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

Jun 2024

Project Reference Number

NIA2_SGN0054

Project Registration

Project Title

Below 7 barg PRI Suitability Assessment

Project Reference Number

NIA2_SGN0054

Project Licensee(s)

SGN

Project Start

June 2024

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Innes Maciver

Project Budget

£67,246.00

Summary

This project will undertake a literature review of the existing evidence from hydrogen projects concerning Pressure Regulating Installation (PRI) performance in pressure reduction, temperature management, control systems, pressure relief, velocity & saltation, and pressure management. This will include work done by NGN at DNV Spadeadam and South Bank, and work undertaken in the Wider Impacts project on noise and vibration in pressure regulators, and slam shut valves functionality. Research will be conducted on pressure regulators and related equipment currently used for 100% hydrogen in other industries. This comparative analysis aims to assess the functionality and performance of such equipment against those currently on the GB gas network. The project will then provide a roadmap to closing out any remaining gaps through additional research and/or testing.

Third Party Collaborators

Long O'Donnell

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

As part of the UK's transition to net zero, network suitability must be assessed. Accurate assessment of the equipment currently installed on the gas network will inform the industry and wider stakeholders of the consequences and associated costs of transitioning to a 100% hydrogen gas network. Utilisation of hydrogen poses several challenges when compared to natural gas. Differences in gas velocity, energy content and other gas characteristics all raise questions around the suitability of existing pressure regulating installations (PRIs).

This work will provide a clearer understanding of the gaps identified by the Asset Interventions project (NIA2_SGN0025) by conducting a detailed literature review and further industry research on PRI suitability to determine what, if any, additional testing and/or research

is required.

Method(s)

Our project partners Long O'Donnell (LOD) have developed a methodology for executing the project. This will ensure that the project remains aligned with the needs of the industry and delivers tangible real world results.

- Search Strategy:
  - Define keywords and search terms based on identified focus areas.
  - Utilize relevant databases such as Scopus, Web of Science, Engineering Village, and Google Scholar.
- Inclusion/Exclusion Criteria:
  - Establish criteria for selecting relevant literature.
  - Consider study type, publication date, and relevance to hydrogen applications.
  - Exclude outdated, irrelevant, or unreliable sources/data.
- Data Extraction:
  - Develop a structured data extraction form.
  - Capture key information from each selected source, including author, publication date, methodology, findings, and limitations.
- Critical Appraisal:
  - Evaluate the quality and trustworthiness of each source.
  - Consider methodology, data analysis, and potential biases.
- Synthesis & Analysis:
  - Identify trends, patterns, and knowledge gaps in the existing literature.
  - Analyse how findings address specific evidence gaps identified through Asset Interventions.
  - Collaborate with industry experts to ensure alignment with current industry knowledge.
- Reporting:
  - Curate and generate a comprehensive report summarizing the literature review.
  - Highlight key findings, limitations, and recommendations for further research.
  - Evaluate the suitability of <7 barg PRIs with 100% hydrogen based on the reviewed evidence.
  - Invite feedback from stakeholders to ensure alignment with objectives.

Scope

Work Pack 1 – Literature Review

- In-depth review of the work done to date to assess the suitability of <7 barg PRIs with 100% hydrogen looking specifically at the evidence gaps identified through the Interventions for Hydrogen by Asset Group project (Asset Interventions): -
  - System asset performance
    - Pressure reduction – effect of vibration and sensing line responsiveness
    - Temperature management – reverse Joule-Thompson effect
    - Pressure relief – sizing of relief valves and associated vent pipes
    - Control systems – pressure and temperature sensors, flow control valves
  - Gas delivery
    - Velocity & saltation – impact of potential higher velocity on PRI components
    - Pressure management – PRI control systems including pilot regulators.
- Reviewing the outputs of the H21 testing done at Spadeadam and South Bank, Middlesbrough and the modelling work undertaken on the Wider Impacts project.

Work Pack 2 – Industry Research

- Identify industries that use regulators for pressure control and other PRI components with hydrogen relevant to <7 barg applications such as pressure relief valves, control systems and sensors.
- Undertake a comparative analysis between the functionality & performance of equipment used in other industries with those installed on the natural gas network. Focussing on equipment materials and design for compatibility, pressure management strategies, operational parameters, and safety considerations.

Work Pack 3 – Map Way Forward

- Determine whether further research and testing is required and what form this should take.
- Plan further testing based on the identified gaps from Work Pack 1 & 2

Stage gate - move to WP4 should earlier work packs identify the need for further research and/or testing.

Work Pack 4 – Additional Research & Testing

- Undertake any recommended further research and testing to close out any remaining evidence gaps in the areas identified in Work Pack 1.

Objective(s)

The aims and objectives of this project are to:

- Conduct a comprehensive literature review of the existing evidence from the Hydrogen for Heat Programme (HHP) to assess the suitability of <7 barg PRIs with 100% hydrogen focussing on gaps identified during Asset Interventions;
- Undertake industry research and produce a comparative analysis on the functionality & performance of pressure regulating equipment used in other industries with those installed on the natural gas network;
- Develop a roadmap to close any remaining gaps by identifying any additional research and/or testing required; and
- Undertake any additional research and/or testing identified in the earlier work packs.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register

This project has been assessed as having a neutral impact on customers in vulnerable situations.

Success Criteria

The outcomes of the project will be considered successful if they can:

- Collect relevant evidence on the operability and performance of PRIs in 100% hydrogen from existing HHP evidence
- Collect relevant evidence on the operability and performance of PRIs in 100% hydrogen from wider industry
- Fill the knowledge gaps first identified in the Asset Intervention Database
- Assess the suitability of PRIs in 100% hydrogen
- Map a way forward for any additional research and/or testing
- Undertake additional research and/or testing if required

Project Partners and External Funding

Long O'Donnell (LOD) will be the suppliers for this project with collaboration from Cadent and NGN.

Potential for New Learning

This project will allow for better understanding of the suitability and operability of <7barg PRIs in 100% hydrogen by reviewing and assessing learnings from trial operations, and wider industry to inform existing knowledge gaps.

Scale of Project

This project has been scaled to allow a comprehensive literature review and assessment to maximise learnings and inform potential further testing. This in turn will ensure only necessary testing is conducted, avoiding duplication and making the most efficient use of resources.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

The outputs of this project will be representative of the GB distribution gas network.

Revenue Allowed for the RIIO Settlement

Not applicable.

Indicative Total NIA Project Expenditure

SGN – External £14,261 Internal £4,749

Cadent – External £28,521 Internal £9,500

NGN – External £7,130 Internal £3,084

Total – External £49,913 Internal £17,333

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:

The outputs of this project will provide a clearer understanding of the impacts that 100% hydrogen gas will have on the performance of PRIs on the distribution network, which will in turn help inform and determine the suitability of converting these assets to run on a 100% hydrogen gas network. The conclusions of this project will directly contribute to the energy system transition by facilitating the development of a safe and efficient low carbon gas network.

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 outcome of this project is relevant to the GB gas distribution network.

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

PRIs are abundant on the whole GB gas distribution network and as a result the learnings from this project will be directly relevant to all GDNs. This project will reduce the need for unnecessary asset replacement and their associated costs and disruptions, ensuring the networks are run as efficiently as possible.

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.

This project is collaborative amongst the GDNs and the results will be in the public domain as well as being disseminated to networks via the Network Safety and Impacts group.

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

PRIs have been run on multiple projects over the course of the HHP without being the focus of these projects. As a result, valuable learnings have not been systematically recorded nor disseminated. This project is innovative as it will comprehensively gather, review, and share these learnings for the first time, research evidence from other industries, and conduct further testing to close knowledge gaps if found to be necessary.

Relevant Foreground IPR

The outputs from the project including the literature review report, industry research report and any results from additional testing will form the relevant foreground IP.

Data Access Details

Information relating to the project will be published on the ENA Smarter Networks Portal at https://smarter.energynetworks.org/

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

The methodology undertaken in this project is deemed a beneficial part of the network conversion to 100% hydrogen. This is not yet a business-as-usual activity for the GDNs.

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 conversion of the GB gas network to 100% hydrogen is a key element on the road towards net zero. A reliable supply and the assurance of safe operations for workers and the public are crucial to support the viability of the hydrogen transition. The NIA framework can support works that ensure results that play an essential part in the roll-out of hydrogen.

This project has been approved by a senior member of staff

☑ Yes