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 2024

Project Reference Number

NIA_NGT0240

Project Registration

Project Title

Impact of Hydrogen on Gas Cleaning Assets

Project Reference Number

NIA_NGT0240

Project Licensee(s)

National Gas Transmission PLC

Project Start

July 2024

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Matthew Hammond, box.GT.innovation@nationalgas.com

Project Budget

£227,929.00

Summary

The National Transmission System (NTS) uses dry scrubbers, filters and strainers to remove contaminants in the gas stream. Introducing hydrogen raises new challenges due to its distinct properties, which could affect the performance and efficiency of these existing cleaning assets. The project investigates the compatibility of these assets with hydrogen and hydrogen blends to ensure gas quality without compromising the safety or efficiency. Alternative4 cleaning technologies, such as wet scrubbers, membrane filtration systems, adsorption methods and other innovative technologies, are being evaluated for their potential to enhance or replace current equipment so it is fit for purpose. This research and testing project will inform technology selection and prepare the integration of hydrogen into the NTS

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Currently dry scrubbers, separators, filters and strainers are deployed across the NTS to remove contaminants, such as dust, debris and liquids from the gas stream. However, the introduction of hydrogen poses new challenges due to its unique properties such as low density and high diffusivity, which could all affect the performance and efficiency of current dry scrubbing and gas cleaning assets.

This project is conceived in response to the need for comprehensive research into the combability of existing dry scrubbers and gas cleaning assets with hydrogen and hydrogen blends. As the NTS evolves to accommodate a higher concentration of hydrogen, it is crucial gas quality is maintained by removing contaminants, and that the infrastructure is capable of handling these changes without compromising safety, efficiency, or environmental compliance.

To support this transition, alternative scrubbing and gas cleaning technologies must be evaluated, including wet scrubbers, membrane

systems, adsorption methods and other innovative solutions that could potentially replace or enhance existing dry scrubbers on the network. This research will provide a knowledge base for the selection of appropriate technologies and lay the groundwork for future deployment and integration of these systems into the NTS

Method(s)

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners who are experts in their given field. The methodology used in this project will be subject to our supplier's own ISO 9001 certified quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and made available for review.

Data Quality Statement (DQS)

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document and NGT internal policies. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Scope

This project is split into 5 work packages detailed below:

WP0 – Project Management

9 months

Covers the project management activities required for the duration of the project

Work package 1 – Evaluation of current gas cleaning capability with hydrogen and blends

2 Months

Assess the gas cleaning equipment present on the NTS and determine their capability for processing hydrogen and hydrogen blends. Assessment of material suitability to hydrogen and blends and operational efficiency analysis. Identification of necessary modifications to ensure compatibility with hydrogen use in the gas network. A report assessing the safety and risk changes posed from transiting to hydrogen from natural gas.

Work Package 2 – Assessment of potential for modified / new cleaning technologies

2 Months

Assess new cleaning technologies suitable for hydrogen and hydrogen blends in the NTS. It includes reviewing advancements in scrubber designs, conducting feasibility assessment of potential technologies and developing a concept design based on a Cost-Benefit-Analysis (CBA) for an integrated gas cleaning system.

Work Package 3 – Review of current and potential new standards

7 Months

This work package will involve a thorough review of existing and potential new gas quality standards for gas cleaning assets involved in hydrogen transportation on the NTS. It will establish criteria for hydrogen compatibility in current operations and guide the development of procedures to ensure compliance with these evolving standards. The goal is to align the NTS scrubbing systems with best practices for safety and efficiency in a hydrogen network, this includes a safety and risk assessment report.

Work Package 4 – Test Plan Development

3 Month

Develop a testing plan for approval by NGT, this includes a detailed testing plan for equipment highlighted in the CBA and the concept design approach.

Work Package 5 - Reporting

1 Month

NIA Reporting

Objective(s)

· Conduct an in-depth analysis of existing gas cleaning assets on the NTS and their suitability of 100% hydrogen and varying hydrogen blends, and how this can affect the operational capabilities.

· Identify and evaluate any alternative technologies/modifications compared to current systems and the impact that these will have on gas quality on the NTS

· Review current standards and procedures for gas cleaning assets and operations and assess the impact of hydrogen and blends

· Physical testing of equipment

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. This is because it is a transmission project.

Success Criteria

The following key criteria need to be met for the project to be considered successful:

Objectives met to time, quality and cost.
Successful and cost-effective demonstration of gas cleaning equipment with useful and logical data
Project findings inform the HyNTS safety case to provide evidence to HSE.

Project Partners and External Funding

Lead Network: National Gas Transmission plc

Supplier: Wood plc

External costs: £167,925

Internal Costs: £60,004

Total: £227,929

Potential for New Learning

· Understanding Hydrogen Impact: Researching hydrogen unique properties (low density, high diffusivity) in the context of current gas infrastructure can provide novel insights into how these properties affect operational performance.

· Compatibility Assessment: studying the compatibility of existing gas cleaning assets with hydrogen and hydrogen blends will advance necessary modifications or replacements, thus contributing to the body of knowledge on infrastructure transition to hydrogen.

· Innovation in gas cleaning: evaluating alternative technologies such as wet scrubbers, membrane systems and adsorption methods could lead to the discovery of more efficient or effective methods of ensuring gas purity in a hydrogen economy.

· Safety & Efficiency: The projects focus on maintaining safety, efficiency and environmental compliance while transitioning to hydrogen fuel can yield new safety standards and efficiency standards.

· Infrastructure Adaption: it offers learning opportunities on how to adapt existing infrastructure for emerging sources, which is valuable for the broader energy sector facing similar transitions.

Scale of Project

The scale of this project allows it to cover a wider variety of NTS parameters and operating conditions. This is required to generate generalised findings which can be used to determine the potential safety & economic benefits of using this technique vs other risk mitigation measures.

This is also a more cost-effective way of undertaking research than assessing each combination of parameters separately which would be required if smaller research projects were undertaken.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

United Kingdom - Warwick

Revenue Allowed for the RIIO Settlement

None – hydrogen focused innovation project.

Indicative Total NIA Project Expenditure

£227,929

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 project has the potential to significantly facilitate the energy system transition by ensuring the viability and efficiency of hydrogen infrastructure. Through its focus on gas cleaning, by removing contaminants, the project aims to mitigate contaminant-related risks, thereby enhancing the safety, integrity, and reliability of gas transmission systems. This supports the increased use of low-carbon gases, aligning with global sustainability goals and the UK's commitment to a net-zero future. Sharing the learnings from the project can accelerate similar transitions globally, as other regions can apply the knowledge to their energy systems.

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

Although this project does not directly affect vulnerable consumers the energy transition may and as such, we must consider the effect of the work we are doing through the NIA funding. The National Transmission System (NTS) is a key UK infrastructure for the transport of Gas to consumers, including those considered vulnerable. In a scenario where hydrogen replaces methane as a household heat source, it is essential the vulnerable are not excluded by virtue of fuel inaccessibility. In cases where vulnerable consumers already utilise gas it is likely that in a net zero future the optimum option is to provide a consistent energy solution. The transition to hydrogen within the NTS provides continuity of access to the vulnerable of hydrogen as a replacement to methane, with ongoing benefits of efficiency and economy of scale within a closely regulated environment. Ensuring robust NTS assets and consistent hydrogen production options will support the transition of the NTS to hydrogen which in turn supports the availability of gas to the vulnerable.

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)

N/A

Please provide a calculation of the expected benefits the Solution

Value tracking

- Maturity
  - TRL 2-3. Research project.
- Innovation Opportunity
  - 100% of asset class. All gas equipment points
- Deployment Costs
  - £0.00. Project is research and there will be no technology developed to be deployed.
- Innovation Cost

o £ 223,900.00 the cost of the innovation includes the desk/research phase, reporting and project management.

· Financial Saving

o £ 0.00. As a research project, financial savings are not possible to quantify. However, understanding of the impact hydrogen will have on our cleaning assets will determine if they can be reused/repurposed for hydrogen introduction

· Safety

o 0%. Data collated from the project will enable understanding of operating conditions required to ensure gas cleaned to appropriate standard to ensure the operability of our assets.

· Environment

o 0.0 tonnes CO2e. Data collated from the project will enable understanding of operating conditions required to ensure gas cleaned to appropriate standard to ensure the operability of our assets.

· Compliance

o Support compliance. Work supports transition to hydrogen.

· Skills & Competencies

o Business Wide. Trained on operation of hydrogen transportation on the NTS, adapting from previous natural gas transportation skills.

· Future Proof

Supports business strategy. Results will support operation of future hydrogen national transmission system

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

The findings of the project, by undertaking research and testing, will provide a good understanding of gas cleaning management across our entire network and provide a framework into which areas might need greater asset management.

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

As this is a majority research project, roll out costs onto the network will be limited/unknown at this stage. A cost benefit analysis for the deployment of potential new technologies is a deliverable highlighted in work package 3 so this could provide some insight into cost of rolling out the method.

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 generated from the project can be used by network licensees to optimise operation and gas quality standards for the transportation of hydrogen, ensuring the NTS is equipped to handle the gas. This project can lead to development/integration of better cleaning control systems, enhance safety measures and inform policy decisions that align with the evolving low carbon energy landscape and regulatory requirements.

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

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.

There will be no duplication of activities done as part of this program. This project will address a gap in national gas's ongoing innovation work looking at maintaining gas purity for hydrogen Specifically, it will involve a novel arrangement and application of existing gas transportation technology and operation practices uniquely tailored to National Gas Transmission operations. This specificity ensures that the projects activities are distinct and do not replicate any existing projects within national gas or other network licensees.

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

The project is innovative as it addresses the emergent challenge of maintaining gas purity(cleanliness) in an evolving energy landscape that will transport hydrogen. It pioneers methodologies to measure and control contaminants in gas streams, anticipates future operational challenges, and sets the stage for scaling low-carbon gas transport. This forward thinking approach is essential for the integrity of future gas infrastructure and the broader energy system transition.

Relevant Foreground IPR

This project will not result in any new Foreground IPR.

Data Access Details

Details on how network or consumption data arising in the course of an NIA funded project can be requested by interested parties, and the terms on which such data will be made available by National Gas can be found in our publicly available "Data sharing policy relating to NIA projects" at www.nationalgas.com/gasinnovation. National Gas data access is managed IAW provisions under 2.15-2.18 for the current NIA Governance Document.

National Gas already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document NGT internal policies. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Measurement Quality Statement (MQS):

The methodology used in this project will be subject to our supplier's own ISO 9001 certified quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and made available for review.

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

Hydrogen is not currently present in the NTS and therefore current valves have not been approved or potentially not capable for hydrogen service. Hydrogen is being directed as a future energy solution, but RIIO-2 business funding does not allow the development of hydrogen ready solutions and therefore this project cannot be undertaken as part of BAU activities.

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

As This research relates to the impact hydrogen will have on gas cleaning assets on the NTS, it is not considered business as usual, therefore National Gas Transmission require the support of the NIA mechanism to fund the research into potential future challenges facing the NTS. The low TRL of this project favours the use of NIA funding as gas separation is not currently carried out on the gas transmission network today. The technical, commercial, and operational risks within the project mean that NIA is the best option to support this project.

This project has been approved by a senior member of staff

☑ Yes