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 2018

Project Reference Number

NIA_CAD0028

Project Registration

Project Title

Roadmap to Development & Certification of Hydrogen Blended Gas Detection Equipment

Project Reference Number

NIA_CAD0028

Project Licensee(s)

Cadent

Project Start

September 2018

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Cadent Innovation Team

Project Budget

£150,000.00

Summary

The cross sensitivity problem could be solved with a hydrogen resistant / null hydrogen CO sensor, but so far a survey instrument that uses this type of sensor has not been identified. This project is therefore needed to engage with instrument manufacturers to stimulate the market to develop and certify suitable equipment for use on networks where hydrogen might be present
The proposed method for engaging with industry is as follows:
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1. Develop technical specification for new gas detection equipment needed for blended gas
2. Identify any suitable instruments/ sensors on the market
3. Share gas detection work completed with industry in workshops to be hosted at HSL
4. Share gas detection challenge with industry through CoGDEM and in workshops to be hosted at HSL
5. Link with European projects including engagement with European projects looking at blending gas to ensure a common approach to instrument development
6. One to one conversations with equipment manufacturers to fully understand the technical challenges and timescales for equipment development and certification

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 not too distant future. Work done on gas detection instruments during HyDeploy has shown several potential problems when using current instruments with blended gas. The main problem with the current gas detectors is the cross sensitivity of the CO sensors to hydrogen as they will detect both CO and leaks of blended gas on the CO range. In a hydrogen/natural gas blended system these two conditions could occur concurrently and there would be no way to decide if it is a gas leak or a gas leak and a CO incident – thus posing a safety issue. This issue may also manifest itself with false CO alarms on domestic detectors when in fact they are detecting a gas leak which could actually be below the permitted leak rate in a property. Whilst procedures can be developed, implemented and controlled to ensure a safe position for the Keele trial this is not possible on a national scale and so the longer term this issue needs to be addressed with development of new equipment. The gas detection issue also poses a problem when purging with blended gas – in the short term (for the Keele trial) the solution to this problem is to use an instrument based on infra-red technology and to change the procedures. However this is not a

feasible or practicable long-term solution, due to compatibility with natural gas only situations, and could become a barrier to the use of hydrogen blended gas.

Given the time it might take to develop and certify suitable instrumentation it is important to start this work early in parallel with the demonstration at Keele to secure a gas detection solution for the future.

Method(s)

The cross sensitivity problem could be solved with a hydrogen resistant / null hydrogen CO sensor, but so far a survey instrument that uses this type of sensor has not been identified. This project is therefore needed to engage with instrument manufacturers to stimulate the market to develop and certify suitable equipment for use on networks where hydrogen might be present.

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This work will have assessed the current gas detection market, developed a future gas detection specification and engaged with key manufacturers - it will culminate, by the end of the year, in a roadmap to development and certification of appropriate gas detection equipment.

Scope

It is predicted that in the future hydrogen blended with natural gas is likely to become more common, but the concentration of hydrogen will be variable. Consequently, new gas detection instruments will be required that will take the variable gas composition into account. There is also the possibility of gas networks that contain 100% hydrogen. From a safety point of view it is desirable that one type of instrument should cover; pure hydrogen, hydrogen blended with natural gas and natural gas. Making measurements on a hydrogen network with a natural gas only instrument or measurements on natural gas only network with a hydrogen instrument could have serious consequences.

The scope of this project will cover:
• A review of the proposed instrumentation output with future gases needs to be undertaken, operations and current gas detectors needs. HyDeploy needs to engage with the instrument manufacturers for comment and discussion on the content of this document, with a view to writing a minimum specification for each of a new type of survey and personal gas detection instrument. CogDEM are willing to help in organising a workshop involving HyDeploy, the other GDNs, the sensor manufacturers and the instrument makers. This should be set up as soon as possible.
• Develop technical specification for new gas detection equipment needed for blended gas
• Identify any suitable instruments/ sensors on the market
• Share gas detection work completed with industry
• Share gas detection challenge with industry
• Link with European projects
• One to one conversations with equipment manufacturers
• Produce road map to development and certification of appropriate gas detection equipment

Objective(s)

This work will culminate, by the end of the year, in a roadmap to development and certification of appropriate gas detection equipment.

This work will seek to:
• Remove barriers to implementation of blended hydrogen solution
• Develop a technical specification
• Simulate the market

The aim of HyDeploy is to collect the evidence to show that if hydrogen is added to natural gas the blend can be safely used on the existing UK gas network. 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 utlising hydrogen blended gas at a national level. It is essential to establish a gas detection solution now to avoid delay in the future.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Completion of the tasks outlined above should produce a road map for the development of suitable gas detection equipment, including mobile gas detectors, fixed gas detectors and domestic gas detectors so that they will be available in time to meet the challenges of a

gas supply system including hydrogen. The roadmap will identify currently available sensors which could be fitted to new instruments and the timescales for new instruments to be developed and certified. In summary the key indicators of success are:

1) Production of an Outline Technical Specification for instrument requirements
2) Engagement with instrument manufacturers to stimulate the market to respond to future demands
3) A roadmap including timescales for instrument development and/ or adoption for certified use in the gas industry

Project Partners and External Funding

Cadent, NGN and the Health and Safety laboratory are all partners for the duration of the project.

Potential for New Learning

At present there is no definition or specification for gas detection equipment for a blended system – this project will generate a specification outlining the requirements of future gas detection equipment and outline a roadmap which defines appropriate development and certification.

This project will draw upon knowledge from gas detection manufacturers, gas industry experts and risk management specialists to establish effective and pragmatic guidance that will stimulate the market.

Scale of Project

The budget requested enables suitable exploration of available gas detection equipment via literature and consultation with manufacturers and industry, from this a coherent understanding of the impact gas equipment will have on the feasibility and practicality of safely rolling out blended hydrogen at large scale – the fundamental aim of HyDeploy. A reduced budget will limit the reach / scope of the exploration thus limiting the conclusions that can be justifiably drawn and risks introducing a future barrier especially when considering the time it might take to develop and certify suitable instrumentation.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

Not applicable

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

External Cost - £120,000
Internal Cost - £30,000
Total Cost - £150,000

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)

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.

However, the principle benefit of this project is to improve safety by ensuring a device is designed and identified that can accurately differentiate between hydrogen and CO.

Please provide a calculation of the expected benefits the Solution

There is no cost saving as a result of this project. This project seeks to remove technical barriers with regards to CO and hydrogen monitors and looks to identify an instrument that can be adopted by the gas networks in the near future as hydrogen blends are deployed into the network.

A hydrogen detection device is necessary to ensure that hydrogen blends can be safely transported and utilized in our existing gas network and therefore the primary benefit of this project is safety rather than expected financial benefit.

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

An instrument could be rolled out across all of the networks and will be required in any network that has a hydrogen blend within it. A hydrogen blend could be present in the networks by the early to mid 2020s.

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

As the instrument has not yet been identified the costs are currently unknown but will be considered as part of the project.

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)

This project will provide supporting evidence for gas detection which can function with hydrogen methane blends and is therefore an enabler for a material reduction in carbon emissions through a hydrogen blend being injected into the domestic network

☑ 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.

This project has been designed as the work in HyDeploy has demonstrated that there is a gap in knowledge which needs to be filled in order to allow network blends to be deployed onto a network. Necessary work in stimulating the instrument market to provide a gas detection unit is vital.

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

Hydrogen blends have not been considered in the network before. This project is work associated with HyDeploy at Keele which is a Network Innovation Competition project and will be the first time that a hydrogen blend has been injected into a UK network

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