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

Mar 2021

Project Reference Number

NIA_NGN_292

Project Registration

Project Title

H2GO - Domestic Hydrogen Detector

Project Reference Number

NIA_NGN_292

Project Licensee(s)

Northern Gas Networks

Project Start

March 2021

Project Duration

1 year and 1 month

Nominated Project Contact(s)

David Tomkins

Project Budget

£113,666.67

Summary

This project will lead to the creation of a prototype domestic hydrogen detection device, similar in style and size to existing, ceiling mounted, indoor smoke and CO detectors. The battery powered device will include a piezo speaker for audio alarm and an LED for visual alarm and to indicate proper functioning. The device will use an available MOS sensor combined with temperature and relative humidity sensor to determine the H2 volume in air.

Over the next few years, it is intended that the current natural gas energy system will transition into a system that is fuelled by a large proportion of hydrogen gas. Hydrogen has many similar characteristics to that of natural gas but does not behave in the same way. To address these different characteristics and to increase customer confidence in hydrogen being used in domestic properties, a method of reliably detecting hydrogen leaks within the home is required.

At project completion, a pre-production prototype domestic hydrogen detection device will have been created and will have been tested in a representative environment. This device will be ready for manufacturers to use as the basis for commercially available sensors.

Third Party Collaborators

DefProc Engineering

Health and Safety Executive

Energy Innovation Centre

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

Over the next few years, it is intended that the current natural gas energy system will transition into a system that is fuelled by a large proportion of hydrogen gas. Hydrogen has many similar characteristics to that of natural gas but does not behave in the same way. To address these different characteristics and to increase customer confidence and overall safety in hydrogen being used in domestic properties, a method of reliably detecting hydrogen leaks within the home is required.

Method(s)

This project will lead to the creation of a prototype domestic hydrogen detection device, similar in style and size to existing, ceiling mounted, indoor smoke and CO detectors. The battery powered device will include a piezo speaker for audio alarm and an LED for visual alarm and to indicate proper functioning and for those with hearing difficulties.

The device will use an available MOS sensor combined with temperature and relative humidity sensor to determine the H2 volume in air.

The method of delivery will be broken down in to 3 stages as follows

Stage 1

- Market research and sensor selection – Select the most appropriate sensor(s) for the project
- Development of hardware – Completion of data collection hardware for use during sensor characterisation
- Sensor characterisation – Sensor reading data at representative temperature and humidity

Stage 2

- Product design and specification - CAD models, bills of materials and electrical schematics.
- Creation of first prototype – single device created with basic function tests.
- Device firmware build – complete device operation using the first prototype
- Building of data-logging platform and data dashboard – Dashboard of first device
- Testing device build – 10 prototype devices for field testing

Stage 3

- Testing of devices – undertaken at test facility with results from each device

Scope

This project will lead to the creation of a prototype domestic hydrogen detection device, similar in style and size to existing, ceiling mounted, indoor smoke and CO detectors.

This proof of concept and commercially ready design will be crucial to take to manufacturers for wider acceptance and production to enable a safe hydrogen future for customers. The ubiquitous use and installation of smoke and CO alarms has demonstrated a tangible safety benefit to the UK public since their inception with many lives being saved from their use – to the point where in many parts of the UK they are required by law. Customers understand and accept that these devices are designed to reduce the risk to their safety. With a hydrogen network the CO risk is eliminated and thus the hydrogen detector can be seen as an evolution/transition of that alarm.

Objective(s)

The objective of the project is:

- To develop a pre-production prototype domestic hydrogen detection device that has been tested and for the device to be ready for manufacturers to use as the basis for commercially available detectors.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be deemed a success if:

- The final pre-production device which has been tested should have a similar look and feel to a standard CO and/or smoke alarm

with both audible and visual alarm indication.

- The device will be simple in operation and to install and with a minimum operating battery life of 1 year with indication of sensor failure and/or low battery.
- The design will also take account and meet and not obviously contravene any current and applicable British Standards.

Project Partners and External Funding

Northern Gas Networks
Wales & West Utilities
DefProc Engineering
HSE
EIC

Potential for New Learning

There are currently no 'off the shelf' hydrogen detector units for the domestic market that is akin to the widely known and accepted smoke and CO alarms, the project can bring learning not only from the development of the device but also the testing. Also, this project will lead to the creation of a prototype domestic hydrogen detection device, similar in style and size to existing, ceiling mounted, indoor smoke and CO detectors. This proof of concept and commercially ready design will be crucial to take to manufacturers for wider acceptance and production to enable a safe hydrogen future for customers. The development and research included in the development of such as device has the potential to further understanding in this field including the testing and location of such as device.

Scale of Project

This project not only inputs into the success of the H21 project, and broader network hydrogen focussed innovation activity which is seeking to provide the critical evidence applicable to the entire UK gas system when considering conversion to 100% Hydrogen but also plays a key safety role across 'streams' (up and downstream) and also to play part in any quantitative risk assessment (QRA) required for trials into the future.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project will be developed and tested by organisations across the UK such as Merseyside and Derbyshire. Ultimately the detectors will be for UK wide usage.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Northern Gas Networks External Cost = £44,000 Internal cost = £11,000 Total Cost = £55,000 Wales & West Utilities External Cost = £44,000 Internal cost = £14,666.67 Total Cost = £58,666.67

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:

n/a

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)

The critical evidence required from all the hydrogen research and ultimate QRA aims to demonstrate that hydrogen can be used as an alternative to natural gas and using the existing network. This may require risk mitigation as well as the confidence of the public that hydrogen will be a safe fuel for the future. As part of this BEIS have signalled that a domestic 'CO style' hydrogen detector is of importance to them – and indeed its development would feed into the QRA model.

This project is also one of a suite of projects to enable a conversion of the UK gas grid to hydrogen. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save £46 billion with minimal gas customer disruption verses alternative decarbonisation solutions

Please provide a calculation of the expected benefits the Solution

The benefits from this project are primarily qualitative. This project will feed into wider projects that deal with the conversion of the gas networks to hydrogen and the roll out costs of these are yet to be defined. However, this project will help to establish and provide an additional safety mechanism to commence conversion.

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

This project will feed into wider projects that deal with the conversion of the gas networks to hydrogen and the roll out costs of these are yet to be defined. However, this project will help to establish and provide an additional safety mechanism to commence conversion.

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

To be defined subject to future policy decision on energy futures.

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 development and research included as part of the development in this project has the potential to provide essential learning to support the progression of a hydrogen future. No hydrogen sensor currently available on the market meets the criteria of cost, accuracy, measurement range, power draw and longevity for a domestic H2 sensor unit.

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

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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.

No hydrogen sensor currently available on the market meets the criteria of cost, accuracy, measurement range, power draw and longevity for a domestic H2 sensor unit

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

As there are no 100% hydrogen supplies in domestic dwellings in the UK then there has been no driver to develop such a device in the past.

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

This project is in the interest of the UK and is not specific to the business and usual operations of the GDNs with no allowance within regulatory business plans. Whilst the benefits are undeniable there is no guaranteed benefit back to gas customers without the regulator and government support – projects associated with 100% hydrogen are at the cutting edge of gas network innovation and not part of standard regulatory settlements.

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 project would only be undertaken with NIA funding support, it is in the interest of gas customers, the regulator and the UK government. There is no allowance in BAU business plans for this type of work and the commercial benefits and technical/operational risks associated with these types of 100% hydrogen projects are outside the traditional environment of any gas distribution network.

This project has been approved by a senior member of staff

☑ Yes