

NIA Project Registration and PEA Document

Date of Submission

Jan 2023

Project Reference Number

NIA_NGGT0195

Project Registration

Project Title

Multi Gas Detection

Project Reference Number

NIA_NGGT0195

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2023

Project Duration

1 year and 3 months

Nominated Project Contact(s)

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

Project Budget

£378,738.00

Summary

This project aims to test and demonstrate Nevada Nano's MPS multi-gas sensor technology at our operational and test facilities, namely the FutureGrid test facility and Bacton. Their single gas sensor should be able to detect LEL% for multiple gases and locate and quantify fugitive emissions, within a mix of Hydrogen and Methane simultaneously with a single calibration. If the NTS is to transport blended Hydrogen and Methane mixes on the transition to pure hydrogen, this type of sensor could be a very useful safety device if proven.

Preceding Projects

NIA_NGGT0137 - Monitoring of real-time Fugitive Emissions (MORFE)

Third Party Collaborators

DNV

Nevada Nano

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Alongside the need for methane gas detection there is a growing need to prove devices for hydrogen detection and blended gas detection. COP26 has escalated the desire to monitor and prevent emissions on our sites whilst in the transition to net zero, gases like

hydrogen provide an even greater challenge in the size of the molecule and the potential leak paths. National Grid Gas Transmission are looking for a technology that is both cost effective and capable of measurement in both methane and hydrogen environments. This project aims to prove the technology is effective in both environments by completing field testing on both an NTS site in operation today with Natural Gas, and the FutureGrid Facility which is operating with pure Hydrogen and Natural Gas/Hydrogen blends.

There is both a safety and environmental challenge associated with the emission of Methane/Hydrogen gases from networks. Both gases pose the risk of creating a flammable atmosphere if released in enough quantity and so an economical detection system that can track both gases will be extremely useful in the transition to a Hydrogen network. Then there is also the environmental challenge of tracking methane emissions to the atmosphere, to enable us to manage them effectively.

Method(s)

Phase 1: Technical Demonstration & Benchmarking

Led by Nevada Nano

The project will be funded by Network Innovation Allowance funding and therefore we are required to demonstrate the innovative nature of the technologies we are looking to deploy. This first work package will provide key background knowledge and understanding of the technology and how it relates to other gas detection systems on the market. Providing a detailed review of gas detection landscape and systems and the benefits of the Nevada Nano system vs other technologies on the marketplace. Providing a lab-based demonstration of the capability of the system with various gas types and variable blends of hydrogen and natural gas

Phase 2: Bacton Demonstration (Natural Gas)

Led by Nevada Nano, supported by Gas Transmission & Metering

Site survey conducted to understand the optimal locations for each sensor to be installed on site, in order to effectively monitor fugitive emissions onsite for the duration of 3 months onsite. All equipment and sensor modules shall be installed following all required safety procedures, with the monitoring results continuously stored on a secure cloud platform, with results also made available on demand to any National Grid employees who require access, such as Bacton operational staff. Weekly reports shall be generated that contain the estimated total emissions volume for each area of Bacton, and a list of leak events including leak time, leak rate, location, duration and a visualisation heat map of the detected leaks on site.

Phase 3: FutureGrid Demonstration (Hydrogen Blends)

Led by Nevada Nano, supported by DNV and National Grid

The FutureGrid Site consists of decommissioned assets from across the Network, installed above ground in a test loop for hydrogen. Through the test period the facility will run with 2%, 10%, 20% and 100% Hydrogen/Natural Gas blends. We would like to trial the NevadaNano gas detection system for these variable blends. The facility provides as an opportunity to undertake controlled leak trials to further assess the system. Future applications on the NTS may be for both fixed and variable blends of hydrogen and natural gas. The system will not only demonstrate capability for future gas detection in a net zero scenario but also enable us to monitor any leaks in the system during the testing activity. Similar to Bacton trials, a site survey shall take place to determine optimum location of sensors, and they shall then be installed and remain in place for 12 months, with continuous monitoring results made available to National Grid and DNV personnel.

Phase 4: Standards and Reporting

Led by Nevada Nano, supported by DNV

Deliver high quality, robust and relevant Technical Report and ENA Closure Reports to meet National Grid's requirements.

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 demonstrations to inform new insights into the use of sensor systems to detect, locate and quantify fugitive emissions of Natural Gas and Natural Gas/Hydrogen blends, as well as pure Hydrogen. The installation of these sensor systems on National Grid operational sites and the FutureGrid test facility shall follow all relevant safety assessments and procedures, with the test procedures designed to quantify the required variables during demonstrations in order to prove the success and viability of the solution.

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

The scope of this project will demonstrate a sensor system that has not been deployed on a UK gas network before, and one that should be capable of both detecting, locating and quantifying fugitive natural gas emissions, but also mixtures of Hydrogen and Natural gas. If successful, this project will have proven a system which could help reduce natural gas emissions to atmosphere, as well as reducing safety risk associated with gas escapes for both Hydrogen and Methane network, supporting a network in transition through to Hydrogen. Having a system that can measure and detect gas mixtures from Natural Gas through to 100% Hydrogen would provide good value to consumers, as it will be viable through the transition to Hydrogen.

The scope of work contained in this project includes:

- Lab demonstration of Nevada Nano's sensor technology and benchmarking against other available technology solutions
- Site survey of Bacton Terminal and appropriate safety assessments to allow installation of MethaneTrack system onsite
- Installation of sensor system onsite at Bacton terminal for 3 months, providing quantification and location of potential leaks – whilst sharing on demand results with appropriate National Grid personnel
- Site survey of FutureGrid facility and appropriate safety assessments to allow installation of system onsite
- Installation of sensor system onsite at FutureGrid facility for 3 months, providing quantification and location of potential leaks – whilst sharing on demand results with appropriate National Grid personnel
- Randomised controlled venting to take place on FutureGrid site to simulate leaks, in order to test the capability of the sensor system against each of the Hydrogen/Natural gas blends being tested (Natural Gas, 2%H₂, 10%H₂, 20%H₂, 100%H₂)

Objective(s)

To demonstrate the capability of gas monitoring systems that can detect both methane and hydrogen for both current and future applications.

- Benchmark and review gas detection landscape and benefits of selected Nevada Nano vs other technologies
- Lab-based demonstration of Nevada Nano technology against variable gas blends
- Demonstration at Bacton facility of methane leak detection
- Demonstration at FutureGrid of hydrogen leak detection, and variable gas 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 project shall be deemed successful if the technology has been proven in an NTS and FutureGrid setting, with its capability shown to be able to measure and detect both Methane, and Methane/Hydrogen mixtures

Project Partners and External Funding

Gas Network – National Grid Gas Transmission

Multi Gas Detector Supplier – Nevada Nano

FutureGrid Facility Testing – DNV-GL

Potential for New Learning

We hope to prove a gas sensor system that can support the natural gas network through to a 100% Hydrogen network, by detecting, locating and quantifying fugitive emissions or gas leaks on sites. To learn how accurately the system is able to pick up on controlled leaks that take place, containing various blends of Hydrogen and Natural gas; success would mean that the system could be used through the transition to net zero. We need to understand the ease of implementing the solution, how it could be maintained, as well as how the data collected could be utilised.

The learnings from this project shall be shared through the smarter network portal, as well as through direct engagement with any other gas networks that could benefit from the results.

Scale of Project

To test the solution against the majority of potential gas scenarios for the NTS we must demonstrate the system against Natural Gas, as well as differing Hydrogen blends, which is why we have chosen to demonstrate at both the Bacton Terminal site and FutureGrid facility. Currently there is no other online high pressure test facility with Hydrogen capabilities in the UK which is why we will utilise the site; where we shall be making use of existing trials in varying blends to make efficient use of investment in other projects. Bacton provides the opportunity to monitor emissions of a complex site on the NTS. Completing this exercise on a smaller scale, for example solely in a lab, would not provide nearly as much benefit, as we need to test these systems in open conditions where external factors such as the weather can affect gas releases.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

United Kingdom – Warwick, Bacton Terminal and FutureGrid Facility (RAF Spadeadam)

Revenue Allowed for the RIIO Settlement

None – Hydrogen network focused project

Indicative Total NIA Project Expenditure

£378,738

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:

It could prove a gas sensor system that can support the current natural gas network through to a 100% Hydrogen network, by detecting, locating and quantifying fugitive emissions or gas leaks on sites, both Methane and Hydrogen. There is a need right now to be able to monitor fugitive emissions from our natural gas network, however we will also need a system that can continue to do so as we move towards blends of Hydrogen and then pure Hydrogen. From both an environmental and a safety standpoint.

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

It is difficult to quantify the benefits for this project, as they shall be of an environmental and safety kind. Through continuous monitoring of natural gas, whether that is natural gas as we use today or blended with Hydrogen, we would be able to target and hope to reduce fugitive emissions from our networks to reduce the negative impact of greenhouse gases on the environment. A successful detection system will also provide a warning system for flammable atmospheres of gas leaks, helping to manage safety risks.

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

The project is focused on gas detection and quantification on the NTS, however the research and learning undertaken as part of this project is applicable to all GDNs within the UK as the networks will have the same gas composition and potential emissions/leak issues and so will assist with future Hydrogen conversion projects.

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

N/A – The Project does not intend to rollout anything, but knowledge and information generated through the lifecycle of the project. Consideration of the business case for utilising the gas detection system beyond the project shall form part of the final report.

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

RIO-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 all pipeline operators and will inform the strategy for hydrogen in the energy transition. Findings from the project will demonstrate the use of new sensor technologies 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 (RIO-1 only)

RIO-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. The project replicates the NTS network to test and understand this system in operational settings. These efforts are to ensure the energy transition can be undertaken at as low a cost as possible to the consumer. The testing of the system will be a bespoke regime unique to the conditions on the NTS, at large facilities unlike elsewhere on the gas network (distribution networks)

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 new gas detection and quantification system has not been tested on such a system as at the FutureGrid facility. The system will be capable of measuring both Natural Gas and Natural Gas/Hydrogen blends, something that is not currently in use on UK networks.

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

The system being developed is untested on a Hydrogen environment. There is currently no part of the NTS that transports Hydrogen, therefore we are unable to conduct testing on a Hydrogen environment as part of business as usual activity. It is therefore relevant for NIA 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 assessing new gas detection systems.

This project has been approved by a senior member of staff

☒ Yes