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

May 2024

Project Reference Number

NIA_CAD0104

Project Registration

Project Title

Hydrogen Blending: National Safety Evidence Review

Project Reference Number

NIA_CAD0104

Project Licensee(s)

Cadent

Project Start

May 2024

Project Duration

1 year and 11 months

Nominated Project Contact(s)

Sikander.Mahmood@cadentgas.com

Project Budget

£1,001,112.00

Summary

This project concerns the submission of the Evidence created through HyDeploy to the Health and Safey Executive and participation in their Review of the Evidence to evaluate the safety implications of introducing a hydrogen blend into the existing gas distribution system. The findings will serve as an input for the Department of Energy Security and Net Zero in shaping their subsequent blending policy work.

Preceding Projects

NGGDGN03 - HyDeploy

CADENT06 - HyDeploy2

Third Party Collaborators

Dave Lander Consulting

Health and Safety Executive

Progressive Energy Limited

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Blending low carbon hydrogen into the Gas Distribution Networks could contribute to the Net Zero energy transition (see Section 3.1.1), however current Gas Safety Management Regulations (GSMR) only permit 0.1%Vol hydrogen in the existing gas distribution

networks. The Government's "10 Point Plan" published in 2020 and subsequent Hydrogen Strategies include the objective to allow this limit to be changed if supported by the required safety evidence.

To date, the HyDeploy consortium has conducted two successful live network demonstrations showcasing the use of blended gas within existing infrastructure. These demonstrations, at Keele University and Winlaton, near Gateshead, were conducted following exemptions to the GSMR being granted by the Health and Safety Executive (HSE).

The HyDeploy2 project was initially planned to develop safety evidence regarding hydrogen blending through preparing to conduct two live public network demonstration projects. The first was conducted at Winlaton, near Gateshead. However, due to the accelerated progress of the project's evidence creation against its initial plan, it was decided with agreement by Ofgem, to remove the second public network demonstration, and reallocate project budget and resources to close remaining evidence gaps necessary to facilitate the rollout of a hydrogen blend. The project is on course to successfully deliver its updated objective to produce the necessary safety evidence for GB-wide blending.

To efficiently deliver GB-wide hydrogen blending would require an amendment to the GSMR to lift the maximum limit on permissible hydrogen composition specified in Schedule 3 from 0.1%vol to 20%vol, instead of relying on site-specific exemptions. In order to commence a regulatory change process to amend GSMR, the HSE would need to have received and reviewed sufficient safety evidence to substantiate that such a change to relevant legislation should proceed.

DESNZ published a consultation on the matter in September 2023 titled 'Hydrogen Blending into GB Gas Distribution Networks' consultation to further asses the case for hydrogen blending. The consultation stated:

"The safety evidence developed within HyDeploy will be reviewed by the Health and Safety Executive into 2024 paving the way for changes to industry regulations needed for blending".

Following this Evidence Review, DESNZ will be able to update/confirm their strategic policy decision and trigger the relevant legislative processes across Government to enable hydrogen blending (such as requesting the HSE to commence a regulatory change process to amend GSMR).

The Department for Energy Security and Net Zero (DESNZ) has now made a strategic policy decision to support GB-wide distribution-level hydrogen blending (i.e., subject to a safety evidence review) at the end of 2023.

However, as described above, for meaningful changes to regulations to be realised requires a sufficient and comprehensive review of the safety evidence by the HSE at a national level. Even the site-specific assessments were extensive, and it is recognised that for the review to evaluate a regulatory change will be a substantially labour-intensive process.

Therefore, a new project vehicle is required to be created to provide the necessary funding to support the HSE review of the full GB-wide evidence base.

Method(s)

The HSE produced a safety assurance protocol in 2020 (RPS/20/07 BEIS Hydrogen for heat programme – safety assurance protocol & gap analysis) for 100% hydrogen usage, in which they defined 65 Evidence Criteria that need to be met (referred to as "Considerations" in the document). These were grouped into 9 overarching topic areas. It was proposed for 51 of these criteria to be "industry-owned" in evidence submissions.

Although these considerations were drafted for 100% hydrogen, they were reviewed by HyDeploy and deemed applicable to be adapted and adopted for use in the blending safety evidence. This position was subsequently confirmed by HSE as an acceptable basis for the blending national safety evidence submission. Therefore, these Evidence Criteria were used as the basis to orient the HyDeploy evidence submission.

The 51 applicable Evidence Criteria were grouped by HyDeploy into 8 categories, which are defined as:

01 System Architecture

02 Gas Characteristics

03 Gas Network

04 Appliances & Installations

05 Public Behaviour

06 Controls

07 Risk Assessment

08 Implementation Strategy

These 8 categories form the subjects of the corresponding 8 Main Reports of the evidence submission, each of which addresses the Evidence Criteria within the relevant category across its various sections.

The Main Reports are supported by fundamental evidence contained in various associated Technical Reports, which may be cross-referenced by other Main Reports and Technical Reports.

This multi-layered reporting structure and mapping of Evidence Criteria to 8 distinct Main Reports described is illustrated in the diagrams below: Please see the attached document for the diagrams.

This national safety evidence base is to be provided to DESNZ for consequent review by the HSE consistent with the direction set by the strategic policy decision, as described in Section 2.1.

For the Review process to be constructive and efficient, it will be necessary to retain the expert members of the HyDeploy project (who have been involved in the creation of the evidence) to support the Review. The HyDeploy team has successfully obtained two exemptions in the past through a similar evidence review process with the HSE and therefore is suitably experienced to respond to the technical queries raised by the HSE.

It is envisaged that some technical queries may be raised which require the creation of more evidence prior to full completion of the review in order to satisfy the needs of the HSE's assessment, and therefore a decision may be made to commission further work during the review to ensure timely completion. This has been factored into the budget for this project. This could include:

Consultation with Subject Matter Experts (SMEs) to provide technical decisions with appropriate peer reviews. (Referred to herein as Expert Engineering Judgement)

- Additional testing and/or studies to produce evidence.

Wherever possible, the project will aim to close any gaps by means of a consultation and/or study/workshop to avoid any extensive delays to the review process. Whilst creation of new evidence is not envisaged to be required due to the comprehensive nature of the HyDeploy project, it is still a possibility that the Review could determine this is required to an extent, and so contingency funding has been allocated for this purpose. This process has been depicted in the diagram below and is based on guidance provided by the HSE for 100% Hydrogen therefore is subject to change once the detailed engagements have begun.

Please see the attached file - stage diagram

Scope

This project aims to provide the necessary vehicle to address all technical queries raised by the HSE with respect to the hydrogen blending evidence for Great Britain. The evidence is limited to the gas distribution networks and will not include the National transmission system, this is covered separately by National Gas in other projects (e.g. Future Grid).

The evidence presented by this project can also be utilised by DESNZ to further inform their policy decision and any subsequent legislative or regulatory changes (e.g. GSMR) required to enable blending at scale.

Work carried out by the Energy Networks Association in collaboration with the Gas Networks has shown that a 20%vol hydrogen blend provides capacity of 35 TWh pa available to be blended into the Gas Distribution Networks. Equal to heating around 3 million homes, saving around 6m tCO2 a year.

Objective(s)

The key objectives of this project are described as follows:

1. Preparation and submission of the HyDeploy evidence for HSE to review.

a. Engagement with the HSE during its Review of HyDeploy evidence.

b. Provision of technical resources to address evidence gaps via:

i. Expert technical judgement.

ii. Further evidence generation (if required).

2. Finalisation of the HyDeploy evidence according to the results of the HSE Review.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not Applicable - The project refers to fundamental safety research as opposed to physical changes to the system.

Success Criteria

The project will be deemed successful using the following milestones:

- HSE initiate a review of the HyDeploy evidence.

- Responses are provided to HSE queries.

- HSE confirm responses have been received and closed where possible.

In summary, this project will be deemed successful upon completion of the evidence review

Project Partners and External Funding

Project funding will be realised through Cadent Gas Limited (Cadent) and Northern Gas Networks Limited (NGN).

For delivery of the project, the key technical partners will be:

Entity	Referred as
Cadent Gas Limited	Cadent
Northern Gas Networks Limited	NGN
Progressive Energy Limited	PEL
Health and Safety Executive Science Division	HSE SD
Dave Lander Consulting Limited	DLC

Additional potential technical support areas (relevant contractors will be chosen upon further understanding of requirement):

Areas may include:
Materials Science
Procedures
Gas Characteristics
Industrial and Commercial
Risk Assessment

Additional contractors may be required to provide technical support and/or testing should any gaps be identified in the initial review.

The cost estimations detailed below have been calculated using the information gathered throughout the previously mentioned HyDeploy projects. Specific attention should be drawn to the existing exemptions completed under HyDeploy 2, which required an iterative review with the HSE along with unforeseen additional testing and technical costs. Although it is envisaged that this process would have some differences to exemption processes, there are additional complexities associated with the national evidence base that are anticipated to require some level of iterative review. Therefore, the budget below accounts for this and outlines the funding required to effectively complete the review process with the HSE, alongside a contingency fund for further evidence generation.

Please see attached document for the diagram

Potential for New Learning

This project provides extensive opportunities for additional learning by being the first of its kind on a global level and will lay the

foundations for future hydrogen – natural gas blend projects (Up to 20%Vol) throughout the gas distribution industry. The evidence collected throughout the HyDeploy projects should prove useful for future hydrogen projects, working towards the UK's commitment to Net Zero.

Scale of Project

The project concerns assessment of the safety evidence relating to conveying a blended hydrogen and natural gas mixture across potentially the entire GB gas distribution network. It is therefore applicable to all GB GDNs

Technology Readiness at Start

TRL7 Inactive Commissioning

Technology Readiness at End

TRL9 Operations

Geographical Area

This project does not have a specific physical aspect in any particular geographical area. However, the safety evidence concerns the entirety of the existing gas distribution network throughout Great Britain.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Please see section 2.7 for full details of project budget figures.

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:

In December 2023 the UK government outlined the role for hydrogen blending as either a strategic enabler or a reserve offtaker for low carbon hydrogen production projects. This enables blending to facilitate the growth of the hydrogen economy and decarbonisation of the gas networks by mitigating against potential supply risks that low carbon hydrogen producers may face.

Work carried out by the Energy Networks Association in collaboration with the Gas Networks has shown that a 20%vol hydrogen blend provides capacity of 35 TWh p.a. available to be blended into the Gas Distribution Networks. This is equivalent to heating around 3 million homes, saving around 6m tCO2 per year.

To ensure the wider benefits of blending can be realised, the safety evidence pertaining to the repurposing of existing gas distribution networks must first be reviewed.

This hydrogen blending evidence review project will provide the necessary safety assurances to DESNZ, via the Health and Safety Executive (HSE), which will in turn allow a decision to be made on enabling blending at scale

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)

n/a

Please provide a calculation of the expected benefits the Solution

This is for Development or Demonstration Projects, not required for Research Projects.

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

This project centres around the review process of evidence gathered in support of a change to the GSMR. The evidence base addresses the safe use of existing infrastructure across GB and therefore will not need to be replicated.

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

The focus of the project is to review evidence related to safety. Following the review process, it is expected that HSE and/or DESNZ would initiate an industry consultation that will include analysis of the costs associated with the review findings.

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 will be transferrable to all GDNs throughout GB as the review process is being conducted by Cadent on behalf of all networks.

The HyDeploy projects have also been completed in partnership with Northern Gas Networks (NGN) with HyDeploy2 completing two successful trials.

The desired outcome of this project is to provide a foundation for an ultimate change to the GSMR to allow for a hydrogen blended gas mixture (up to 20%vol), leading to all GDNs operating to the new regulations.

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.

This project is the first of its kind so any initial duplication will not occur. HyDeploy maintains regular channels of communication with other industry projects to help prevent any subsequent duplication. The learnings created by proceeding with this review project can be used by other analogous projects (e.g. for 100% hydrogen) to reduce duplication. The review process detailed in this project document for GB-wide distribution level blending will only be conducted once by the HyDeploy project and any further site-specific exemption processes prior to a regulatory change will take learning from this project.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

N/A – there are no similar projects being undertaken by other Network Licensees or with the same objectives as this project

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This Hydrogen Blending, National Safety Evidence Review project is the first of its kind, involving review of evidence for GB-wide distribution-level hydrogen blending up to 20% vol into the existing GB gas infrastructure which has never been done before.

Relevant Foreground IPR

n/a

Data Access Details

All review data will be confidential between the project team, HSE and DESNZ however, resulting reports will be made available as per NIA requirements.

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

Due to this project being the first of its kind, the scope and scale of this project is such that further cooperation and funding from Ofgem via the NIA process is deemed essential

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 scope and scale of the project is covering ground not currently encompassed in gas industry standards and regulations. The NIA process ensures the correct cooperation from GDNs, Ofgem and the UK government (incl. HSE) and that the direction is aligned with the UK's Net Zero goal. The project is being initiated following discussions with HSE and DESNZ to support the hydrogen blending decision.

This project has been approved by a senior member of staff

☑ Yes