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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

May 2015

Project Reference

NIA_NGGT0076

Project Registration

Project Title

Gas Quality Study for NTS Unconventional Gas Supplies

Project Reference

NIA_NGGT0076

Project Licensee(s)

National Grid Gas Transmission

Project Start

May 2015

Project Duration

1 year and 0 months

Nominated Project Contact(s)

Alex Ferguson, box.GT.innovation@nationalgrid.com

Project Budget

£90,000.00

Summary

The gas quality study will focus on:

- The impact on the NTS of increasing the oxygen content to 1% for non-conventional gases to bring the transmission system into line with the entry requirements for the distribution networks. The study will use and build on existing knowledge for the oxygen limit exemption for the distribution networks. The proposed gas quality study will also include information from Europe and USA to introduce a best practice and harmonisation approach to the 1% oxygen content study. Corrosion rates can be accelerated if both liquid water and other contaminants are present. The approach will be to derive a probability of corrosion rates to calculate wall losses over the NTS lifetime.

- Investigating a range of flow ratios to determine the point at which the lack of full mixing becomes an issue for determining the bulk properties of the fluid flow. Use this study to define the characteristics of a well-mixed system.

- Using Computational Fluid Dynamics (CFD) modelling to determine whether the requirement for a sample point to be 20 pipe diameters downstream from the confluence of two flows is suitable and appropriate (reference ISO 10715). The input for this part of the study requires details from the flow ratio sub-part to select the best test cases to study; it is also likely that the mixing will be dependent on gas velocities so a number of different gas velocities will be explored using the same CFD model. For one proposed design, use the model to highlight the impact of pipeline infrastructure on mixing quality.

- Using the CFD model to determine whether the requirement for centre one third sampling is realistic (reference ISO 10715). The model will enable the gas quality variation over a cross-section of pipe to be simulated and the system homogeneity to be determined. Again the flow ratio sub-part will be used to select the best test cases to study.

- Investigating forced mixing systems including the options for bi-directional flow. Forcing the gases to mix using static mixer

arrangements will be studied to highlight the potential benefits, and provide an overview of the impact on bi-directional flow

· Conducting a high-level survey of the NTS to look at the prevalence of bi-directional flow both now and in the future. Evaluate the mixing arrangement options to determine if there are alternative approaches to reduce site size.

· Compliance with GS(M)R as well as maintaining the calorific value of the prevailing flow which is a commercial issue. Use the NGGD/NGN Flow Weighted Average Calorific Value NIA project to inform this work.

There is a strong link between this study and the NIA project NIA_NGGT0070 NTS Block Valve Connections. NIA_NGGT0070 focusses on an engineering design solution for block valve connections, and the information and new learning from this work, particularly on sampling and blending will help determine the most efficient design solution.

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

This study is an investigation into a number of gas quality related topics that determine the limitations for gas supplies onto the NTS. The standards, systems and processes have been successfully used for conventional connections for a number of years however; these will not necessarily be the most appropriate, efficient or effective for unconventional gas suppliers (e.g. bio methane or shale). This study will therefore investigate and challenge several key parameters to ensure that any approaches to NGGT for connections can be offered the most appropriate solution.

Method(s)

The project deliverables broken down into four stages as follows:

1. Impact of increasing oxygen in the NTS - 4 weeks
2. Investigation into flow regimes, gas quality and static mixers - 8 weeks
3. Computational Fluid Dynamics study - 17 weeks
4. Combining of results, reporting, technical governance - 8 weeks

Scope

The gas quality study will focus on:

- The impact on the NTS of increasing the oxygen content to 1% for non-conventional gases to bring the transmission system into line with the entry requirements for the distribution networks. The study will use and build on existing knowledge for the oxygen limit exemption for the distribution networks. The proposed gas quality study will also include information from Europe and USA to introduce a best practice and harmonisation approach to the 1% oxygen content study. Corrosion rates can be accelerated if both liquid water and other contaminants are present. The approach will be to derive a probability of corrosion rates to calculate wall losses over the NTS lifetime.

- Investigating a range of flow ratios to determine the point at which the lack of full mixing becomes an issue for determining the bulk properties of the fluid flow. Use this study to define the characteristics of a well-mixed system.

- Using Computational Fluid Dynamics (CFD) modelling to determine whether the requirement for a sample point to be 20 pipe diameters downstream from the confluence of two flows is suitable and appropriate (reference ISO 10715). The input for this part of the study requires details from the flow ratio sub-part to select the best test cases to study; it is also likely that the mixing will be dependent on gas velocities so a number of different gas velocities will be explored using the same CFD model. For one proposed design, use the model to highlight the impact of pipeline infrastructure on mixing quality.

- Using the CFD model to determine whether the requirement for centre one third sampling is realistic (reference ISO 10715). The model will enable the gas quality variation over a cross-section of pipe to be simulated and the system homogeneity to be determined. Again the flow ratio sub-part will be used to select the best test cases to study.

- Investigating forced mixing systems including the options for bi-directional flow. Forcing the gases to mix using static mixer arrangements will be studied to highlight the potential benefits, and provide an overview of the impact on bi-directional flow

· Conducting a high-level survey of the NTS to look at the prevalence of bi-directional flow both now and in the future. Evaluate the mixing arrangement options to determine if there are alternative approaches to reduce site size.

· Compliance with GS(M)R as well as maintaining the calorific value of the prevailing flow which is a commercial issue. Use the NGGD/NGN Flow Weighted Average Calorific Value NIA project to inform this work.

There is a strong link between this study and the NIA project NIA_NGGT0070 NTS Block Valve Connections. NIA_NGGT0070

focusses on an engineering design solution for block valve connections, and the information and new learning from this work, particularly on sampling and blending will help determine the most efficient design solution.

Objective(s)

To provide answers to the following two key challenges to the current process:

1. Oxygen content: the GS(M)R limit for oxygen is 0.2 mol%. Unconventional gas supplies may have higher oxygen content, and whilst gas distribution networks have an exemption to allow biomethane sites to flow up to 1 mol% oxygen, no such exemption exists for the NTS. Is this appropriate?

2. Gas Quality Blending: the co-mingled gas quality sample point location is set at 20 pipe diameters from the injection point, in line with current ISO standards. Is this appropriate for smaller unconventional gas connections?

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Delivery of a project report detailing the results of the gas quality study and addressing the two key challenges as per the objective.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This is a desk based project

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The project will take place at the supplier premises and NG offices in the Midlands.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£90,000

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 the key gas quality challenges can be overcome, aspects of this work will contribute towards a reduced connection cost for smaller unconventional gas connections.

Please provide a calculation of the expected benefits the Solution

N/A Research project

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

It has been estimated as part of project NIA_NGGT0070 NTS Block Valve Connections, that potential savings for small connections through block valve sites, could be in the region of £700K – £1m per connection as an alternative to a new connection point. This work on the gas quality aspects of unconventional gas supplies has the potential to drive these costs down further, plus additional benefit from increasing options to connect onto the transmission network that will be available to customers.

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

This cannot be established at this stage of the work. But the project should facilitate more efficient connections for smaller unconventional gas supplies.

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

n/a

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 is aligned to our Enabling Connections theme.

☑ 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.

n/a

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

☑ Yes