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

Oct 2017

Project Reference Number

NIA_SGN0113

Project Registration

Project Title

Gas Quality Impacts on Industrial and Commercial applications

Project Reference Number

NIA_SGN0113

Project Licensee(s)

SGN

Project Start

September 2017

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Phil Bradwell, Angus McIntosh SGN (Lead Network) Cadent – Andy Lewis NGGT – Tom Neal WWU – Ian Marshal NGN – Ben Hanley

Project Budget

£130,590.00

Summary

The project aims to explore the effects of a wider gas Wobbe Index range including blended hydrogen mixtures (up to 20% H2) by researching the measures in place around the world to ensure safe and efficient combustion of wider specification gas. The research will review the effects of rate of change of Wobbe Index and the frequency/magnitude of these gas quality changes and how this will impact network modelling. The industrial and commercial equipment examined will be greater than 1 MW in size and the research will also consider any instrumentation used in the burner/process that controls, measures or may be affected by gas quality.

The range of Wobbe Index for this study is 45.67 MJ/m3 to 53.25 MJ/m3. This range is not exclusive and any appropriate information outside of this range will be considered.

The project will be conducted in the phases as outlined:

Phase 1 – Review of GB I&C market and prior work

1. Identification of types of Industrial and Commercial equipment potentially impacted by gas quality changes and categorise the population of this equipment

2. Review of prior relevant and representative work into gas quality impacts on each equipment type or category

3. Summary of available instrumentation, hardware and software for controlling gas quality in pre-burner/post burner combustion systems

4. Conclusions and Recommendations

5. {C}Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

Phase 2 – Conclusions of gas quality impacts

1. Engagement with customers/manufacturers to identify current equipment examples and case studies

2. Assessment of effectiveness in terms of rate of change of Wobbe Index/ gas quality with high-level cost estimates and a comparison of the performance of different systems in terms of rate of change. It will also consider future changes to gas quality, i.e. CO2, O2, H2 and biomethane.

3. Engagement with instrumentation suppliers to understand solutions for controlling gas quality for each I & C type/category are available and what gaps or development is necessary for future changes to gas quality

4. Conclusions and Recommendations

5. Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

Nominated Contact Email Address(es)

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Problem Being Solved

Schedule 3 of GS(M)R 1996 sets out the minimum gas quality requirements to ensure safe operation of the gas transmission and distribution system and appliances used by consumers. Licenced Gas Transporters have a legal duty to convey compliant gas. The limits in GS(M)R were based on the quality of gas originating from the UK Continental Shelf (UKCS) in the North Sea.

Since 1996 there has been a significant shift in the sources of gas available to the GB market. Currently less than half comes from the North Sea and the proportion of imported LNG is increasing. This is likely to be supplemented by renewable gases, such as biomethane, and unconventional gases such as shale.

Flexible energy networks will play an important role in supporting carbon and cost reductions. Whilst GS(M)R has served the industry well, having a more accommodating and inclusive gas quality regulatory regime would facilitate the transition to a lower carbon economy whilst maintaining security of supply and consumer safety.

These domestic market drivers, coupled with current discussions on the need for a gas quality standard across European markets to improve interoperability, provide a robust case to re-examine the current UK gas quality regulations.

There is a need to understand the impacts of a wider gas quality specification, including hydrogen, on industrial and commercial (I&C) users of gas in the UK. According to DUKES in 2016, overall gas demand was around 891 TWh and domestic use was 311 TWh. The I&C sector accounts for around 282 TWh, and gas used for power generation around 298 TWh. The I&C sector is thus a significant part of the overall UK gas market.

As a result of SGN's Network Innovation Competition project, "Opening up the Gas Market" it was determined that domestic and small commercial appliances can safely burn gas with a Wobbe Index (WI) of up to 54.76 MJ/m3. One of the recommendations from "Opening up the Gas Market" is that the GB Wobbe Index upper limit be increased to 53.25 MJ/m3 as this allows for sufficient head room for any unknowns in the field condition of an appliance. However, this study was limited to domestic and small commercial appliances and hydrogen was not considered.

A number of studies on the impact of gas quality on industrial and large commercial gas-fired equipment have been carried out previously. There is a requirement to consolidate previous findings in light of recent and future gas quality developments.

This study aims to understand the impact of a wider gas quality on I&C applications (including those in use in the gas networks) and the associated impact on gas distribution and transmission networks.

Method(s)

It is proposed this be a collaborative project between all Gas Networks

The project consists of two phases:

- Phase 1 is a desktop review the GB I&C market and any prior work in the field
- Phase 2 is to engage with key stakeholders and draw on the findings from the first phase to reach conclusions on the impacts of Gas Quality on I&C applications in order to develop a Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

The project proposal aims to:

- Share knowledge on gas quality and impacts with stakeholders
- Study the real impact of gas quality on I&C applications

Engage with key industry manufacturers, end users and other representatives.

Scope

The project aims to explore the effects of a wider gas Wobbe Index range including blended hydrogen mixtures (up to 20% H2) by researching the measures in place around the world to ensure safe and efficient combustion of wider specification gas. The research will review the effects of rate of change of Wobbe Index and the frequency/magnitude of these gas quality changes and how this will impact network modelling. The industrial and commercial equipment examined will be greater than 1 MW in size and the research will also consider any instrumentation used in the burner/process that controls, measures or may be affected by gas quality.

The range of Wobbe Index for this study is 45.67 MJ/m3 to 53.25 MJ/m3. This range is not exclusive and any appropriate information outside of this range will be considered.

The project will be conducted in the phases as outlined:

Phase 1 – Review of GB I&C market and prior work

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5. {C}Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

Phase 2 – Conclusions of gas quality impacts

1. Engagement with customers/manufacturers to identify current equipment examples and case studies

2. Assessment of effectiveness in terms of rate of change of Wobbe Index/ gas quality with high-level cost estimates and a comparison of the performance of different systems in terms of rate of change. It will also consider future changes to gas quality, i.e. CO2, O2, H2 and biomethane.

3. Engagement with instrumentation suppliers to understand solutions for controlling gas quality for each I & C type/category are available and what gaps or development is necessary for future changes to gas quality

4. Conclusions and Recommendations

5. Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

Objective(s)

The objectives of the project are:

- Identify types of Industrial and Commercial equipment potentially impacted by gas quality changes and categorise the population of this equipment
- Conduct a review of prior relevant and representative work into gas quality impacts on each equipment type or category
- Produce a summary of available instrumentation, hardware and software for controlling gas quality in pre-burner/post burner combustion systems

- Engage with customers/manufacturers to identify current equipment examples and case studies
- Produce an assessment of effectiveness in terms of rate of change of Wobbe Index/gas quality, with high-level cost estimates, and a comparison of the performance of different systems in terms of rate of change.
- Engage with instrumentation suppliers to understand solutions for controlling gas quality for each I & C type/category that are available and what gaps or development is necessary for future changes to gas quality
- Produce a full project report with Conclusions and Recommendations
- Produce a Roadmap to adoption of Wobbe Index of 53.25 MJ/m3

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are:

- Studying the real impact of gas quality impacts on I&C applications
- Knowledge on gas quality impacts on I&C applications shared with key stakeholders
- Full project report with Conclusions and Recommendations
- Roadmap to adoption of increased Wobbe Index to 53.25 MJ/m3

Project Partners and External Funding

DNV GL

Potential for New Learning

Gas quality requirements are changing. The industry understanding and evidencing of gas quality impacts has advanced significantly through recent projects both in the UK and in the EU. For example, the 'Opening up the Gas Market' project has produced a large evidence base in relation to domestic and small commercial appliance safety and performance across the Wobbe Index range. This evidence suggests that GB gas consumers would benefit significantly from a change to the allowable Wobbe Index, particularly at the upper level. However there appears to be a lack of consistent and coherent evidence upon the impact of gas quality on Industrial and Commercial users. This project will attempt to consolidate past and current work in this field in order to produce a road map towards changing gas quality in the UK. Results of this project will feed into the NIA funded IGEM Gas Quality Standard Working Group.

Scale of Project

This project will be split into two phases. The first phase will be largely a desk top study. The second phase will include engaging with I&C users, manufacturers, suppliers and other stakeholders across all of GB and potentially Europe.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This is a GB wide study, but will also consider the implications of change to Europe. All GB gas distribution networks and the transmission system will be considered including those I&C applications supporting network operation.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

The total project expenditure is £130,590.00, 90% (£117,531.00) 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)

Analysis obtained from National Grid and IGEM has shown that the potential benefit of increasing the range of Wobbe Index within GS(M)R to remove the requirement for nitrogen ballasting in GB would save around c.£180m per annum, rising to £325,000,000 per annum as LNG utilisation increases. These figures are considered conservative as they exclude potential processing costs associated with pipeline imports.

Please provide a calculation of the expected benefits the Solution

This research-based project therefore not applicable.

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

This project is applicable to all gas networks including Transmission.

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

As this is a research project, there are no associated roll out costs.

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

Network licensees need to understand how flexible the network can be in relation to gas quality, both in terms of risk and how the network can be managed.

A comprehensive project report will be compiled detailing the outputs of this project and will be disseminated to all project partners. This learning will then be referenced and taken into a further project phase if it is deemed appropriate.

Results of this project will feed into the NIA funded IGEM Gas Quality Standard Working Group.

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

Competition, security of supply and lowering of carbon emissions

☑ 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.

A review of all other Network Licensees Innovation Funding Incentive annual reports has been performed and no similar Projects have been 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

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

- [x] Yes