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

Nov 2024

Project Reference Number

NIA_NGT0252

Project Registration

Project Title

NTS Hydrogen Blending Management Approach

Project Reference Number

NIA_NGT0252

Project Licensee(s)

National Gas Transmission PLC

Project Start

November 2024

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Harriet Guiry, box.GT.innovation@nationalgas.com

Project Budget

£194,188.00

Summary

The conversion of the National Transmission System into a hydrogen transmission network has been widely discussed, and it is recognised that blending of hydrogen and natural gas in the network is an important intermediary step towards that goal. It is therefore important to understand how the NTS will operate with a mix of natural gas and variable blends up to 20% hydrogen.

This project will investigate how activities carried out by the system operator need updating to accommodate hydrogen blends. The project will assess the modelling software used to inform the short-term strategy for running the network and maintenance planning. The project will investigate the technical feasibility, and resource implications for deploying solutions, and the output will inform NGT's transition strategy with hydrogen blending.

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

The conversion of the NTS into a hydrogen transmission network has been widely discussed and extensive work is underway to prove the technical capability and commercial viability of a 100% hydrogen network. However, it is recognised that blending of hydrogen and natural gas in the network is an important intermediary step towards that goal.

It is therefore important to understand how the current national transmission system will operate with a predominately natural gas supply and manage the injection of hydrogen blends up to and including 20% hydrogen. It is expected that green hydrogen production

rates will vary and therefore variable blends will be seen and require management on the network.

This project will investigate how activities carried out by the system operator need updating to accommodate blends of hydrogen. The project will assess the modelling software currently used to inform the short-term strategy for running the network and medium-term maintenance planning. Additionally, the project will investigate the technical feasibility, safety case and resource implications for deploying solutions that either upgrade or replace current software. The output of this project will be to inform NGT's transition strategy for hydrogen blend integration on to the NTS.

Method(s)

The overall aim of this project is to understand how the modelling software we use for the NTS needs to be upgraded or changed to accommodate a network with both natural gas and hydrogen blends up to 20% and how policies, processes and resources need to be developed to support this transition.
The approach will be to review current modelling software applications within the system operator, how this is utilised for maintenance planning and what processes/policies are followed during use. This will be done by collaborating with internal SMEs and using previously acquired knowledge. Through research and workshops with internal SMEs, the next step will be identifying what are the future proof requirements for modelling software and any additional tools.
Then multiple different modelling software applications will be comparatively assessed against each other using a risk matrix and a recommendation will be put forward based on these results. Further information on each modelling software application will be gathered through researching and directly reaching out to the owners. This project will also consist of desktop reviews of National Gas' internal policies, and end to end processes specific to system operator departments by appropriate partners. The next step will be to identify any skills gaps and make recommendations for changes to policies/processes.

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

Work Package 1 – H2 Blending Modelling Software Assessment

Tbd

Work Package 2 – Impacts of blends on Maintenance Planning

Tbd

Work Package 3 – Policy, Procedures & Skills

Tbd

Work Package 4 – Reporting

Reporting will be carried out throughout the project, summarising the proposed approach and subsequent findings. A final technical report will be produced along with the ENA Closure Report as required for NIA projects.

Objective(s)

The project objectives are as follows:

1. Assess the impact on variable hydrogen blends ≤ 20% on daily system operations of the NTS (understanding impact on GNCC).

2. Research and develop software/technological options to meet the changes required to model blends and identify opportunities beyond what is currently utilised.

3. Assess the opportunity to model a network that is not intact and understand the impact of blends on modelling maintenance planning.

4. Identify policies and procedures used within the system operator that will need adapting for hydrogen blends.

5. Recommend resource and competency requirements and produce timelines and costs to prepare the system operator for blends.

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

· Outputs can be fed into subsequent project(s) where demonstration of modelling software future applicability can be carried out to bridge evidence gaps, ultimately leading to updated policies and procedures for hydrogen blends operability.

Project Partners and External Funding

Lead network: National Gas Transmission

Suppliers: Wood Group

Potential for New Learning

The project will provide stakeholders with an understanding of the future requirements for modelling software and what needs to be developed schedule in the maintenance planning when there are multiple molecules on the NTS. This project will highlight any skills gaps and updates required for system operator internally developed process documents so that resourcing and updating strategies can be developed. This is a key activity in enabling hydrogen blending onto the NTS and supporting the energy transition.

The project should inform the future parameters to consider when either upgrading or changing the modelling software used to support day to day system operation and maintenance scheduling.

The learning will develop an understanding of changes required to gas networks system operations strategy to meet hydrogen blends safety and optimum operation. The findings from the project will be uploaded to the ENA Smarter Networks portal and will be shared via NGT innovation social media.

Scale of Project

This project is a desktop-based study that will provide insight into whether there are changes required to the current network to ensure safety and optimised operation (and operational strategy) for when hydrogen blends enter the NTS. The extent to which hydrogen blends will flow through the NTS has not been looked into extensively and this project will lay the groundworks for the future

requirements of modelling software to support the management of the NTS with hydrogen blends.

The scale of the project is sufficient to deliver the review of the current and future network modelling software requirements and highlight how changes to this technology would need to be reflected in documentation that references its use. This is a vital piece of information to inform operational strategy with hydrogen blends in addition to identifying what future considerations need to be made and feed into physical maintenance being scheduled. To date the focus has been on understanding the capability of individual assets this will consider how they work together as a system.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

UK-wide.

Revenue Allowed for the RIIO Settlement

None – hydrogen blends-focused innovation project

Indicative Total NIA Project Expenditure

£194188

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 focuses on initial steps to preparing the system operator for managing hydrogen blends up to 20% on the NTS which is a key step in facilitating the energy transition. In addition to recommending a modelling software that is future-proofed, this project will also review policies and end to end processes specific to the system operator. Some of these policies (identified within the project) will need updating for hydrogen blends to be managed on the NTS. There will be gaps in evidence required to update these documents. This project is the first step in updating these documents and will identify the gaps in evidence which can then be picked up by the system operator to develop.

This project will feed directly into future work to demonstrate modelling software capabilities and develop how blends will be manage at specific critical sites on the network.

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

The project focuses on initial steps to preparing the system operator for managing hydrogen blends up to 20% on the NTS which is a key step in facilitating the energy transition. In addition to recommending a modelling software that is future-proofed, this project will also review policies and end to end processes specific to the system operator. Some of these policies (identified within the project) will need updating for hydrogen blends to be managed on the NTS. There will be gaps in evidence required to update these documents. This project is the first step in updating these documents and will identify the gaps in evidence which can then be picked up by the system operator to develop.

This project will feed directly into future work to demonstrate modelling software capabilities and develop how blends will be manage at specific critical sites on the network.

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
Definition
Data Point
Maturity
TRL 2-3
The project is identifying the gaps in current modelling capability and future modelling requirements for a system that accommodates

hydrogen blends and natural gas. The modelling software currently used does not utilise its full potential to model hydrogen blends and by the end of this project TRL will increase marginally to reflect the research and knowledge of the hydrogen blend impacts that need to be accounted for when identifying the most applicable modelling software technology.
Opportunity
100% & multiple asset classes
The project will review the modelling scenarios and maintenance specific modelling affect the entire system operability. It will also review specific end to end processes for system operations which responds to manage the entire NTS.
Deployment costs
-
The project will not deploy any technology. The project will provide cost estimates where applicable for recommended software and as part of the skills gap analysis.
Innovation cost
£
The cost includes reviews of current and developing hydrogen blend modelling software, and a review of all existing internally developed processes by appropriate partners and Subject Matter Experts, which will require significant time and effort. This will inform our resourcing strategy, identify and recommend key changes to documents and identify key considerations for maintenance planning scheduling with the use of software.
Financial Saving
-
The project may not result in financial savings. There is potential that future-proofed modelling software proposed as an output of this project could result in long-term financial savings if implemented at the next cyclical update to software.
Safety
-
The outputs of this project can be taken forward to update policies and procedures for hydrogen blend management, which will contribute to enabling safe operation and maintenance of the NTS.
Environment
-
No direct savings from this project but it will enable hydrogen blends to be safely transported through the NTS. If blends are able to be accommodated, 20% hydrogen blends provide a 7% carbon saving.
Compliance
Ensures compliance
Part of the criteria to consider for modelling software technology reviewing relates to compliance and our obligations currently and foreseen compliance requirements.
Skills & Competencies
Departmental
The outcomes of this project will ultimately lead to updated policies and procedures which will affect teams across the business and identify skills gaps which will directly feed the resourcing strategy for the system operator.
Future proof
Supports business strategy
Supports the transition to hydrogen by developing the preparedness of the system operator to accept and manage hydrogen blends onto the NTS. Also providing evidence for policies and procedures to be updated and highlight skills gaps.

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

National Gas Transmission, as the operator of the UK's gas transmission system, have a number of similar documents (operational procedures) to the Gas Distribution Networks. A number of projects are underway where the TSO and GDNs are collaborating on updating these documents. This project focuses specifically on National Gas documents, however there will be similarities and overlaps with GDN documents. Therefore, the findings from this project could inform GDN work into procedure updates. Furthermore, the research into modelling software requirements for hydrogen blends and associated risk criteria will be beneficial across GB for all multi-molecule systems that utilise modelling.

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

The project will not deliver a method that can be rolled out. The solution proposed will be specific to National Gas policies, procedures and modelling software. When the software comes up for review, this project will directly feed into the decision to upgrade or change the current software in order to be future-proof.

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

National Gas Transmission, as the operator of the UK's gas transmission system, have a number of similar documents (operational procedures) to the Gas Distribution Networks. A number of projects are underway where the TSO and GDNs are collaborating on updating these documents. This project focuses specifically on National Gas documents, however there will be similarities and overlaps with GDN documents. Therefore, the findings from this project could inform GDN work into procedure updates. Furthermore, the test designs could also support evidence gathering for GDN documents. This project is also focussing on modelling software and whilst the requirements for transmission and distribution networks are different, the software requirements for hydrogen blends that are additional to the current natural gas network needs will be beneficial for the GDNS to also be aware of.

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 will focus solely on National Gas internal documents, therefore will not be duplicated elsewhere. There is ongoing work into updating documents for hydrogen across the gas networks, however the evidence gaps and test plan requirements for National Gas internal policies and procedures have not been identified, therefore this project is unique to system operator documents that have been developed internally and are not externally reviewed. Similarly, the modelling software requirements for the transmission business are different to those of the distribution networks as are the maintenance planning needs via modelling software therefore there will be no 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

National Gas Transmission are carrying out work to repurpose the National Transmission System to carry hydrogen. As well as the technical feasibility of repurposing physical assets, current policies, procedures must be updated to allow operators and technicians to work on the network safely. As an important intermediatory step towards the 100% hydrogen network goal, introducing hydrogen blends to the network can support the development of hydrogen markets and help decarbonise and meet net zero/clean power targets in the short-medium term.

Part of managing a hydrogen blend on the network will be based on how well we can model, predict and track how the blends of potentially varying percentages up to 20% flow through the NTS. Additionally, understanding how modelling can help facilitate maintenance on the NTS with both natural gas and hydrogen molecules and inform the safest scheduling of physical operations work.

There are multiple modelling software technologies that have been developed for multi-molecule systems but developing the specific requirements of a unique system such as the NTS will be critical in deploying a software that is future-proof for our network needs.

The project is also innovative as an output will be to recommend how to utilise a new or upgraded modelling software though processes and procedural developments. The project will also highlight where development of skills and processes will be required to enable managing a network with hydrogen blends.

Relevant Foreground IPR

The project is a research and development activity, therefore no new Foreground IPR will be generated. However, the project will deliver test programme conceptual designs which may be developed further in future project resulting in relevant 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 transported in the NTS and the current policies and procedures are not appropriate for hydrogen or hydrogen blends. 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

Energy transition projects and research is not catered for in the current RIIO-2 settlement and the project is high risk and low TRL which would not be considered for BAU funding. NIA funding reduces this exposure to the risk and enables early stage research to be carried out.

This project has been approved by a senior member of staff

☑ Yes