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

Sep 2024

Project Reference Number

NIA_NGT0243

Project Registration

Project Title

HyNTS Variable Gas Blend Measurement System Development - Phase 2

Project Reference Number

NIA_NGT0243

Project Licensee(s)

National Gas Transmission PLC

Project Start

October 2024

Project Duration

1 year and 5 months

Nominated Project Contact(s)

Alistair Carvell, box.GT.innovation@nationalgas.com

Project Budget

£495,257.00

Summary

The project will also examine whether the sensors could be suitable for fiscal and CV measurement. This could be an opportunity to provide, at an affordable scale, much more localised billing zones through increased measurement of CV across the network. This will also enable power and industrial customers to adjust their processes in real time to account for varying H2 content in gas supplied. The project will also study the installation, operation, and integration of the devices into operations, including recommending locations for installation, so project outputs can be directly carried into wider NTS deployment if the devices prove useful.

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

NGT expects hydrogen blending into the transmission system to occur in the near future, beginning from ~2% by volume. The Variable Blend Measurement Phase 1 work showed that our metering assets are ready for blends of up to 10%, and up to 20% with some recalibration. It also highlighted a known issue with the gas analyser fleet, in that widespread modifications

will be required to prepare many analyser units for any hydrogen measurement. Preparatory work is already underway to prepare these analyser units for upgrade, so that entry and exit points (fiscal measurement) will be able to accurately measure hydrogen blends.

However, we expect that adding capacity for better process/operational composition measurement will be required. It is not completely understood how hydrogen will propagate through the network, especially when it is introduced as a small percentage of gas composition. To add to this, injection infrastructure will vary in location and size, and may not inject at a flat rate, meaning that different

parts of the network will see different levels of hydrogen, varying over time. As hydrogen content increases, up to an expected 20%, it will also be useful to have a better understanding of hydrogen content across the NTS to allow hydrogen-only customers to de-blend hydrogen from the network, knowing there is sufficient H2 upstream and without impacting other users across the system. Customers using gas-facing equipment sensitive to H2 content will also be able to adjust their processes in real time if these sensors provide a method of providing fast response hydrogen measurement.

Method(s)

This project will identify readily available, fast-response sensor solutions for process measurement of hydrogen

content, that would be suitable for use at AGIs including blend injection/draw sites. The solution will then be installed and trialled at Future Grid during the Future Grid Phase 2 Deblending project, currently slated for July 2025. If feasible, this project will also simultaneously test a blend measurement device to fiscal tolerances, and examine whether this device can be ISO certified to fiscal standards. The project will study and report on the accuracy and performance of the trialled device(s), and provide a summary of their usefulness for NTS deployment, with recommendations of suitable locations for deployment, in consideration of different likely blending scenarios. It will also record a comprehensive lessons learned for future installation and integration into these sensors into the NTS.

The project will also produce a report that studies, using the results from the trials of these device(s), whether they can be used to improve billing methodologies by improving FWACV calculations and improve the localisation of billing zones, in consideration of the reduced capex (comparatively) offered by these blend measurement devices.

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

The project is split into five work packages detailed below:

WP0: Project Management

This work package describes the required project management activities, the activities are as follows:

1. Project Plan, Risk Register and Lessons Learned:

The project supplier will create and maintain a project plan through the lifetime of the project. The supplier will also create and maintain a risk register identifying and managing identified project risks, and a lessons learned document which will added to the final report at the end of the project.

2. Meeting requirements:

The project supplier will hold a kick-off meeting and subsequent review meetings at regular intervals, the frequency of which will be decided by the project team.

WP1: Market Review & Procurement

This phase will identify the optimum solution for blend measurement by conducting a market scan and completing a report for NGT assessment. Then, the supplier will arrange procurement of the device(s) which NGT will reimburse.

The scope of work proposed for this work package is as follows:

1. Market Review:

Supplier to conduct a full market review of available technology and suppliers of appropriate blend measurement device. This device will satisfy NGT's requirements for hydrogen content as a mol% of gas composition. National Gas will provide criteria for sensor selection and will decide on which sensors to take forward to trial. The criteria for selection will be speed of response, accuracy, linearity, selectivity, robustness, drift, maintenance requirements, limits of detection and affordability – National Gas will ensure the project benefits consumers by choosing and testing sensors that provide good measurement capability to the network at a capital cost that is significantly cheaper than further installation of gas chromatographs.

2. Procure Devices:

National Gas may want to test a number of devices, depending on cost to purchase, and cost/availability of installation on the Future Grid loop. At least one device will be purchased and tested for operational use, if possible, a second and possibly further devices will be purchased and tested for trialling against fiscal measurement standards. The project supplier will arrange purchase and delivery of the devices, which National Gas will reimburse once devices are received and receipt provided.

WP2: Design, Installation & Certification

This work package will produce a design pack for installation of chosen devices, and construct a test plan to run alongside pre-planned Deblending flows. This work package also covers the installation on the Future Grid phase one loop, and fiscal

certification of devices. The scope of work proposed for this work package is as follows:

1. Full design pack:

The project supplier will produce a full design pack, in conjunction with National Gas and the Spadeadam DNV team, for the devices selected. Installation of the devices may be able to take advantage of existing stabbings/tappings on the Future Grid phase one loop.

2. Test Plan

A test plan will be devised that manages the thorough testing of the devices, against the pre-selected criteria, by measuring their performance on the planned flows for the Future Grid Phase 2 - Deblending project. The project team will ensure that the test plan for these sensors obtains as much value as possible from running alongside the planned deblending flows, for instance it may be possible to change sensors out half way through the deblending project, to allow for more sensors to be trialed – this will depend on the choices made from the market scan.

3. Install Devices

The project supplier will install the chosen devices for test one the phase one loop as shown in the design pack, or they will arrange for installation with relevant device manufacturers. DNV Spadeadam will prepare the loop for install by providing tappings/stabbings. The project supplier will work with National Gas and DNV Spadeadam to ensure compliance.

4. Fiscal Certification

The project will attempt to certify a sensor to the ISO17023 standard, or similar. This is an attempt to see if a high performance sensor, which remains a cheaper alternative to a gas chromatograph, can be certified to perform at fiscal measurement standards. National Gas understands that this element of the project may not be feasible or may fail, but believes the pay-off if such a process is possible, could save considerable amounts of consumer money.

WP3: Testing

This phase will see the testing of the devices as designed in the test plan. Testing of the devices will take place on the planned deblending flows, so as to maximise value from existing projects. 3 Months has been allocated to the testing phase, actual timings may vary if the timeline for deblending changes.

WP4: Reporting

This element of the project will produce a comprehensive final report that includes full analysis of the various devices performance, as well as other reporting to include: consideration of the tested devices usefulness for potential FWACV calculations, placement of trialed sensors on the network in consideration of anticipated blending scenarios, and a full lessons learned from procurement, installation and use.

The scope of work proposed for this work package is as follows:

1. FWACV Report:

The project supplier will produce a report that compares the performance of the trialled devices against the recommendations made in Cadent's 'Future Billing Methodology' report (available freely online.) It should seek to answer whether the device(s) trialled are useful for calculating FWACV, and whether they could enable zonal or local pricing, with an examination of likely costs and benefits to NGT dependent on roll out scale (i.e., cost of deployment vs. reduced shrinkage.)

2. Rollout Analysis

An examination of use-cases for the trialed sensors, with consideration of likely blending scenarios, which will recommend ideal

sensor placements on the NTS. This report will provide example use cases for deployment of the devices tested.

3. Final Technical Report

Final technical report to analyse overall performance of the trialed devices, including performance against the test plan and an analysis of results obtained. Final Technical Report will also contain summary and key points from the lessons learned log, which will be maintained throughout project lifecycle by project supplier.

Objective(s)

· Compare available hydrogen blend measurement options, and identify at least two solutions that meet National Gas Transmission's performance criteria.

· Procure two devices, one to process measurement standards and a second for fiscal trial. (Representing varying TRL levels.)

· Complete detailed design pack for Future Grid installation.

· Install the device(s) on the Future Grid Phase 1 loop, ahead of Deblending trials.

· Examine whether the device(s) can be certified to ISO fiscal measurement standards and attempt this certification if reasonable.

· Test the installed device(s) on varying blends during the Future Grid Deblending project.

· Report on performance of the new device(s), including commentary on suitable roles and locations for wider network deployment ahead of likely blending scenarios.

· Report on the usefulness of these devices for FWACV calculations, in respect to the options presented in the 'Future Billing Methodology: Recommendations (March 2022)' report - available freely online.

· Complete a 'lessons learned' exercise from the procurement, installation, and operation of the device(s), for the purposes of informing wider network rollout.

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:

· National Gas Transmission are able to define required qualities of an ideal fast response hydrogen% sensor, and such a device is located by market scan.

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At least 2 sensors are installed on the Future Grid ahead of deblending trials.

· Sensors are tested during deblending flows.

· Report completed on the performance of the tested sensors - plus feasibility of ISO certification, usefulness for calculating local CV values, lessons learned for wider network deployment, and suggestions for deployment locations in respect to envisaged likely blending scenarios.

· Project completed to time, cost and scope.

Project Partners and External Funding

Lead Network: National Gas Transmission plc

Supplier: DNV

External costs: £ 371,442.75

Internal Costs: £ 123,814.25

Total: £495,257.00

Potential for New Learning

The project will be the initial step in understanding the performance of new sensor technologies, including those at lower TRL which are unproven in blended service, and their usefulness in the measurement of hydrogen content measurement, and how they can enable the safe and efficient management of a H2/NG blended transmission system. It will also deliver an understanding of how hydrogen sensors need to placed in respect of different blending scenarios to ensure a blended transmission system stays within safe and regulatory limits.

The findings from the project will be uploaded to the ENA Smarter Networks portal and will be shared via National Gas innovation social media.

Scale of Project

This project will take advantage of the existing planned flows on the Future Grid phase facility, by the Deblending project. The purchase of gas for loop operations, and control of the system during testing, is expensive and so this project provides value to consumers by making use of existing work.

Testing a range of sensors, from those at low TRL through to more developed options, is desirable as it allows for the proving out of cheaper but also lower TRL technologies, and allows a direct performance comparison to existing assets. To maximise the benefit described above, as wide a range of technologies as is possible should be tested, to maximise the available test time on blended flows of natural gas and hydrogen – something that has not before been possible on an NTS replica. The testing of a range of sensors will allow for the most cost-beneficial option to be selected from blend measurement on the NTS, including options for reducing the geographical size of billing zones at the most beneficial cost.

This project also benefits from a significant reporting aspect: consideration of FWACV calculations, lessons learned for network rollout, and a study of use cases given likely blending scenarios. The reporting allows National Gas Transmission to maximise the learnings available from the project, and provides a firm basis for roll out of the most effective technology at the end of the project.

Technology Readiness at Start

TRL5 Pilot Scale

Technology Readiness at End

TRL9 Operations

Geographical Area

United Kingdom, Warwick.

Future Grid, RAF Spadeadam, Cumbria.

Revenue Allowed for the RIIO Settlement

None – hydrogen focused innovation project.

Indicative Total NIA Project Expenditure

External costs: £ 371,442.75

(DNV cost is £191,442.75, plus £180,000 allocated for purchasing and installing sensors. This exact number will depend on the results of the market scan – WP1.)

Internal Costs: £ 123,814.25

Total: £ 495,257.00

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:

National Gas Transmission (NGT) are committed to reducing emissions from the operation of the National Transmission System (NTS) and eliminating emissions by 2050. A key route to achieving this involves transitioning the network from natural gas to hydrogen. Successfully transitioning from methane to a hydrogen network, including blending hydrogen into natural gas, will require fast response hydrogen measurement to be deployed across the network. This will ensure that the system can stay within permitted and safe hydrogen content limits, as it isn't fully understood exactly how hydrogen will travel in a blended gas system.

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

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.

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

	Data Point	Data Point Definition
Maturity	TRL5	Some of the sensors identified for scan/trial are at TRL5.
Opportunity	100% or multiple asset class	The project can be applied to • Pipeline • Branched pipework • Stub/dead end pipework. • Above Ground Installations AGIs

Deployment costs	-	Deployment costs are not known at the start of the project but will be defined throughout the project.
Innovation cost	£ 495,257	The cost includes all installation, testing and sensor costs.
Financial Savings	-	Exact financial savings not known at this phase.
Safety	-	Ability to operate NTS within GS(M)R guidelines E.g. hydrogen content safely managed across NTS.
Environment	-	Deployment of fast response sensors likely a blend requirement
Compliance	Support compliance	Review guidelines, procedures
Skills & Competencies	Individuals	Skills gap analysis / training requirements
Future proof	Supports business strategy	The project will help enable hydrogen in the NTS and support the energy transition.

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

The findings from this project will directly inform the implementation strategy for installing fast response hydrogen sensors on the NTS. The exact nature of installation, in terms of locations (sites,) will depend on how blending is first introduced into the network. The findings from this project will be relevant and applicable to all NTS AGI's in the UK, and will also be applicable to GDN AGI's.

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

The findings from this project will directly inform the implementation strategy for installing fast response hydrogen sensors on the NTS. The exact nature of installation, in terms of locations (sites,) will depend on how blending is first introduced into the network. The findings from this project will be relevant and applicable to all NTS AGI's in the UK, and will also be applicable to GDN AGI's.

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 management in the energy transition. Findings from the project will deliver new data for use to understand control of quality on gas networks of variable gas blends which can in-turn develop safe hydrogen standards and procedures.

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.

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

Some of the sensors identified in the research stages of this project are early level TRL, meaning they have been proven in a lab setting but have not seen real use that demonstrates their viability. This project offers to the chance to compare these sensors against

other more developed options, in a genuine blended service environment via the Future Grid deblending flows. These sensors should be tested out in a blended environment before they can be considered for wider deployment across the NTS. Many of the manufacturers of these sensors are new companies, as the technology behind them is relatively new. UK gas networks and consumers will benefit from a study of the performance of these new sensing technologies.

Relevant Foreground IPR

This project will not result in any new 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 present in the NTS. 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 NTS hydrogen fast response sensors is demonstrative research and therefore carries additional exposure to risk. The NIA funding reduces exposure to risk and enables feasibility assessment of hydrogen transmission technologies.

This project has been approved by a senior member of staff

☑ Yes