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

Jan 2023

Project Reference Number

NIA_NGGT0205

Project Registration

Project Title

Safe venting & recompression of hydrogen

Project Reference Number

NIA_NGGT0205

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2023

Project Duration

1 year and 0 months

Nominated Project Contact(s)

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

Project Budget

£518,653.00

Summary

Venting or flaring of natural gas is currently required in operational or maintenance procedures for work to be undertaken on the gas network. We currently utilise venting and recompression systems on the network to capture gas and inject it back into the NTS. This project will investigate how hydrogen will impact on these systems and their operation, and conduct a technology review of innovative systems which could be utilised on the NTS once hydrogen / hydrogen blends is injected into the network.

Third Party Collaborators

Wood PLC

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Gas Transmission and Metering (GT&M) are committed to reducing emissions from the operation of the National Transmission System (NTS) and eliminating emissions by 2050. A key technology in this transition is hydrogen as an alternative for carbon fuels in heat, transport, and industrial uses. The NTS currently provides a resilient supply to homes, businesses and industry, and GT&M aim to provide the same capability for hydrogen and hydrogen blends.

Due to the difference in characteristics between hydrogen and methane, venting procedures may need to change to ensure safe venting can take place. Process venting released 1,839 tonnes of natural gas into the atmosphere between April '21 to March '22 and

although there are measures being taken to reduce NTS emissions, considerations are required for hydrogen/hydrogen blends. Although flaring is not currently carried out on the NTS, a comparison between flaring and venting is required to assess the processes with hydrogen. The opportunity to recompress hydrogen into the pipeline will also need to be explored. The transition to hydrogen blends and 100% hydrogen could be catastrophic in terms of emissions and therefore these solutions will need to be worked into a vent free transition scenario aligned with the UK's Hydrogen Backbone.

Method(s)

This project will carry out an initial investigation into the impact of hydrogen and hydrogen blends on the venting and recompression systems, continuing from work undertaken in distribution led projects. The project looks to provide guidance on the required changes to standards and procedures in place for natural gas and undertake a technology review of potential innovative systems that can be used for safe venting, flaring and recompression of hydrogen. This project will also investigate the solution to transitioning to a hydrogen network vent free and will develop solutions to eliminate, capture, and minimise potential future emissions.

The following approach will be adopted:

Work Package 1 – Initial assessment on impact of hydrogen on venting and recompression operations

Work Package 1 (WP1) of the project will include an impact assessment on current venting and recompression units / operations.

The assessment will address:

- The impact of hydrogen on current units /operations
- Requirements for what a hydrogen ready unit / operation would need

Work Package 2 – Technology review & assessment of hydrogen / hydrogen blends on venting, flaring and recompression unit technologies

Work Package 2 (WP2) of the project will include a technology review for all recompression unit and emission reduction/elimination technologies that can accept 100% hydrogen and hydrogen blends.

- Technology search for hydrogen ready devices
- Technical review of technologies
- Determination of demonstration of hydrogen ready venting/flaring and recompression solutions

Work Package 3 – Safety standards and procedures consideration for hydrogen / hydrogen blends venting, flaring, purging and recompression

Work Package 3 (WP3) of the project will include an assessment of current safety measures for venting, flaring, purging and recompression of Natural Gas as a pre-FEED to identifying and recommending changes to safety standards and processes.

- Review current safety standards & procedures
- Access safety standards & procedures for hydrogen to identify recommendations for changes
- Assess the effects of these standards/procedures if used for hydrogen
- Identify changes to be implemented to ensure safety for a hydrogen network

Work Package 4 – Propose a vent free transition strategy considering Project Union

Work Package 4 (WP4) of the project will include a proposal detailing how to transition from a natural gas network to facilitating hydrogen blends before converting to 100% hydrogen.

· Review transition scenarios

· Feasibility study

Work Package 5 – Reporting

Creation of technical report, technical summary and ENA closure report.

Measurement Quality Statement

The measurement approach used to meet objectives will be through the identification of high calibre project partners who are experts in their given field. In this instance the project will be limited to a desktop analysis from TRL2 to TRL3 to understand the impact the transportation of hydrogen and hydrogen blends will have on linepack.

Data Quality Statement

The project will ensure that data used is of sufficient quality to deliver project objectives by engaging with GT&M colleagues from various areas of the business. The relevant data and background information will be stored for future access within the National Grid Innovation SharePoint site.

Scope

· Current venting and recompression systems review and baseline

· Review of past work on venting, flaring, purging and recompression and applicability to NTS applications

· Determination of changes required when considering hydrogen and likely impact on safety, cost, procedures, and timelines

· Technology review of hydrogen venting, flaring, purging and recompression technology on the market – review any alternatives not yet considered

· Development of likely requirements for recompression across whole NTS today and when considering hydrogen application

· Determine the opportunity to utilise recompression in current venting scenarios

· Requirements for safe venting of hydrogen and hydrogen/methane blends

· Summary of procedural adaptations to consider

· Plan for demonstration of proposed solution at FutureGrid and next phase of project

· Propose a plan for the transition of Project Union to 100% H2 including consideration of hydrogen blends initially

· Final technical report for submission on ENA portal

Objective(s)

The objectives of the project are to:

· To identify safe venting / recompression technologies and procedures currently in use on the NTS.

· To review recompression technologies applicable for hydrogen and develop requirements to scale up technologies for the entire NTS.

· Investigate solutions to eliminate or minimise process venting natural gas from transmission pipelines to be repurposed for use with hydrogen / hydrogen blends

· To determine the safety requirements for venting, flaring and recompression of hydrogen and hydrogen blends.

· Recommend changes to current standards and procedures for safe venting and recompression to account for hydrogen, hydrogen blends and associate emissions.

· To develop a plan for vent free transition considering Project Union strategy

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 and cost.

· Technology identified to help reduce, eliminate or capture emissions of both natural gas and hydrogen.

· Demonstration of new technologies and procedures to support the transition from natural gas to hydrogen and hydrogen blends.

Project Partners and External Funding

Wood Plc

Potential for New Learning

The project will be the first step in understanding the impact of hydrogen on NTS venting, flaring and purging activities. The learning will develop an understanding of changes required to gas operations to meet future safety standards and procedures with hydrogen and hydrogen blends. The findings from the project will be uploaded to the ENA Smarter Networks portal and will be shared via GT&M innovation social media.

Scale of Project

The project is a desktop study which will provide insight into the impact of hydrogen on NTS venting, flaring and purging procedures. This learning will help to inform the hydrogen strategy and develop required learning for the energy transition.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

United Kingdom

Revenue Allowed for the RIIO Settlement

None – Hydrogen network focused project

Indicative Total NIA Project Expenditure

£518653

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 supports the decarbonisation of the network by investigating the impact of hydrogen current NTS venting, flaring and purging activities with a view to improve and reduce the negative impact to the environment. Specifically, this project will investigate opportunities for Project UNION to transition to hydrogen vent free.

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)

RIIO-1 Question N/A

Please provide a calculation of the expected benefits the Solution

As the benefits of this project will be environmental it is difficult to quantify the benefits. The project will inform the hydrogen strategy for the NTS and provide valuable learning to the whole of the UK gas industry.

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

The project is focussed on venting and recompression devices and activities on the NTS with hydrogen; however, the research undertaken and learning from the project will assist with future hydrogen conversion projects for onshore gas infrastructure and industry.

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

N/A – The Project does not intend to rollout anything, but knowledge and information generated through the lifecycle of the project.

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

Many the gas networks currently vent, flare and purge gas to atmosphere, and the learning from this project will therefore be applicable to all gas networks.

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

RIIO-1 Question 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 and the learning will be shared with the gas industry and wider energy industry to avoid future duplication.

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

Work has not yet been undertaken to understand the impact of hydrogen upon venting and recompression technologies and operations. This project will be the first step in understanding the impact and potential solutions to any challenges identified.

Relevant Foreground IPR

The results of the project will enable us to inform the overall NTS hydrogen strategy and operational activities for venting and recompression. The project will not create any new systems.

Data Access Details

Data for this project, and all other projects funded under the Network Innovation Allowance (NIA) funding scheme, can be found or requested in a number of ways:

· A request for information (RFI) via the Smarter Networks Portal at https://smarter.energynetworks.org. National Grid Gas Transmission regularly publishes much of the data arising from our innovation projects on the ENA portal, before submitting a RFI check this website.

· Via our managed mailbox box.GT.Innovation@nationalgrid.com. Further data can be shared upon request through the innovation mailbox. Each request will be assessed by the GT Innovation Team for its merits and viability.

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

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

This investigation into the impact of hydrogen on venting, flaring, purging, recompression technologies and procedures is early-stage research and therefore carries additional exposure to risk. The NIA funding reduces exposure to risk and enables feasibility assessment of hydrogen production technologies.

This project has been approved by a senior member of staff

☑ Yes