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

Jun 2024

Project Reference Number

NIA2_SGN0064

Project Registration

Project Title

Hydrogen Ignition Risk from Static & Autoignition - Stage 2a

Project Reference Number

NIA2_SGN0064

Project Licensee(s)

SGN

Project Start

June 2024

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Innes Maciver

Project Budget

£69,027.00

Summary

This project will aim to address a key risk area identified in Stage 1 of Hydrogen Ignition Risk from Static & Autoignition relating to the generation of static due to particulates in flowing gas. Evidence on this topic is anecdotal at best and is currently insufficient to provide the appropriate assurance to the HSE. The project will look to better understand the impact of potentially increased velocities and different gas mixtures on the generation of static from particulates in gas pipes. This will be facilitated at DNV Spadeadam in collaboration with the Velocity Design with Hydrogen project to gather empirical data to understand how increased static generation rates combined with hydrogens lower minimum ignition energy will impact risks and determine any required mitigations.

Preceding Projects

NIA2_SGN0044 - Hydrogen Ignition Risk from Static & Autoignition - Stage 1

Third Party Collaborators

Steer Energy Solutions

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

An output from Stage 1 of the Hydrogen Ignition Risk from Static & Autoignition project was that the static generated from particulates in flowing gas posed an increased ignition risk when considering hydrogen in the gas network. Current evidence surrounding ignition from static generation is largely anecdotal and the industry needs to understand how static generation differs when we change the gas mixture from 100% Natural Gas, a 20% hydrogen blend with Natural Gas, and 100% hydrogen. This combined with the lower minimum ignition energy (MIE) of hydrogen highlights a particular evidence gap which must be filled in order to safely convert the gas networks.

Method(s)

This stage of the project (2a) will take the form of a field study to gather empirical evidence relating to static generation caused by particulates in flowing gas for both Natural Gas, hydrogen, and a blend of 20% hydrogen in Natural Gas. The project will be broken down into two parts. Firstly, Steer Energy will create tools to measure static charge in pipes and explore charge generation from dust transported in pipes in the laboratory. This will provide a benchmark to assess the further testing. Secondly, Steer Energy will collaborate with DNV Spadeadam to apply the tools in a field environment demonstrating the potential impact of generation of static charge from realistic dust transportation levels and gas velocities.

Measurement Quality Statement

The methodology used in this project will be subject to Steer's own quality assurance regime. Quality assurance processes and the source of data, measurement processes and equipment, and data processing will be clearly documented and verifiable.

The measurements, designs and assessments will also be clearly documented in the relevant deliverables and final project report and will be made available for review. This will include the procedures and techniques used, and mechanisms to ensure traceability, reliability and comparability of results.

Note that we believe this project should be rated low in the common assessment framework detailed in the ENIP document after assessing:

- the total project value (less than £500,000),
- the progression through the TRL levels (less than 2),
- the number of project delivery partners (less than 2) and
- clearly defined assumptions and principles are made regarding project data and delivery.

Data Quality Statement

We believe this project will be delivered under the NIA framework, in line with the agreed Energy Networks Innovation Process document, as well as SGN internal policies. We will follow good practice and relevant standards during this work.

Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and that sources of information are appropriately documented.

We have reflected on the data likely to be created, obtained, and used during this project:

- We are not expecting to have to deal with data sensitivities, such as personally identifiable information (GDPR) or intellectual property.
- We may be provided with potentially sensitive commercial data from product suppliers. If this is the case, we will agree to address the data management of this before receiving the data.
- We may be provided with potentially sensitive information from our client and other Networks. If this is the case, we will agree to address the data management of this before receiving the data.
- We will ensure that any data (raw and processed) created through testing is of sufficient completeness, accuracy and integrity.
- All deliverables and project outputs will be stored on our internal cloud platform (Tresorit) and Teams (where appropriate) ensuring backup and version management.
- We use standard Microsoft office programmes (PowerPoint, Word, and Excel) throughout the work. In addition, we may use specialist software, which will be reported through standard Microsoft office programmes.
- At the completion of the project, relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal, and dissemination material can be shared with the relevant stakeholders.

Scope

This stage of the project will undertake testing to explore the impact of static generation due to particulates in flowing gas. The primary objectives to achieve this outcome will be:

· Create tools to measure static charge in PE pipes and explore charge generation from dust transported in pipes in the laboratory.

· Apply the tools in a field environment demonstrating the potential generation of static charge from realistic dust transportation levels and gas velocities.

The work will be split into 3 work packages which are explored in more detail below.

Work Package 1
The aims of this work package are to:

· Procure and set up the equipment, explore and refine the experimental process and carry out initial investigations

· Demonstrate test validity (with implications for testing on DNV's Particle Transport rig at Spadeadam)

The first work package mainly consists of design and procurement of test equipment to be used to measure any static charge build up during the Particle Transport testing work pack of the Velocity Design with Hydrogen project. We will also carry out preliminary scoping experiments in the workshop, ensuring the test programme maximises value.

Anticipated steps for preliminary tests are:

1. Generate and measure static on a PE pipe outer wall through known methods (manually rubbing with a cloth)

2. Measure manually generated static through the pipe wall (manually rubbing the inside of the pipe)

3. Construct a flow loop and circulate dust, monitoring for build-up of static charge

4. Compare static generation levels between PE and Perspex or PVC

5. Make the test setup robust and suitable to connect to DNV's experimental equipment

It is critical that Steer's experiments do not adversely impact DNV's experiments, so we anticipate that ongoing open discussions will be required. The first of these meetings has already happened, with SGN assisting.

Work Package 2
This work package aims to measure static charge generation during experiments on realistic dust transportation levels from increased gas velocities.

All the measurement equipment must comply with DNV's requirements, and any restrictions imposed on site. Steer will liaise with DNV supported by SGN to ensure these experiments integrate appropriately with the test schedule.

The sensing equipment must be selected for a suitable range to measure expected charges. We are unlikely to be able to infer absolute values but expect to detect differences as variables change. It is intended to show if static charge build up occurs and whether there is a difference in static generation with hydrogen and methane gas flows. It will also explore the controlling parameters of pressure and flow velocity. There is also the option to measure charge build up on the vent stack used, by monitoring the earth cable.

Particular technical challenges already identified with this work are:

· Perspex pipe will be used for the DNV tests, which will produce a lower static charge than PE pipe

· ATEX IIC rating may be required for all electrical equipment within the exclusion zone at the test site

· The particles are being collected, so we cannot measure the charge directly as if it were released through a vent

Work Package 3
At the conclusion of WP1, a Steering Group meeting will be held to provide the laboratory work's outcomes and confirm the work to be carried out at DNV Spadeadam. Following work package 2, a short final report will be provided to the client, outlining the full project work carried out and the findings.

Objective(s)

The primary objectives of this project are:

· Develop a testing tool to measure static generated by particulates in flowing gas.

- Undertake measurements in a field test environment.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having a neutral impact on customers in vulnerable situations.

Success Criteria

Work Package 1: Successfully design and develop a tool to measure static generation from particulates in flowing gas.

Work Package 2: Collaborate with DNV to gather empirical evidence relating to static generation in a range of scenarios including various gas velocities, as well as gas mixtures (100% Natural Gas, a 20% hydrogen blend with Natural Gas, and 100% hydrogen).

Work Package 3: Liaise with project partners to ensure the project is aligning with requirements and remaining on scope. Compile the evidence to disseminate to stakeholders and provide context around the data gathered.

Project Partners and External Funding

Steer Energy will be the suppliers for this project with SGN being the sole partner.

Potential for New Learning

This project seeks to develop empirical evidence relating to static generated due to particulates in flowing gas, and in turn provide a better understanding of any associated increase in risk between Natural Gas and hydrogen.

Scale of Project

This project will begin in a laboratory setting based at Steer Energy. This environment will be utilised to design and develop the static generation tools as well as benchmarking the static generation results for future comparisons. The project will then graduate to field based work. This will be facilitated at DNV Spadeadam in order to connect with the testing being carried out as part of the Velocity Design with Hydrogen project.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

This project will be representative of the entire GB gas network.

Revenue Allowed for the RIIO Settlement

Not applicable.

Indicative Total NIA Project Expenditure

SGN – External £51,900, Internal £17,127

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:

This project will help to build a more robust evidence base for hydrogen ignition risk from static. The outputs of this project will highlight the real-world ignition risks posed by static generation due to particulates in flowing gas. The development of this evidence will influence how the network conversion strategy is implemented as well as indicating how required mitigations will have an impact on existing policies and procedures around 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

There is a lot of ongoing work to identify the most effective route to meet net zero in the UK and this project is one of many projects which will assist in this area. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save millions of pounds with minimal gas customer disruption versus alternative decarbonisation solutions.

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

This method is replicable across the entirety of the GB gas 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

The learning uncovered in this stage of the project is applicable to the wider gas network. These results will provide a tangible view of the impact on ignition risk when considering the transition from Natural Gas to hydrogen. The dissemination of these results will provide opportunity for other network licensees to implement the results and ensure their operations are aligned with safe working and best practices.

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 outputs of this project will be shared with the network parties by way of the Network Safety & Impacts working group, and through the SNP portal.

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

This project is innovative as it explores gaps in the evidence relating to ignition risk from static generated from particulates in flowing gas. The evidence surrounding this mechanism is anecdotal and is not supported by empirical evidence but will be addressed through the execution of this project.

Relevant Foreground IPR

The test results and other outputs included in the report will form the foreground IP for this project.

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

- [x] Yes