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 2021

### Project Reference Number

NIA2_SGN0008

## Project Registration

### Project Title

HyPurge

### Project Reference Number

NIA2_SGN0008

### Project Licensee(s)

SGN

### Project Start

October 2021

### Project Duration

0 years and 7 months

### Nominated Project Contact(s)

David Raymond

### Project Budget

£310,926.00

### Summary

There are significant differences between methane and hydrogen, in particularly the very low density of hydrogen that mean the purging processes and procedures need to be reviewed to ensure safe purging of the network. There are a number of challenges with transposing the current purging procedures for Methane directly to Hydrogen.

This project will investigate the purging processes for commissioning and conversion of network pipes with hydrogen. It specifically aims to identify the conditions and procedures required to successfully carry out direct purging from air to hydrogen without the need to resort to using large volumes of inert gases such as nitrogen.

The aim is to deliver the work relevant to H100 Fife for Q1 2022, outlining specific work instructions.

### Third Party Collaborators

Steer Energy

### Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

### Problem Being Solved

A fundamental requirement for the transport of gas is to ensure the safety of our consumers and operatives engaged in construction, maintenance and repair of the network, safe control of operations when purging is a fundamental safety requirement. When commissioning gas distribution network one of the final processes is to commission the network to natural gas. Initially the network will be filled with air, displacing this with natural gas is the process of purging. During network purges there is a likelihood that a flammable mix of gas could be present inside the network. This carries a risk of ignition.

The process of direct purging of air to natural gas is understood, with safe control of operations and purging procedures in place to carry out this operation safely on networks across the UK. The purge velocities required to prevent substantial mixing of air and natural gas are known. Purging is carried out on a regular basis and is an intrinsic element of safe network operations, in particular during network construction and replacement and is carried out on a regular basis by all GDN's

The H100 Fife project aims to deliver 100% hydrogen to domestic customers the first time. A key element of this project is a new fit for purpose 100% hydrogen distribution network

There are a number of challenges with transposing the current purging procedures for Methane directly to Hydrogen. This project will ensure that these key issues are identified and solutions evidenced in terms of:

- Commissioning – introducing hydrogen to new pipelines
- Conversion – introducing hydrogen to existing pipelines, and

Indirect purging is another option, this process displaces air with an inert gas, such as nitrogen prior to purging to hydrogen or natural gas. Whilst effective, this is very costly in terms of nitrogen and adds significant complexity to the process.

The response to this challenge is to investigate the process of direct purging to hydrogen and to determine the parameters required to do this safely.

The project will develop process procedures that can be used for safe commissioning and decommissioning of Hydrogen networks.

## Method(s)

The Project consists of the following costed project milestones as outlined below.

**WP1: Define requirements for H100 Fife**

This work package will review the proposed H100 Fife network, identify any areas of concern and define the experimental research programme accordingly to demonstrate a safe purge method.

This work will be reported in Interim Report 1

**WP2: Review of theory, standards, practices and procedures**

The aim of this work package is to document current theory and procedures for purging between air and methane. The work will then assess the validity in hydrogen and refine the procedures accordingly.

This work will be reported in Interim Report 1

*Steering Group Meeting 1*

An Interim Report will be provided for this Steering Group meeting, outlining the work carried out in WP1, WP2, and WP3 to date.

**WP3: Experimental Lab work**

This work directly builds on the work already carried out by Steer who have developed an analytical method of visualising a purge. This work scope will use the method of measuring purge efficiency to determine the effects of different parameters on the overall purge.

Part of this work will be reported in Interim Report 1, with the conclusion reported in Final Report

**WP4: Third party field trials**

Steer have an in-principal agreement to collaborate with Kiwa to use this 375 m long 180 mm PE pipe as a large-scale trial for purge tooling and procedures.

This work will be reported in Final Report.

*Steering Group Meeting 2*

The Final Report will be provided for this Steering Group meeting, outlining the work carried out in WP1, WP2, and WP3, and WP4.

**WP5: Reporting and dissemination of findings**

The supplier will ensure that all management services including the final report are supplied as specified in NIA project deliverables

## Scope

There are significant differences between methane and hydrogen, in particularly the very low density of hydrogen that mean the purging processes and procedures need to be reviewed to ensure safe purging of the network. There are a number of challenges with transposing the current purging procedures for Methane directly to Hydrogen.

This work scope studies the purging processes for commissioning and conversion of network pipes with hydrogen. It specifically aims to identify the conditions and procedures required to successfully carry out direct purging from air to hydrogen without the need to resort to using large volumes of inert gases such as nitrogen.

The aim is to deliver the work relevant to H100 Fife for Q1 2022, outlining specific work instructions.

This is a 7 month project, that has been broken up into to 3 main stages:

- Gap analysis and work definition (work packages 1 – 2)
- Experimental work and assessment of tooling (work packages 3-4)
- Reporting and dissemination of findings (work package 5)

## Objective(s)

The aim is to deliver the work relevant to H100 Fife for Q1 2022, outlining specific work instructions. The deliverables are:

- **WP1: Define requirements for H100 Fife**

The outcome from this work package will be an agreed format for the H100 Fife network purge plan for commissioning to Hydrogen.

- **WP2: Review of theory, standards, practices and procedures**

Outcomes of this work will be an increased understanding of critical aspects to investigate to provide purge assurance for H100 Fife.

- **WP3: Experimental Lab work**

Outcomes of this work will be knowledge of purge efficiency for a range of pipe diameters and orientations along with determination of the flow rates to ensure efficient network purging.

- **WP4: Third party field trials**

Outcomes of this work pack will be a site demonstration of a full-scale network purge on the PE180 pipe. If it is not possible to carry out this work at Kiwa, then alternatives sites will be sought and this may require additional funding.

- **WP5: Reporting and dissemination of findings**

Alongside monthly meetings, and standard interim reporting, there will be a number of key documents that are delivered at various points during this project.

- Recommended purge procedures for the H100 Fife project
- Recommended purge tooling for the H100 Fife project
- HSE considerations for mitigation of extreme cases, this could include the implications of partial purging the system and subsequent dispersion leading to homogenous flammable and possibly stoichiometric mixes.
- Final report: The Supplier will produce a comprehensive closure report in SGN format, in a structure that contains the following information:
- Introduction
  - An executive summary that outlines the NIA Project deliverables and outputs
  - Recommendations
  - Further work (if required)
  - Project background
  - The Supplier’s background and qualifications
  - Project objectives
  - Stakeholder Engagement

- Project team structure
- Detailed project development and background
- Project delivery
- Conclusions
- Recommendations

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

## Success Criteria

Success Criteria below:

- **Defined requirements for H100 Fife**

The outcome from this work package will be an agreed format for the H100 Fife network purge plan for commissioning to Hydrogen. This plan will be reviewed and approved by SGN. Other outputs will be submitted in Interim Report 1 which will be reviewed and approved by SGN.

- **Review of theory, standards, practices and procedures**

Outcomes of this work will be an increased understanding of critical aspects to investigate to provide purge assurance for H100 Fife. This work will be submitted in Interim Report 1 which will be reviewed and approved by SGN.

- **Experimental Lab work**

Outcomes of this work will be knowledge of purge efficiency for a range of pipe diameters and orientations along with determination of the flow rates to ensure efficient network purging. This work will be submitted in Final Report which will be reviewed and approved by SGN.

- **Third party field trials**

Outcomes of this work pack will be a site demonstration of a full-scale network purge on the PE180 pipe at Kiwa Gastec or similar. Details of this work will be submitted in Final Report which will be reviewed and approved by SGN.

- **Reporting and dissemination of findings**

SGN will review and approve:

- Interim and Final Reports
- Other documents, including recommended purge procedures for the H100 Fife project, and recommended purge tooling for the H100 Fife project

## Project Partners and External Funding

Steer Energy will be the partner for this project.

## Potential for New Learning

The project will provide key learning on the purging processes for commissioning and conversion of network pipes with hydrogen. It specifically aims to identify the conditions and procedures required to successfully carry out direct purging from air to hydrogen without the need to resort to using large volumes of inert gases such as nitrogen.

As part of the project, SGN will produce a comprehensive closure report which will be made available on the Smarter Networks Portal.

## Scale of Project

The has been broken up into to 3 main stages:

- Gap analysis and work definition (work packages 1 – 2)
- Experimental work and assessment of tooling (work packages 3-4)
- Reporting and dissemination of findings (work package 5)

## Technology Readiness at Start

TRL2 Invention and Research

## Technology Readiness at End

TRL3 Proof of Concept

## Geographical Area

The project will establish details and suitability purging processes for commissioning and conversion of network pipes with hydrogen. Outputs of the project will provide a methodology that can applied on a UK wide scale for conversion of the network to hydrogen.

## Revenue Allowed for the RIIO Settlement

Not applicable

## Indicative Total NIA Project Expenditure

£310,926

# 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:

A fundamental requirement for the transport of gas is to ensure the safety of our consumers and operatives engaged in construction, maintenance and repair of the network, safe control of operations when purging is a fundamental safety requirement. When commissioning gas distribution network one of the final processes is to commission the network to natural gas. Initially the network will be filled with air, displacing this with natural gas is the process of purging. During network purges there is a likelihood that a flammable mix of gas could be present inside the network. This carries a risk of ignition.

The process of direct purging of air to natural gas is understood, with safe control of operations and purging procedures in place to carry out this operation safely on networks across the UK. The purge velocities required to prevent substantial mixing of air and natural gas are known. Purging is carried out on a regular basis and is an intrinsic element of safe network operations, in particular during network construction and replacement and is carried out on a regular basis by all GDN's

The H100 Fife project aims to deliver 100% hydrogen to domestic customers the first time. A key element of this project is a new fit for purpose 100% hydrogen distribution network

The project will establish details and suitability purging processes for commissioning and conversion of network pipes with hydrogen. Outputs of the project will provide a methodology that can applied on a UK wide scale for conversion of the network to 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 potential outcomes of this project are applicable across GDN's. All the Network Licensees are aiming to reduce carbon emissions through transition to hydrogen. The project will provide a robust framework that GDN's can utilise to convert operating areas to hydrogen and ensure security of supply for downstream users.

## 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 gained from this project aims to inform Network Licensees of details and suitability purging processes for commissioning and conversion of network pipes with hydrogen. Outputs of the project will provide a methodology that can applied on a UK wide scale for conversion of the network to hydrogen.

### 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 scope has been reviewed against all existing projects and no areas of duplications have been identified.

### 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

Not applicable

## Relevant Foreground IPR

Not applicable

## Data Access Details

Any consumer data gathered throughout this project will be anonymised and will be compliant with General Data Protection

Regulations (GDPR) and the UK Data Protection Act. Any compliant data can be made available for review upon request

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

This work scope studies the purging processes for commissioning and conversion of network pipes with hydrogen. It specifically aims to identify the conditions and procedures required to successfully carry out direct purging from air to hydrogen without the need to resort to using large volumes of inert gases such as nitrogen. As such it is not part of the usual activities of the business.

## 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 NIA framework offers a robust, open framework to support this work and ensures the results are disseminated to all licenses. The commissioning and conversion of network pipes with hydrogen involves significant technical risks. The project will address all considerations and requirements to allow for the transport of hydrogen and delivery to end users, converting from existing natural gas supply.

## This project has been approved by a senior member of staff

☑ Yes