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 2024

Project Reference Number

NIA_NGT0230

Project Registration

Project Title

Hydrogen & Carbon Dryness Management

Project Reference Number

NIA_NGT0230

Project Licensee(s)

National Gas Transmission PLC

Project Start

April 2024

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Haider Hussain, box.GT.innovation@nationalgas.com

Project Budget

£104,628.00

Summary

The project will innovatively address the challenge of integrating low-carbon gases into the National Transmission System (NTS). Focused on the crucial aspect of gas dryness, it aims to provide greater understanding on the NTS's capacity to ensure gas dryness of hydrogen, hydrogen blends and carbon for transportation in the NTS and also the potential impacts that these gases will have on the operation of the NTS.

Preceding Projects

NIA_NGGT0181 - HyDew

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

This project is designed to address the management of hydrogen and carbon dryness within the National Transmission System (NTS). It will evaluate current gas analysers' capacity to assess the dryness levels for 100% hydrogen and hydrogen blends, and for CO2 transportation also.

A key component of this project involves understanding how gas dryness is currently measured, and ensuring these metrics remain

relevant and accurate for the rollout of hydrogen, including blends, and CO2 into the network. Furthermore, considering the producers role in maintaining dryness from different production methods, this project seeks ways to ensure the integrity of dryness levels is maintained from the producer side, addressing questions about the impacts of hydrogen/carbon on liquid content in the NTS, and how it will be monitored and managed.

The outcomes of the project should provide a clearer insight and strategy on how to effectively manage hydrogen and carbon dryness within the NTS, ensuring that the gas remains within the required specifications for current and future demands.

Method(s)

The research element of this project will be split into 3 main phases.

· Calculating dew points for hydrogen, hydrogen blends and carbon dioxide.

· The impact CO2 will have on NTS flow today

· Identification and evaluation of potential differences in gas measurement practices due to varying hydrogen and CO2 production methods.

Results from this methodology will provide a solution to the project problem.

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

7 months

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

WP1 – Impact of hydrogen blending and 100% on dew points & dryness

2 Months

Determine the impact that hydrogen of blends and 100% hydrogen will have on the water dew point and therefore the dryness of the gas and the subsequent impact on the NTS. The work undertaken in the HyDew NIA project will be considered to prevent duplication of work.

WP2 – Impact of CO2 on NTS Flow/Energy Measurement Today

2 Months

Conduct an impact assessment on CO2 transportation on the NTS in terms of measurement and dryness.

Work Package 3 – Approach development for deployment on the NTS

2 Months

This work package will consider how different production methods by the producers of Hydrogen and CO2 can impact the gas dryness of both gases and what this means for the NTS. It will also assess how producers will ensure the dryness of the gas and determine suitable specifications for entry to the network. The work package will determine the likelihood of liquids forming within the pipeline and consider methods to prevent this or/and extract liquids from the network. The equipment required will be costed and designed into the NTS system at a concept level. The work package will identify the possible solution manufacturers and provide insight into the CBA for managing liquids at entry vs along the pipeline route.

WP4 – Reporting

1 Month

NIA Reporting, ensuring governance requirements are followed, and that all activity through the project is logged and disseminated accordingly.

The benefits that this project will provide the business are as follows:

· Enhanced system efficiency and integrity by maintaining optimal gas dryness for hydrogen and CO2

· Improved understanding of the impact of dew points on gas quality and system performance within the NTS for more effective management of gas properties

· Aligning with the UK's decarbonisation goals by effectively managing low carbon gases like hydrogen and CO2 in the NTS

· Supporting the transition to net-zero future while maintaining gas quality standards.

Objective(s)

Project Aims:

To develop a clearer understanding for effectively managing hydrogen, hydrogen blends and carbon dioxide dryness in the NTS, ensuring gas meets required specifications for current and future energy demands.

Project Objectives:

· Conduct an in-depth analysis of existing analyser technologies and their suitability for 100% hydrogen and hydrogen blends/ CO2 dryness measurement.

· Investigate the effects of hydrogen and blends and carbon dioxide incorporation on liquid content in gas systems

Identify and evaluate potential changes in gas measurement practices due to varying hydrogen and CO2 production methods.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Due to the nature of the National Transmission System and position within the gas industry this project will affect all consumers in the same way and will not have an increased impact on consumers in vulnerable situations

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 three-piece bodied valve refurbishment process
Project findings inform the HyNTS safety case to provide evidence to HSE.

Project Partners and External Funding

Lead Network: National Gas Transmission plc

Supplier: DNV

Potential for New Learning

The project is a desktop top study/research project, which will enable more detailed understanding of the current NTS capacity to transport and handle hydrogen, hydrogen blends and also CO2. The work packages detail the specific methodologies to determine this and will provide a process solution to develop potentially new standards around quality requirements for both gases for transportation in the NTS. The findings from the project will be uploaded to the ENA Smarter Networks portal and will be shared via National Gas innovation social media.

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 & PROJECT PARTNER LOCATION

Revenue Allowed for the RIIO Settlement

None – hydrogen focused innovation project.

Indicative Total NIA Project Expenditure

External costs: £78,471

Internal Costs: £ 26,157

Total: £ 104,628

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 "Hydrogen & Carbon Dryness Management" project has the potential to significantly facilitate the energy system transition by ensuring the viability and efficiency of hydrogen and CO2 infrastructure. Through its focus on dryness management, the project aims to mitigate moisture-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.

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 single asset class. All gas analyser points
- Deployment Costs
  - £0.00. Project is research and there will be no technology developed to be deployed.
- Innovation Cost

o £

· Financial Saving

o £ 0.00. As a research project, finical savings are not possible to quantify. However, understanding of dew points for both hydrogen and CO2 will enable a decision to be made whether new technology is needed or current technology adaptation which could impact financial savings

· Safety

o 0%. Data collated from the project will enable understanding of operating conditions required to ensure gas is kept above it's dew point which will reduce likelihood of corrosion, hydrate formation and defects to the NTS integrity.

· Environment

o 0.0 tonnes CO2e. Project not expected to have CO2e savings, however knowledge of dew points could ensure that the gas is at the optimal operating conditions therefore emissions can be controlled.

· Compliance

o Support compliance. Work supports transition to hydrogen.

· Skills & Competencies

o Business Wide. Trained on operation of hydrogen and CO2 transportation on the NTS, adapting from previous natural gas transportation skills.

· Future Proof

o Supports business strategy. Results will support operation of future hydrogen and CO2 national transmission system

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

The findings of the project, while research based, will provide a good understanding of dryness 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 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 and CO2, ensuring the NTS is equipped to handle both these gases. This project can lead to development/integration of better dryness 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' ongoing innovation work looking at maintaining gas dryness in both hydrogen and CO2.

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 dryness in an evolving energy landscape that will transport hydrogen and CO2. It pioneers methodologies to measure and control moisture 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 hydrogen & Carbon Dryness Management 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