position at Keighley
- ◦ A range of leakage tests to establish hydrogen concentrations in and above the ground under different leakage scenarios at Spadeadam
- ◦ A range of consequence tests to ascertain the consequence form potential sources of ignition including background ignition sources (cars, cigarettes etc) and operational ignition sources (e.g. when excavating to repair)
- Obtain Design Assurance from DNVGL for the final design recommendations
- Obtain design assurance form the HSL for the final designs ability to meet with the testing requirements.

Tender the final designs to obtain final costs for the site modification works.

Scope

1) Undertake the design (and subsequently tender the build) which will be required to enable modifications to the Keighley site which will facilitate the experimental testing plan for phase 1a) background testing of the 2017 H21 NIC bid (See ISP)

2) Undertake the design (and subsequently tender the build) which will be required to enable modifications to the Spadeadam site which will facilitate the experimental testing plan for phase 1b) background testing of the 2017 H21 NIC bid (See ISP)

3) To obtain design approval form DNVGL (akin to a G17 procedure) for the designs

4) To obtain design approval form the HSL that the final design should meet the objectives of the experimental testing plan.

Objective(s)

The project scope has been developed to deliver the following objectives;

1. **Scope of Work** – As a project team agree the scope of the work, including equipment to be tested, measurements parameters and tests to be conducted
2. **Design** – the objective for the design phase would be to complete a compliant design that is approved by the Design Assurance Authority.
3. **Design Assurance** – the Design Assurance process is conducted with agreement by all parties
4. **Project -** The facility should be designed to facilitate the various tests that are to be conducted with the minimum amount of reconfiguration
5. **Measurement** – working with NPL decide the process measurements required and design the location for the instrumentation as well as suitable fittings for them and the correct environmental condition (habitat for the testing facilities)

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

In considering the success of the project the following success criteria as a minimum output from the project to provide Technical and Strategic Evidence:

1. Final design and design assurance for Keighley site
2. Approval from the HSL that the design at Keighley meets with the objectives of the experimental testing plan
3. Final design and design assurance for spadeadam site
4. Approval from the HSL that the design at spadeadam meets with the objectives of the experimental testing plan

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project will provide critical information applicable to the entire UK gas system when considering conversion to 100% hydrogen incrementally over time.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The NGN project support will be based out of the H21 project office in Leeds. The research programme will cover the Leeds area in scenario one and the wider UK GDN network areas for scenarios two and three (equivalent to 10 x Leeds area and 50 x Leeds area respectively).

The design work will be conducted at the designer's offices for construction in the North East, due to the location of a suitable site and availability of fittings required for the testing.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

External Costs;

- Design House
  - Preliminary Design - £20k
  - Conceptual Design - £30k
  - Detail Design -£60k
  - Incorporation of Spadeadam design drawings - £20k
- Project Management (professional services) - £50k
- Design Assurance - £30k
- Master Testing Plan Development and validation – specialist support & literature review - £50K
- Element Energy Specialist Hydrogen Supply and Distribution - £8k

NGN estimated external costs - £134k

NGGD estimated external costs - £134k

Total estimated external costs - £268k

Internal costs NGN £44,666

Internal costs NGGD £44,666

Combined internal costs £89,333

Total estimated project costs - £357,333

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 one of a suite of projects to enable a conversion of the UK gas grid to hydrogen. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save £100s billions with minimal gas customer disruption verses alternative decarbonisation solutions.

Please provide a calculation of the expected benefits the Solution

N/A

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

N/A

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

- [ ] 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 generated will be undertaken directly across all GDNs making the knowledge transferable and assisting with knowledge dissemination of the original H21 Leeds City Gate project.

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 sits centrally to NGNs future of the gas network strategic requirements

- [x] Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

Is the default IPR position being applied?

- [x] 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