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

Mar 2022

Project Reference Number

NIA2_SGN0018

Project Registration

Project Title

Hydrogen Entry Unit Design

Project Reference Number

NIA2_SGN0018

Project Licensee(s)

SGN

Project Start

February 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Alex Webb Brown

Project Budget

£350,000.00

Summary

This project will determine the impacts of 2% and 20% hydrogen blends on SGN's national offtake sites. By undertaking an assessment and review of a specified number of sample sites, SGN will produce a site-specific blueprint design compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This will provide a roadmap for the upgrade of all SGN offtake locations.

Third Party Collaborators

Kelton Engineering Limited

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

While the net zero end goal remains to deliver 100% hydrogen within the GB gas network, there remains a challenge in the interim period to achieve levels of blending, whether 2% in the NTS or 20% within the distribution system. National Grid Transmission's Future Grid project is due to conclude in 2023 and looks to state the case for 2% blend of hydrogen within the NTS. Evidently, this blending will have a profound impact downstream with all of SGN's system impacted.

Furthermore, it is expected that a change to GS(M)R standard will conclude in 2022 with implementation of changes in gas quality expected to roll out in 2023. With these factors in mind, a 2% blend from the NTS by 2024 is quite conceivable.

SGN currently have an obligation to accept gas from the NTS through a series of National Offtake sites. At these sites, among others, the following functions are performed:

- custody transfer is achieved through monitoring of flow, pressure etc.,
- calorific value (CV) is recorded for Ofgem's Flow Weight Average CV (FWACV) calculations, impacting on downstream billing
- gas composition is monitored to calculate gas density for the determination of standard flow

There is currently uncertainty regarding the relevant network assets about the level of impact of an addition of 2% hydrogen in both function and accuracy. The parameters for flow measurement are set out in NGGT T/SP/ME/1 and define an accepted tolerance of ±1% on volume flow and ±1.1% on energy flow over a defined pressure and temperature range. However, a 2% blend of hydrogen at 60bar would have >1% impact on volume flow and >2% impact on energy flow. This is not a linear relationship and therefore accurate monitoring is fundamental to these calculations.

For measuring CV, Ofgem's requirements set out a tolerance of ±0.1MJ/m3 and although the impact of blended hydrogen is largely dependent on the relevant gas composition, a 2% blend could result in a variance of ±0.5MJ/m3.

There are two means of addressing this challenge, either develop a theoretical relationship for 2% hydrogen with a view to gaining Ofgem approval or measure the hydrogen content of the gas. The former solution would prove exceptionally complex and failure to acquire Ofgem's approval would result in a lack of mechanism for Offtake site measurement.

Currently there are 18 National Offtake sites in Scotland with St Fergus, at certain demand conditions, impacting on the flow of most of these sites and providing up to a third of the UK's gas. Blending from the NTS could have a profound impact, not only at targeted locations but across the grid. The requirements, focussing on Local Gas Treatment (odourisation) and gas chromatography upgrades from as well as safety considerations such as hazardous area zoning and DSEAR, identifies the criticality of this work to deliver the roll out for both Scottish and Southern sites.

Method(s)

The main objective is to develop deliverables that will provide a blueprint for the upgrading of all Offtake locations on SGN's network, in support of the Heat Policy reopener. The design will not only identify relevant asset upgrade requirements but will also include timescale recommendations and associated roll out costs.

- **Site survey & problem definition**
  - Offtake sample site selection
  - Full site survey of selected typical offtake site
  - Telemetry benchmarked against industry requirements
    - Ofgem FWACV
    - NGGT custody transfer
  - Review of ATEX accreditation relevant telemetry
  - Review of SR25 for 2% & 20% hydrogen blend
  - Overview of DSEAR requirements for 2% & 20% hydrogen blend
- **Asset recommendation and testing**
  - Site requirement workshop
  - Horizon scanning and benchmarking of relevant metering equipment
  - Laboratory testing and demonstration of novel technologies
  - Identify changes to HPMIS
  - Report on identified and recommended asset requirements
- **Hydrogen blend upgrade design**
  - Apply outcomes from WP2 to inform site specification
  - High level site design for SGN
  - Detailed design to be produced in line with PS/5 & PS/6
  - Design independently appraised and approved
- **Delivery of roadmap and final reporting**

- Apply blueprint design to relevant SGN locations to determine roll out timescales
- Evidence process for Ofgem approval for the new CV measurement and a new version of DANINT
- Detailed CBA for roll out to three SGN LDZs
- Full report to inform Heat Policy Reopener application

Scope

In order to ensure SGN are able to meet the challenges associated with accepting blends of hydrogen through the relevant Offtake sites, the project will seek to assess and review onsite assets, carry out relevant laboratory testing to ensure existing equipment can perform the required functions and, if necessary make recommendations for further calibration requirements, asset upgrades and/or new metering installations. Further to this, considerations will be given to SR/25 hazardous area drawings, ATEX ratings of equipment, SCADA upgrades, DSEAR considerations and changes to HPMIS.

A site-specific, detailed design will be produced, compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This design, although site specific, will comply with PS/5 to provide a blueprint for the upgrading of all Offtake locations on SGN's network, in support of the Heat Policy reopener. The design will not only identify relevant asset upgrade requirements but will also include timescale recommendations and associated roll out costs

The approach adopted in this project is potentially repeatable at other similar sites across GB, however this project will mainly focus on SGNs asset configurations and create blueprint designs for hydrogen conversion of this specific asset groups

Objective(s)

The objective of this project is to determine the impacts of 2% and 20% hydrogen blends on SGN's national offtake sites. By undertaking an assessment and review of a specified number of sample sites, Kelton will produce a site-specific blueprint design compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This will provide a roadmap for the upgrade of all SGN offtake locations.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

Success Criteria

Work Package 1 - Site survey & problem definition

The Work package 1 success criteria are submission of the following documents, as described above, to SGN for review:

- Work package 1 summary report, including the DSEAR requirement for the offtake where the gas flow is a hydrogen blend.

Work Package 2 - Asset recommendation and testing

The Work package 2 success criteria are submission of the following documents, as described above, to SGN for review:

- Asset recommendation and testing summary report.

Work Package 3 – Design

The Work package 3 success criteria are submission of the following documents, as described above, to SGN for review:

- Site specification document
- Design document describing the high-level design of the upgrades specified in the site specification
- Detailed design packs of the upgrades

Work Package 4 – Roadmap and final reporting

The Work package 4 success criteria are submission of the following documents, as described above, to SGN for review:

- Apply blueprint design to relevant SGN locations to determine roll out timescales
- Evidence process for Ofgem approval for the new CV measurement and a new version of DANINT
- Detailed CBA for roll out to three SGN LDZs
- Full report to inform Heat Policy Reopener application

Project Partners and External Funding

Kelton Engineering Limited

Potential for New Learning

This project will determine the impacts of 2% and 20% hydrogen blends on SGN's national offtake sites. By undertaking an assessment and review of a specified number of sample sites, Kelton will produce a site-specific blueprint design compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This will provide a roadmap for the upgrade of all of SGN's offtake locations.

Scale of Project

The project will be a desktop study, with regular engagement between SGN and Kelton project teams.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

Kelton will produce a site-specific blueprint design compliant with TD/13 and appraised and approved in line with SGN's PS/6 process on a specified number of sample SGN sites,

This will provide a roadmap for the upgrade of all of SGN's offtake locations.

Revenue Allowed for the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

£350,000

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:

In order to ensure SGN are able to meet the challenges associated with accepting blends of hydrogen through the relevant Offtake sites, the project will seek to assess and review onsite assets, carry out relevant laboratory testing to ensure existing equipment can perform the required functions and, if necessary make recommendations for further calibration requirements, asset upgrades and/or new metering installations. Further to this, considerations will be given to SR/25 hazardous area drawings, ATEX ratings of equipment, SCADA upgrades, DSEAR considerations and changes to HPMIS.

A site-specific, detailed design will be produced, compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This design, although site specific, will comply with PS/5 to provide a blueprint for the upgrading of all Offtake locations on SGN's network, in support of the Heat Policy reopener. The design will not only identify relevant asset upgrade requirements but will also include timescale recommendations and associated roll out costs.

How the Project has potential to benefit consumer in vulnerable situations:

Not applicable

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)

Not applicable

Please provide a calculation of the expected benefits the Solution

Not applicable

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

The approach adopted in this project is potentially repeatable at other similar sites across GB, however this project will mainly focus on SGNs asset configurations and create blueprint designs for hydrogen conversion of this specific asset groups.

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

Not applicable

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

This project will determine the impacts of 2% and 20% hydrogen blends on SGN's national offtake sites. By undertaking an assessment and review of a specified number of sample sites, the project will produce a site-specific blueprint design compliant with TD/13 and appraised and approved in line with SGN's PS/6 process. This will provide a roadmap for the upgrade of all of SGN's offtake locations.

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

Not applicable

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.

The scope has been reviewed against all existing projects and no areas of duplications have been identified.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not applicable

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

While the net zero end goal is to deliver 100% hydrogen within the GB gas network, there remains a challenge in the interim period to achieve levels of blending, whether 2% in the NTS or 20% within the distribution system. The current set up for network entry, driven by a need to meter for custody transfer between NGGT and the GDNs accounts for a range of monitoring equipment which, as yet, has not had a requirement to facilitate quantities of hydrogen. However, should a decision be made (potentially by 2024) to inject 2%

hydrogen into the NTS, then our offtake sites will need to support these changes. This aligns with the network agreed decarbonisation pathway (see image below) and SGN's GD2 business plan.

The project seeks to understand the impacts of these changes, considering aspects such as hazardous areas, ATEX ratings, HPMIS impacts, onsite monitoring calibration and hydrogen capabilities etc.

Relevant Foreground IPR

Not applicable

Data Access Details

Any consumer data gathered throughout this project will be anonymised and will be compliant with General Data Protection Regulations (GDPR) and the UK Data Protection Act. Any compliant data can be made available for review upon request.

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The project is carrying out research and development on an emerging technology. The objective of this is to develop energy storage solutions and reduce CO2 emissions though the use of hydrogen. This technology is at a low technology readiness level and as such it is not part of the usual activities of the business.

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

The NIA framework offers a robust, open framework to support this work and ensures the results are disseminated to all licenses. The project will address key considerations and requirements to allow for the safe delivery of hydrogen to end users, converting from existing natural gas supply.

This project has been approved by a senior member of staff

☑ Yes