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

Dec 2023

Project Reference Number

NIA2_SGN0044

Project Registration

Project Title

Hydrogen Ignition Risk from Static & Autoignition - Stage 1

Project Reference Number

NIA2_SGN0044

Project Licensee(s)

SGN

Project Start

December 2023

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Innes Maciver

Project Budget

£72,267.00

Summary

This project will aim to help the gas industry fully understand the hydrogen ignition risk from static and autoignition. Stage 1 of the project will be an initial desktop study to review the existing information regarding types of ignition for existing natural gas operations, hydrogen installations from other industries, and academic papers. The focus will be on autoignition and static built up in pipes or from tooling and clothing, but other ignition sources may be identified. Areas of concern will be highlighted and it is expected that a number of relevant ignition types for which there are gaps in evidence will be identified. The project will research the mechanisms by which static and autoignition arise, and whether and how ignition could occur in real-world situations.

Third Party Collaborators

Steer Energy

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

From the assessments undertaken as part of the Asset Interventions project, a gap in the evidence base was identified relating to ignition risk. The recommended intervention was to produce a test programme to investigate whether static is a credible ignition source across all pressure tiers. Current recorded evidence regarding static and autoignition risk is limited but anecdotal accounts indicate that natural gas can be ignited by static sparks and static is considered by the gas industry to be a potential ignition source. Hydrogen's lower minimum ignition energy has raised concerns that ignition sources that do not commonly ignite natural gas could lead to increased ignitions during hydrogen operations.

Method(s)

This initial stage of the project will be a desktop study that will collate existing information regarding types of ignition for existing natural gas operations, hydrogen installation from other industries, and academic papers. The focus will be on autoignition and static built up in pipes or from tooling and clothing, but other ignition sources may be identified. The differences between types of static will be highlighted, and terminology used will be clarified and defined to remove any confusion.

During this process the supplier will provide an interpretation of the current theory within realistic parameters.

Areas of concern will be highlighted, and it is expected that a number of relevant ignition types for which there are gaps in evidence will be identified. The supplier will research the mechanisms by which static and autoignition arise, and whether and how ignition could occur in real-world situations.

A programme of experiments will be outlined, designed to provide sufficient evidence to fill the gaps highlighted. This is work will be carried out in stage 2 of the project and will likely be substantially different for transmission and distribution.

Scope

The scope of work for Stage 1 of this project is as follows: -

WP1 – Literature Search & Summarise Theory

This work pack will begin with a literature search to find and collate relevant prior material. Terminology used will be defined to ensure clarity. This will involve an overarching theoretical exploration into potential causes for unexplained or spontaneous ignition, including ignition from static and autoignition. The scope of the project will be defined, providing a set of parameters within which ignition types may occur.

WP2 – Autoignition desktop study

Autoignition is referred to as a possible cause of ignition of flammable gas, and hydrogen. This work pack is a more detailed investigation into autoignition. Anecdotal and recorded examples of natural as and hydrogen ignition will be explored. As many of the examples are expected to come from other industries, the possibility of this occurring within the parameters of this project will be determined. The mechanisms through which autoignition of hydrogen could occur will be investigated and presented within the context of this scope. This should be tied back to reality as much as possible. This will be approached to cover both distribution and transmission pressure bands.

WP3 – Static desktop study

Ignition from electrostatic charge will also be explored. This work pack is split into two parts – generation of static, and ignition from static. Static charge can be generated through a variety of methods, which will be explored. The main ways are expected to be through tooling, clothing, and gas flow through electrically insulated pipes. The likelihood of these happening in mains gas operations will be investigated. We will examine how factors such as material pressure, flow rate affect generation of static. We expect to investigate how much charge is generated, the energy released (which includes a time factor), and the incendivity of any spark created. This should be tied back to reality as much as possible, including consideration of realistic minimum ignition energies adjusted for factors such as concentration and gas velocity, and gas concentrations at which ignitions can occur.

WP4 – Map way forward

Based on the findings from WP2 and WP3, a programme of experiments will be designed. These may be intended to provide evidence supporting developed theory, or to determine limits and likelihood of occurrences. With respect to a comparison between hydrogen and natural gas we anticipate experiments to address or demonstrate:

- Autoignition possibility, and differences in how sufficient heat could be generated
- Differences in potential for autoignition
- Differences in static generation between the two gases
- Differences in potential for ignition from static

Any recommendations or hazard mitigations discovered will be highlighted. Note that we expect that this may evolve into two different proposals of how to move forward, covering distribution and transmission pressure bands separately.

WP5 – PM and Reporting

This work pack covers the management of the project. Bi-weekly meeting are anticipated which will ensure the project is on course and is providing the evidence required. A final report will be provided, presenting the findings and recommendations from the project, and support will be provided to cover ENA closure form.

Objective(s)

The objectives of this study are as follows:

· Fully understand the parameters for static ignition and autoignition in the context of the distribution and transmission gas networks.

· Present the information in a clear and easily accessible way to highlight potential areas of concern.

· Determine which ignition types are relevant and realistically possible, with an indication of hazard change from natural gas.

· Outline a programme of experimental work that will provide evidence to highlight any significant increases in hazard, reassure stakeholders if risk level is minimally changed, and provide information to allow the change in risk to be objectively assessed.

· Examine mitigation options as appropriate.

Ensure key messages are disseminated and fully understood.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Any conversion to hydrogen should be done with minimal impact both financially and technically to consumers, particularly vulnerable consumers. By assessing mitigations to potential increase in ignition risk from hydrogen then any upgrade costs would be kept to a minimum.

Success Criteria

The success criteria for each work pack is described below:

WP1: Defining a set of parameters within which ignition types may occur.

WP2: Understanding of the mechanisms through which autoignition of hydrogen could occur in real-world scenarios and how likely this would be at gas transmission and distribution operating conditions.

WP3: Understanding of how static is generated, the likelihood of these happening in transmission and distribution gas operations, and how factors like material, pressure, and flow rate affect the generation of static.

WP4: Designing a programme of experiments for future work to compare the static and autoignition risk between hydrogen and natural gas, determining the limits and likelihood of occurrences.

WP5: Effective project management throughout the life of the project, and clear and concise reporting for networks and the ENA.

Project Partners and External Funding

Steer Energy will be supplier for this project with SGN, NGT and NGN being project partners.

Potential for New Learning

The project aims to fully understand the parameters of static ignition and autoignition of hydrogen in the context of the gas network, both in terms of transmission and distribution. Better understanding of which ignition types are relevant and realistically possible, with an indication of hazard change from natural gas.

Scale of Project

This initial stage of the project will be a desktop study to determine which ignition types are relevant and realistically possible. It will also outline a programme of experimental work for the future stages of the project that will provide evidence to highlight any significant increases in hazard. This will also provide information to allow the change in risk to be objectively assessed and allow possible mitigation options to be developed.

Technology Readiness at Start

Technology Readiness at End

TRL2 Invention and Research	TRL4 Bench Scale Research

Geographical Area

The project outputs will be representative for the entire GB gas network.

Revenue Allowed for the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

SGN – External £18,067 Internal £6,022

NGT – External £18,067 Internal £6,022

NGN – External £18,067 Internal £6,022

Total – External £54,201 Internal £ 18,066

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:

The outputs of the project will determine the realistic scenarios whereby the hydrogen ignition risk from static and autoignition could occur in the distribution and transmission gas networks and the change in hazard from natural gas. The project will also map the way forward for a programme of experimental work that will provide evidence to highlight any significant increase in hazard and will explore mitigations options to help facilitate the conversion of the existing gas network to transport hydrogen.

How the Project has potential to benefit consumer in vulnerable situations:

Not applicable.

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)

Not applicable.

Please provide a calculation of the expected benefits the Solution

Not applicable.

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

The outcomes of this project are replicable across the GB distribution and transmission network.

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

Not applicable.

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

By defining the parameters for static ignition and autoignition in the context of the gas network and by defining which ignition types are realistic, the project will allow the gas networks to assess the hazard change from natural gas to hydrogen. Through future experimental work, networks will be able to highlight any significant increases in hazard, reassure stakeholders if risk level is increased and examine mitigation options.

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

Not applicable.

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 project is an output from the NIA project Interventions for Hydrogen by Asset Categories and will involve collaboration from 3 of the GB gas networks (SGN, NGT & NGN) with results being reported to all via the Network Safety and Impacts group.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not applicable.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The project will investigate instances of static ignition and autoignition from other industries, research the mechanisms by which static and autoignition arise, and relate this to real-world scenarios in the context of the distribution and transmission gas networks.

Relevant Foreground IPR

Not applicable.

Data Access Details

Information relating to the project will be published on the ENA Smarter Networks Portal at https://smarter.energynetworks.org/

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

The methodology undertaken in this project is deemed a beneficial part of the network conversion to 100% hydrogen. This is not yet a business-as-usual activity for the GDNs.

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

The conversion of the GB gas network to 100% hydrogen is a key element on the road towards net zero. A reliable supply and the assurance of safe operations for workers and the public are crucial to support the viability of the hydrogen transition. The NIA framework can support works that ensure results that play an essential part in the roll-out of hydrogen.

This project has been approved by a senior member of staff

☑ Yes