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 2021

Project Reference Number

NIA_CAD0069

Project Registration

Project Title

I-0343 Calorific value and gas quality impact assessment of hydrogen and biomethane blends

Project Reference Number

NIA_CAD0069

Project Licensee(s)

Cadent

Project Start

March 2021

Project Duration

0 years and 5 months

Nominated Project Contact(s)

James Whitmore - Cadent

Project Budget

£10,000.00

Summary

The objective of the project is to understand the impacts of blending hydrogen into a gas distribution LDZ to understand the operational envelope and any limitations on hydrogen or biomethane content allowable in the gas stream under the current and proposed regulatory regimes.

Preceding Projects

NGGDLGN04 - Future Billing Methodology

Third Party Collaborators

Dave Lander Consulting

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Recent publications such as the UK Government's Ten Point Plan for a Green Industrial Revolution identifies Hydrogen Generation as a key priority to accelerating the path to net zero, with a specific target milestone of being able deliver "20% blending of hydrogen into the gas distribution grid" by 2023.

Biomethane has successfully been injected into the UK natural gas grid for a number of years. There are now in excess of 100 plants connected with the number of new connections continuing to rise. Biomethane is playing a role in decarbonising heat and transport today and is considered to have a key role in decarbonising the gas grids for years to come.

The Gas Safety (Management) Regulations and The Gas (Calculation of Thermal Energy) Regulations contain limits that are relevant to the composition of natural gas.

By introducing blends of biomethane and hydrogen, gas compositions will be wider ranging than that of just natural gas that's transported today. Biomethane plants currently enrich their biomethane to meet the regulatory requirements which is costly and counter-productive in reducing CO2 emissions, so there is a strong pull from industry to enable un-enriched biomethane injection. If natural gas is to be blended with hydrogen and biomethane, it is unknown what operating parameters and levels of the constituent gasses would be allowed under the current regulatory regimes.

Method(s)

The aim of the proposed work is to assess the operational envelope of hydrogen injection up to 20% by volume under the existing regulatory regimes. The objectives are as follows:

· Establish a suitable Case Study to illustrate the likely operational envelope given the regulatory constraints. The case study suggested is to assess impacts on the North West LDZ and assume hydrogen injection at one or more offtakes or locations in a lower pressure tier.

· Illustrate any constraints on hydrogen content for different locations of injection within the current regulatory regime, (assuming an exemption to GSMR is in place allowing up to 20% h2 by vol.)

· Illustrate any constraints on biomethane content for different locations of injection within the current regulatory regime.

Establish either one or two case studies for other LDZs. This would permit an assessment of impacts across the UK

Scope

a)Construct a model of daily LDZ energy flows, daily LDZ volumes, daily flow-weighted average CVs for each day in a selected year. The model will assess hydrogen and biomethane injection at NTS offtakes and into lower pressure tiers. The model will permit identification of calorific value (CV) constraints associated with the existing billing regime set by the GasCOTE regulations, and Wobbe index (WI) constraints set by the GSMR.

b) Populate the model with daily data for an LDZ and assess hydrogen injection at NTS offtakes to determine the likely operating envelope initially (when natural gas is the dominant gas conveyed) and in future scenarios (where biomethane and hydrogen are dominant).

Objective(s)

The objective of the project is to understand the impacts of blending hydrogen into a gas distribution LDZ to understand the operational envelope and any limitations on hydrogen or biomethane content allowable in the gas stream under the current and proposed regulatory regimes.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project can be summarised as follows:

· A technical report outlining assessment methodology and summarising the impacts and likely operating envelope hydrogen and biomethane blended into a real LDZ.

Project Partners and External Funding

This project will be funded via NIA and completed in RIIO GD1. The project is being led by Cadent. The additional project partners are Dave Lander Consulting Ltd.

Potential for New Learning

To date, no work has been undertaken that investigates impacts of natural gas blended with hydrogen and biomethane together. This learning should help inform all gas networks biomethane/ hydrogen strategy as we transition to net-zero.

Scale of Project

This project is an entirely desk-based study. This study is a small-scale project that can therefore be considered a strategy project rather than a detailed engineering project. This project could form the basis for further, more in-depth, research should it be required and project partners are agreed.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This study is based initially the North West of the England., with the intention to look at other LDZs with differing natural gas compositions.

Revenue Allowed for the RIIO Settlement

Not Applicable

Indicative Total NIA Project Expenditure

Cadent External Cost - £10,000

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:

n/a

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)

The outputs of this project will inform the operational window for blending hydrogen and biomethane together into the gas networks. The CO2 saving associated with decarbonising heat by displacing natural gas with hydrogen and biomethane is huge. There is also the added financial benefit to biomethane producers of not having to enrich biomethane. The project itself will not be solving these problems but providing key learning to inform future strategy for hydrogen and biomethane.

Please provide a calculation of the expected benefits the Solution

N/A – this is a research study to inform future strategy

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

There are now 7 recognised industrial clusters in the UK. This includes Humberside, Merseyside, Teesside, South Wales, Grangemouth (Scotland), The Thames Estuary and Southampton. All of these clusters are at different stages of maturity but if successful its likely they'll have intentions to blend hydrogen into the gas network LDZs.

The knowledge created in this study has the potential to be replicated in LDZs that could potentially see a hydrogen blend in the UK.

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

N/A

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 learnings from this project will be applicable to all LDZs across all Gas Distribution 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)

n/a

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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 is the first project to look at the operational impacts of blended hydrogen and biomethane on a real LDZ.

The funding licensees involved with this project have discussed the project with other Network Licensees and can confirm that there is no duplication with either other historic projects or those currently being considered.

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 will represent the first study looking to model the operational impact of blending hydrogen and biomethane into a real LDZ

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

This project is looking at potential future scenarios that may be required to achieve the transition to net-zero and therefore not part of BAU. It is appropriate to be funded through NIA.

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 project conforms to NIA requirements. Technical risks, which require NIA support include the absence of funding relevant expertise for modelling these future scenarios as BAU. Support for this project, under the NIA, will allow all licensees to understand to operational envelopes of these future scenarios to inform future strategy and deliver maximum benefits to customers in the form of lower costs carbon emissions.

This project has been approved by a senior member of staff

☑ Yes