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_NGGT0201

Project Registration

Project Title

HyNTS Variable Gas Blend Metering and Gas Analyser System Development - Phase 1

Project Reference Number

NIA_NGGT0201

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Peter Martin, box.GT.innovation@nationalgrid.com

Project Budget

£90,035.00

Summary

Soon we will require flow meters and gas analysers that have the required capability in Hydrogen. Our network could become even more complex to manage, meaning we will need an increasing number of accurate measurement systems that are better connected and can respond quickly to the possibility of varying Hydrogen blends. Therefore, it is important that we complete an assessment of the Hydrogen capability for all our relevant gas analyser and flow metering assets, to understand the point at which we may need to intervene to maintain accurate measurements of our system as Hydrogen is introduced. We will also review developing technology to ensure we are able to introduce new Hydrogen capable systems onto our network as required.

Third Party Collaborators

Kelton Engineering Limited

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Traditionally, flow meter and gas analyser technology has been required to measure the flow and energy characteristics of purely Natural Gas in the National Transmission System. Introducing Hydrogen into the NTS will alter the physical characteristics of the gas being transported in our pipelines, therefore impacting the capability of measurement technology we use on today's network. For the purposes of fiscal measurement, we are required to operate within specific tolerances of measurement uncertainty which will need to continue in a Hydrogen blended network.

This project aims to complete an assessment of the capability of the current measurement assets in use on the NTS in different Hydrogen scenarios to understand the potential limitations once we start to introduce Hydrogen into the network. A thorough technology review will also provide a view of potential asset solutions for maintaining accurate gas measurement in future Hydrogen scenarios

Method(s)

The project will be divided into 5 Work Packages:

Work Package 1: Project Management

Led by – Kelton Engineering

To manage the delivery of each work package, Kelton will assign a project manager to the project for its duration. The project manager will be responsible for chairing regularly scheduled project review meetings between Kelton, GT&M subject matter experts and key project stakeholders. Project review meetings shall cover, but shall not be limited to, reporting of risks, mitigating actions, project timeline updates, and costs throughout the duration of the project. In addition to regularly scheduled project review meetings, the project manager will arrange and run any workshops that are required.

Work Package 2: Impact of H2 on NTS Flow/Energy Measurement Today

Led by – Kelton Engineering

Key stakeholders engaged to review full list of flow measurement sites to identify which types of metering systems should be reviewed e.g. FWACV, offtake, compressor fuel, process flow. The metering system impact review will be a desk-based exercise using existing asset information provided by NGGT for all meter and analyser technologies. Each existing meter (USM, turbine, orifice plate etc) and analyser technology (Danalyzer, GasPT etc) will be assessed for hydrogen suitability (blends of 0-100% hydrogen with natural gas). A matrix of asset types will be produced showing each of the meter and analyser technologies against suitability for blends of hydrogen with natural gas. This matrix will be used to understand the point which technologies need to be upgraded or replaced. The addition of hydrogen could increase the requirements for data fields to be telemetered to the control room via the RTU. The outputs of the metering system impact assessment will be reviewed and discussed with key stakeholders.

Work Package 3: Measurement Technology Landscape Review

Led by - Kelton Engineering

Kelton will undertake a technical review of available and in-development metering and analyser technologies to identify potential risks, emerging issues and opportunities. This should also take into consideration any relevant work already being undertaken by other NGGT hydrogen metering and analyser projects. Using data provided by equipment manufacturers, possible upgrades will be analysed for suitability. Relevant technical papers will be referenced and issues with each type of equipment will be documented. The analysis of the possible upgrades will consider the issues in the initial calibration, installation, commissioning, operation, maintenance and decommissioning of the equipment and the effects of the gas composition throughout the lifecycle of the equipment.

Work Package 4: Conceptual Design and Test Plan Development

Led by – Kelton Engineering

Based on the outputs from the previous work packages Kelton will produce a design specification with the technical requirements for a 100% hydrogen Network Entry point measurement system which meets uncertainty requirement of ±1% volume flow. In addition, Kelton will identify the differences for metering systems with wider uncertainty limits, smaller flowrates and for hydrogen blends. Reporting, diagnostics and performance analysis requirements for remote monitoring via telemetry shall be identified with required data infrastructure in compliance with The Network and Information Systems Regulations 2018. Kelton will produce a high-level conceptual design for a 100% hydrogen Network Entry point measurement system. Where the equipment identified as possible upgrades has not been fully tested by the manufacturer for up to 100% hydrogen, Kelton will identify the testing required whether it is lab1 scale or live

testing e.g. on FutureGrid. This will be in the form of a FAT (Factory Acceptance Testing) and SAT (Site Acceptance Testing) procedures. The outputs of the conceptual design and test plan development will be discussed with key stakeholders before the reporting is undertaken.

Work Package 5: Reporting

Led by – Kelton Engineering

Once the prior work packages are finalised, Kelton will produce and submit a technical report, including technical summary, for review and acceptance by GT&M. Once accepted, the technical report will be used to complete an ENA closure report for the project, finalising project completion.

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners whom are experts in their given field and the use of real data and materials from National Grid sites. In this instance the project will be a demonstration to inform new insights into the use of Metering systems with the ability to measure varying blends of hydrogen. The design and fabrications of the testing unit will adhere to Gas Transmission technical standards and the test procedures will determine the optimum Design of Experiments for the variables and systems in question.

Data Quality Statement

The project will be delivered under the NIA framework in line with OFGEM, ENA and NGGT internal policy.

Data produced as part of this project will 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.

Scope

· Technical review of Hydrogen capability for existing flow metering and gas analyser assets in use on the NTS

· Technical review of Hydrogen capability for available and 'in-development' flow metering and gas analyser global assets–define best practice utilised on other hydrogen network systems (South Korea etc...)

· Define the technical requirements for a combined flow and energy measurement system and develop the conceptual design

· Produce a generic test plan for any combined metering/analyser system including the potential for new product testing vs repurposing existing systems

· Produce a technical report and completeENA closure report

Objective(s)

· Understand the impacts of potential Hydrogen scenarios on existing NTS flow/energy measurement assets

· Conduct a technology review of available measurement systems that have Hydrogen capability

Develop a conceptual design for a combined flow/energy measurement system that can handle Hydrogen blends and a test plan that enables future phase testing of potential systems

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 project will be deemed successful if:

- The project delivers objectives within time and cost parameters
- Demonstration of a thorough technology review has been completed
- Conceptual design of combined Hydrogen measurement system is accepted by GT&M
- Test plan accepted by GT&M
- Technical requirements of a combined flow/energy Hydrogen measurement system have been captured
- Final technical report has been completed by the supplier and accepted by GT&M

Project Partners and External Funding

Gas Network – National Grid Gas Transmission

Kelton's Engineering – Measurement Consultancy

Potential for New Learning

One of the key outputs from this project will be to understand the current capability of our measurement asset base against future Hydrogen scenarios, whether blended or pure Hydrogen. Whilst the project is focussed on the NTS, a lot of the findings are likely to be beneficial to the other distribution networks as well. Through a thorough technology review we shall also learn of the existing and in-development measurement assets that could become part of the solution to managing a Hydrogen network in the future. This piece of work will inform future projects where we intend to complete lab-scale and live testing of assets.

The learning from this project will add to the NTS Strategy on energy transition and inform the changes needed to ensure metering of a varying hydrogen gas blend. The output may also support and inform other gas networks. The data will be shared through the smarter network portal and provision made for other networks to utilise the metering application test system as appropriate.

Scale of Project

The scale and cost of this project is appropriate for the expected results and benefits, with the length of the project required to complete the desktop studies in each of the work packages. The various work packages are required to deliver a final technical report that summarises where we are today in terms of readiness for Hydrogen measurement, how future Hydrogen scenarios shall impact our network and also the available technologies and methodologies we will be able to apply to maintain accurate flow/energy measurement. Relative to the cost associated with the project, the potential benefits will be far greater in terms of preparation for Hydrogen measurement readiness, allowing us to inform the investment strategy and make better, longer-term decisions much earlier. Trying to complete the project in a shorter timeframe would not be advantageous as we would potentially sacrifice on quality. Future projects are likely to be of a larger scale when we begin forms of lab scale or live testing of measurement assets.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

United Kingdom

Revenue Allowed for the RIIO Settlement

None – Hydrogen network focused project

Indicative Total NIA Project Expenditure

£90,035

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:

For the transition to hydrogen, the NTS will need to ensure hydrogen can be supplied to consumers reliably from producers. Metering is a key requirement for the gas networks and reliable, accurate data is required for any gas that is being transported. This project will provide the assessment of the NTS current capability for measurement flow/energy in different Hydrogen scenarios allowing us to understand the potential impacts on measurement from Hydrogen and enable preparation for future investment decisions required in the energy system transition.

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

Currently, gas networks are required to measure the volume and energy of gas flow within certain levels of accuracy (uncertainty) to ensure that, as network operators, there is a solid understanding of the energy balance in the UK and therefore consumers are billed accurately. Moving to a Hydrogen future, this level of accuracy will need to be maintained and measurement devices in use today on the network most likely will not be able to achieve this in Hydrogen or pure Hydrogen blends. The key benefits from this project are difficult to monetise at this time; however it will contribute to ensuring that on a Hydrogen network, we will have the right assets in place to enable accurate billing of consumers for their energy usage.

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

The learnings from this project shall be relative to all the other gas distribution network operators in GB, as similar measurement operations are carried out across the networks. Any location where there are measurement assets is likely to benefit from the findings from this project.

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

N/A – This is not specifically a method that will be rolled out across the GB, but rather findings that will inform NTS strategy and could also benefit GDN strategy.

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 research and analysis undertaken in this project will be applicable to pipeline operators and will inform the strategy for hydrogen in the energy transition. Findings from the project will deliver new data for use to understand metering on gas networks of variable gas blends which can in-turn develop Hydrogen investment strategies.

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 project. These efforts are to ensure the energy transition can be undertaken at as low a cost as possible to the consumer. The project scope has been notified to all other gas network operators to ensure that there is no duplication taking place.

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

This project will be assessing our measurement asset readiness for hydrogen scenarios, something that we have not seen before on the NTS, therefore innovation funding is required. New technologies and methodologies shall be examined as well, that may not have been implemented on the NTS before.

Relevant Foreground IPR

This project and the resultant outcomes/deliverables will conform to the default treatment of IPR as set out under the agreed NIA Governance (where the default requirements address two types of IPR: Background IPR and Foreground IPR).

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

Current business as usual activities are not funded for Hydrogen related work and so this shall be utilising innovation funding.

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 approach is unknown and there are many routes that could be taken, there is a risk that without this work the different energy networks would spend time and money on carrying out the research and testing. The NIA funding reduces this risk and enables the feasibility of existing measurement assets to be assessed.

This project has been approved by a senior member of staff

☑ Yes