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NIA Project Registration and PEA Document

Date of Submission

Jul 2019

Project Reference Number

NIA_SGN0148

Project Registration

Project Title

An Investigation of the Performance of Oxygen Depletion Sensors

Project Reference Number

NIA_SGN0148

Project Licensee(s)

SGN

Project Start

July 2019

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Phil Bradwell (SGN), Andy Lewis (Cadent)

Project Budget

£227,300.00

Summary

There is a desire to reduce carbon emissions by the GDNs where several projects have looked at both widening the gas WI and introducing hydrogen blends. Therefore, the learning from this will be beneficial to all networks by allowing the introduction of other gases into the network.

The project aims are to evidence the ODS performance on wider gas qualities and to undertake extensive testing on ODS devices and appliances, coupled with research and analysis on non-methane components (i.e. hydrogen, ethane and propane) to fully understand and inform industry on the safety aspects of ODS systems. Report on the various effect of potential future gases on ODS performance and if/how test standards could be improved to accommodate future gases.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

The Gas Distribution Networks (GDNs), are looking to demonstrate that varying gas qualities that are currently outside Gas Safety (Management) Regulations (GS(M)R) can be utilised and transported safely within the UK's gas networks. This is being evidenced within innovation projects across the GDNs, notable projects are SGN's NIC project "Opening up the Gas Market" and SIU project, as well as Cadent's NIC project "Hydeploy".

The Opening Up of the Market project has demonstrated that appliances tested in the field at the 4 SIU's along with evidence from a cross section of appliances tested in the Laboratory were not materially affected by the proposed increase in Wobbe Index to 53.25MJ/m³. The project concluded that all well installed and maintained appliances could operate entirely satisfactorily up to Wobbe Index (WI) 54.7MJ/m³. This evidence was then used to secure exemptions granted by the HSE to use higher Wobbe Index gas at the 4 SIU's.

The HyDeploy project has demonstrated that for the cross section of appliances that were correctly installed and maintained that were

tested both in the field and in the lab, were found to operate safely on blended hydrogen up to 28 vol%. This evidence fed into the Exemption granted by the HSE for the Keele University trial which demonstrated for the purposes of the trial, blended gas with 20 vol% is as safe as natural gas. This evidence base will be extended and strengthened during the HyDeploy2 program.

An area of further investigation needed is that there can be sub-optimal performance issues of the Oxygen Depletion Sensors (ODS) on some appliances when used with natural gases containing increased amounts of ethane (higher WI) or blends of Hydrogen.

An ODS is commonly fitted to open flue or flueless appliances. It acts as a primary safety device (PSD), to prevent dangerous accumulation of combustion products within a living space, in the event of flue blockage and/or extremely inadequate ventilation. Under a fault condition, oxygen levels in the room decrease and create ODS flame instability. At some point the ODS can no longer generate the required heat at the thermocouple and the appliance shuts down.

Method(s)

The aim of this project is to evidence the ODS performance on wider gas qualities by carrying out a two-part testing programme, where Part 1 will involve testing 10 ODS devices that represent the available units in the current marketplace. These will be fitted to a bespoke KWA test rig to simulate a range of scenarios. Part 2 will involve testing of 8 appliance in a test room using the existing testing standard. The experimental testing will be overseen by specialist scientists at the HSL throughout.

Scope

The project aims are to undertake extensive testing on ODS devices and appliances, coupled with research and analysis on non-methane components (i.e. hydrogen, ethane and propane) to understand and inform industry to prove ODS devices can operate safely on a wider range of gas qualities. Where necessary provide the evidence to industry on how ODS systems could either meet existing standards and/or introduce improved standards that will ensure the continued safe use of ODS devices when used with other potential future gases.

Objective(s)

The objectives of this project are to:

- Investigate and analyse the current performance of ODS systems with natural gas containing hydrogen, ethane and propane.
- Understand the underlying science and associated behaviour through extensive laboratory data sets.
- Understand ODS in the modern-day home to evaluate if they still contribute to safety based on a detailed desktop study.
- Confirm (or otherwise) that there are ODS designs and/or methods of deployment that still operate safely with increased amounts of non-methane components such as ethane, propane or hydrogen and determine the levels of these that may limit performance.
- Develop recommended changes to the standards for ODS testing, reflecting the range of gases expected in the networks currently and in the future.
- Liase with the Heating and Hotwater Industry Council (HHIC) to consider a revision to the ODS performance testing standards that may include testing with limit gases.
- Collaborate with the HHIC to progress changes to ODS performance tests in future versions of standards.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project will be reviewed against the following criteria:

- Understand behaviour of present ODS systems.
- Demonstrate level of compliant ODS devices/systems products
- Produce new test protocols and implement new standards if required.
- Quantify the number of ODS sensors that in GB that might show sub-optimal performance with wider WI.
- Indicate potential routes by which these performance issues could be addressed (on a proportionate basis).

Reduce concerns over the performance of ODS as a barrier to the roll out of potential future gas mixtures with properties that are currently outside those defined within GS(M)R.

Project Partners and External Funding

KWA
HSE

Potential for New Learning

The project aims are to undertake extensive testing on ODS devices and appliances, coupled with research and analysis on non-methane components (i.e. hydrogen, ethane and propane) to fully understand and inform industry on the safety aspects of ODS systems. Report on the various effect of potential future gases on ODS performance and if/how test standards could be improved to accommodate future gases.

Scale of Project

This project involves carrying out testing of the ODS devices and testing of the complete appliance. Testing will be carried out using a range limit test gases and other gas mixtures (including headroom) that will be representative of any proposed future gas supplies.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project will be relevant to all the GDN areas.

Revenue Allowed for the RIIO Settlement

This is a low TRL research project, therefore not applicable.

Indicative Total NIA Project Expenditure

The total project expenditure is £227,300, 90% (£204,570) of which will be recovered via the NIA funding mechanism in line with the funding conditions.

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 project is at a low TRL and it is therefore not possible to provide an accurate estimate of the potential saving. The project can provide savings by the avoidance of nitrogen ballasting and supports the pathway to decarbonisation.

Please provide a calculation of the expected benefits the Solution

This is a low TRL project, therefore not applicable.

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

The potential outcomes of this project are applicable to all networks, where Network Licensees are aiming to introduce higher WI gas, reduce carbon emissions and improve safety.

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

No additional costs to the network are anticipated as the outcome of the project will be used to support the change from GS(M)R to an IGEM standard to allow other gases into the network

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

There is a desire to reduce carbon emissions by the GDNs where several projects have looked at both widening the gas WI and introducing hydrogen blends. Therefore, the learning from this will be beneficial to all networks by allowing the introduction of other gases into the network.

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 ability to safely inject other gases into the gas networks to increase UK gas availability and de-carbonise the networks.

- 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.

Project scope was reviewed against all existing projects and no areas of duplication were identified.

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

GDNs are looking to build on the existing evidence that shows varying gas qualities that are currently outside GS(M)R can be used safely within the UK. In order support this evidence this project aims to undertake additional extensive testing on appliances fitted with ODS devices.

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

activities

The project relates to the use of other gases that are outside current GS(M)R gas qualities and involves carrying out a number of tests on gas appliances.

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 NIA project has a low TRL and involves carrying out initial testing and report writing. This project is applicable to all the GDN's where the learning can be shared between the networks.

This project has been approved by a senior member of staff

Yes