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 2020

Project Reference Number

NIA_CAD0056

Project Registration

Project Title

Field Trials For Hydrogen Blended Gas Detection Equipment

Project Reference Number

NIA_CAD0056

Project Licensee(s)

Cadent

Project Start

March 2020

Project Duration

3 years and 6 months

Nominated Project Contact(s)

Cadent Innovation Team

Project Budget

£41,313.00

Summary

1. Development of G23 –
Develop a G23 document to help facilitate a rigorous approach to evaluation of blended gas detection equipment and requirements for field trials
2. Operational Field Trial –
The evaluation exercise will seek to establish the performance of the new equipment to ensure accuracy, fitness for purpose, ease of use and durability. The instruments will be enabled with oxygen and CO sensors and the effectiveness of this functionality will be evaluated in conjunction with the blended gas sensors.

Third Party Collaborators

Health and Safety Executive

Costain

Lesniak Swann

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

In the UK it is very likely that hydrogen will be blended with natural gas at levels of up to 20% in the near future. Work done on gas detection instruments during the HyDeploy project has shown several potential challenges when using current instruments with blended gas. The main challenges being the cross sensitivity of uncompensated Carbon Monoxide (CO) sensors to hydrogen, as they will detect both CO and leaks of blended gas on the CO range.

Whilst procedures can be developed, implemented and controlled to ensure a safe position, such as those developed through the HyDeploy project. It is not ideal to use such procedures as a long-term solution; therefore, new equipment must be developed.

The method of leak detection employed by the HyDeploy project allowed current gas detectors with modified calibration settings to be used alongside modified procedures and a specified operational management plan. Therefore, there is a need for the development and testing of gas detection equipment which will work with both Natural Gas (NG) only and Hydrogen blended gas (Up to 20%). This development is required to vastly improve the operating model and facilitate bulk roll out of hydrogen blends.

Method(s)

1. Development of G23 –

Develop a G23 document to help facilitate a rigorous approach to evaluation of blended gas detection equipment and requirements for field trials

2. Operational Field Trial –

The evaluation exercise will seek to establish the performance of the new equipment to ensure accuracy, fitness for purpose, ease of use and durability. The instruments will be enabled with oxygen and CO sensors and the effectiveness of this functionality will be evaluated in conjunction with the blended gas sensors.
The User Acceptance process should prove the instruments fitness for purpose for the following Operations activities:
• Commissioning mains/services - Purging to gas (2 consecutive readings of more than 90% GIA)
• De-commissioning mains/services - Purging to air (2 successive readings of 10% LEL or less)
• Bar hole surveys
• Appliance checks in domestic and commercial premises
• Walking surveys
• Atmosphere checks prior to use of non-intrinsically safe equipment (20% LEL or less)

The operational field trial will include testing at Keele University to prove the accuracy of the modified Bascom Turner gas detection instrument when sampling blended gas. This will be done by taking blended gas samples from rhinology boxes located in the blended gas network. These samples will be cross referenced with the on-site gas chromatograph.
Cadent staff and operational teams who currently use gas detection equipment will have the opportunity to test the new equipment in field conditions and raise any queries and/or concerns which will be collated into final G23 documentation.

3. Laboratory testing –

Phase 1

• Gain familiarity with the detector.
• Assess and analyse Bascom Turner's own test data.
• Re-commission test apparatus and order test gases if necessary. Set-up test apparatus for ppm tests.
• Laboratory testing of the existing first instrument's flammable gas sensors to confirm that they will operate accurately with little chance of false measurements: a. Testing of all the flammable gas sensors against NG ranging from parts per million (ppm) concentrations through percentage lower explosive levels (%LEL) to greater than 90% gas in air (GIA) concentrations.
• Repeat tests of the above but with a range of H2 in NG content that will include between 5% to 20%.
• Laboratory testing of the first final prototype instrument, (possibly with other instruments if they are available) to confirm the effectiveness of the CO sensor isolation system and O2 and H2S sensors if present. This will involve a limited selection of the flammable gas tests above and bump testing of individual sensors to CO, reduced O2 and H2S.

Phase 2

• Further tests can be carried out if required. These could include sensor cross-sensitivity testing (e.g. does the H2 sensor respond to H2 or H2S?), a wider range of O2, CO or H2S concentrations to supplement the bump tests above, or sensor recovery tests.

Scope

The scope of the process proposed is to undertaken a rigorous field trial programme, consisting of operative-based field tests and laboratory testing. This will provide the necessary evidence base to holistically assess the suitability of a blended gas detector for use by operatives.

Objective(s)

The work outlined above will seek to :
• Remove the requirement for logistical constraints for gas detection on blended gas networks.
• Enable the adoption of future-proof equipment within GDN operations, facilitating the transition to a low-carbon future.
• Stimulate the gas detection market to develop further equipment that is hydrogen-ready, ensuring a competitive market environment to the benefit of consumers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

An approved G23 for Blended gas detection equipment. The output of this process will be shared with other GDNs, to facilitate other gas networks in their transition to a low-carbon future and minimise cost by not replicating acceptance processes.

Project Partners and External Funding

This project will be wholly NIA funded.

- Cadent
- Northern Gas Networks (NGN) - Non Funding Partner
- The Health and Safety Executive Science and Research and Centre – Nil External Funding

Potential for New Learning

Currently there are no gas detectors on the market ready to detect a blended gas mixture (up to 20%vol hydrogen). This project will enable the use of blended gas detectors via the G23 procedure which allows the evaluation of both technical and operation aspects of new products or equipment before they are approved for use in the gas networks.

Scale of Project

The investment will allow the design and safe operation of the required test apparatus to undertake the gas detection tests. These tests will allow sufficient evidence to be captured to assess the performance and accuracy of the device. A reduced budget would limit the ability to conduct the required tests and reduce the quality of information required to inform the GDN's.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

N/A

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total Cost - £41,313

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)

This work will form a major part of the assessment of how feasible it is to manage the safety of a hydrogen blend in the grid due to the importance of leak detection as a key safety control measure, thus this work will inform decisions about utilising hydrogen blended gas at a national level.

If a hydrogen blend can be injected into the network at 20% volume this could generate 6TWhr per annum of low carbon heat and save the consumer £8billion per annum compared to the equivalent heat from air source heat pumps. The quantity of low carbon heat provided by blended hydrogen is potentially greater than the Renewable Heat Incentive (RHI) which has cost billions since its adoption.

Please provide a calculation of the expected benefits the Solution

These short term financial benefits will be accrued by other gas network operators not having to replicate a necessary future-proof process. The long term financial benefits will be in facilitating the use of current procedures in a robust manner whilst operating with blended natural gas, this will significantly reduce expenditure that would be required to fund the procurement of separate hydrogen detectors alongside natural gas detectors.

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

The approval process evidence would be made available to other GDNs to facilitate the acceptance and adoption of hydrogen blend-ready gas detectors at no additional cost to other GDNs.

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

It is not envisaged any material additional cost will be incurred due to the adoption of hydrogen blend-ready gas detectors.

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

It is envisaged that in the near future all networks in GB will be accepting a blend of hydrogen (potentially up to 20% vol) in their respective networks. If this is the case the learning created from this project will be of importance to all of GB's distributed network operators (DNOs).

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

The project plays a key role in reducing the evidence gap which will allow blended gas with up to 20%¬vol-hydrogen to be delivered across the UK. If Hydrogen blending was done across the UK this would equate to savings of around 120 million tonnes of CO¬2E¬ by 2050.

☑ 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.

The results of the process will be openly shared with other GDNs to allow adoption of hydrogen blend-ready gas detection equipment, therefore eliminating the need for replicated approval processes and field trials.

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 work has not been required before as hydrogen blends have only been deployed at pilot scale, which allows bespoke arrangements to be utilised. Hydrogen blends will become BAU in the future for GDNs, however this innovative work to allow adoption of future-proof equipment will be required.

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

Hydrogen blends being injected into the network and the decarbonisation of the exiting gas grid sits beyond what can be considered BAU and therefore cannot be funded as BAU activity.

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

There is significant technical, operational and regulatory risk in changing the nature of the gas that is transported within the network – therefore this project qualifies for innovation funding.

This project has been approved by a senior member of staff

☑ Yes