

NIA Project Registration and PEA Document

Date of Submission

Nov 2023

Project Reference Number

NIA_WWU_02_40

Project Registration

Project Title

Emissions Mitigations – Purging for a Hydrogen Future

Project Reference Number

NIA_WWU_02_40

Project Licensee(s)

Wales & West Utilities

Project Start

November 2023

Project Duration

0 years and 7 months

Nominated Project Contact(s)

Darren Cushen

Project Budget

£151,199.00

Summary

At present, gas distribution networks transporting natural gas suffer environmentally harmful carbon emissions through shrinkage: venting from safety equipment, leaks, regulators, and scheduled maintenance. Leaks are set to decrease in frequency owing to the mains replacement programme; purging natural gas to air as part of GDN operational procedures, however, is prominent. With hydrogen being seen as a viable potential solution to decarbonising domestic heat and industry, a UK wide network conversion utilising the existing pipeline infrastructure is not unlikely. To do so, however, would require purging significant volumes of natural gas to atmosphere. Although similar work was undertaken as part of the H21 project, its scope of work has only looked at venting and some flaring. The project aims to investigate the feasibility of eliminating natural gas emissions from both current operations and a large scale hydrogen conversion programme.

Preceding Projects

NIA_WWU_2_13 - EUSE – Hazardous Areas Within Buildings

NIA_WWU_2_12 - EUSE - Ventilation Within Buildings

Third Party Collaborators

Steer Energy

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

At present, GDNs transporting natural gas experience carbon emissions through shrinkage from leaks, safety equipment venting,

regulators, and scheduled maintenance. Leakages are currently decreasing in frequency owing to the mains replacement programme. Purging natural gas to air is, however, still prominent as part of higher-pressure tier maintenance, as well as REPEX and other operational procedures.

The UK government has committed to reducing greenhouse gas emissions to net zero by 2050 with the Scottish government targeting net zero by 2045. All future energy modelling identifies a key role for hydrogen in providing decarbonised energy for heat, transport, industry, and power generation. Significant decisions on the future of UK heat policy are expected from the UK government in 2026 so the need for further evidence to influence these decisions is of critical importance.

Due to the cost-effectiveness of repurposing existing pipes to carry hydrogen, it is likely that a nation-wide network conversion could take place. In order to replace the natural gas in the pipes with hydrogen, significant purging will be necessary, resulting in large volumes of natural gas emissions.

This project seeks to explore the feasibility of re-using the purged natural gas elsewhere in the network, or otherwise capturing the gas and not re-circulating.

Method(s)

This project seeks to remove the need to vent or flare natural gas (or hydrogen, in the future) into the atmosphere, as both a part of current operations and a large-scale hydrogen conversion programme. NGN's H21 programme has previously explored venting and flaring of natural gas but this research didn't explore the viability of recirculation or gas capturing as options.

This spend will fund the delivery of 11 work packages across two phases:

- Phase 1 (Literature Review): Categorising natural gas emissions in volumes and carbon emissions from common operational practices across GDNs, and research current products and technologies currently exist to avoid venting of natural gas to air on a distribution network or applicable industry.
- Phase 2 (Solutions): Investigating ways of removing the need to vent or flare to the atmosphere and, if no or limited potential solutions are identified in Phase 1, to conceptualise and prototype options for addressing this challenge.

Data Quality Statement

Steer will follow good practice and relevant standards during delivery of the project. 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 their knowledge and that sources of information are appropriately documented.

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

- Steer are not expecting to have to deal with data sensitivities, such as personally identifiable information (GDPR) or intellectual property.
- Steer acknowledge that they may be provided with potentially sensitive commercial data from product suppliers. If this is the case, Steer agree to address the data management of this before receiving the data.
- Steer may be provided with potentially sensitive information from WWU and other GDNs. If this is the case, Steer agree to address the data management of this before receiving the data.
- Steer 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 Steer's internal cloud platform (Tresorit) ensuring backup and version management.
- Steer use standard Microsoft office programmes (PowerPoint, Word, and Excel) throughout the work. In addition, Steer may use Miro during the Ideation work package – this will be locked post-project and can 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.

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.

The project is rated low in the common assessment framework detailed in the ENIP document after assessing the total project value,

the progression through the TRL levels, the number of project delivery partners and the high level of data assumptions. No additional peer review is required for this project.

Scope

The project will be delivered through 11 work packages (WP) across two phases:

Phase 1: Literature Review

There are five work packages associated with this phase:

- WP1: Review & Categorise Emissions
- WP2: Review & Categorise Current Techniques / Products
- WP3: Review & Categorise Previous Innovation Projects
- WP4: Combined Scored Matrix
- WP5: Decision Point

Phase 2: Solutions

There are six work packages associated with this Phase.

- WP6: Working Group Engagement
- WP7: Develop Design Specification
- WP8: Progress Options direct from Phase 1
- WP9: Ideation
- WP10: Initial Prototyping and Validation
- WP11: Future Plans

Steer will develop an initial methodology to simply categorise natural gas emissions in volumes from common operational practises across GDNs, working with input from the other GDNs to inform this. Steer will also look beyond the gas industry for technologies or procedures that enable the following:

- Removal of the need to vent or flare
- On-site direct use or energy conversion
- Products for reinjection at site or off-site
- Techniques for improving efficiencies of existing processes e.g., purging techniques

Using the scoring methodology developed, these techniques and products will be ranked. A short summary report will be produced on the findings of Phase 1.

WP6 will necessitate the formation of a working group to advise on work processes, practices, safety, and environmental impact throughout WP7-10, consisting of core staff from Operations, Policy, and HSE teams; the Innovation Project Manager is to assist with the recruitment and running of this team. Steer will work with this group to develop a design specification for the solution, progressing those identified in Phase 1. The initial prototyping and validation phase will:

- Identify key barriers and look at how these might be overcome
- Review safety with the appropriate body/individual
- Consider how testing, qualification, and training might be carried out.

The final work package will culminate in an overview of the project findings and details of the ideas for taking forward. This will be consolidated into a report or presentation for dissemination.

Objective(s)

To produce a final report summarising the findings of the work packages that encompass phases one and two of the project. Namely, the outputs of the literature review (which focuses on categorising and quantifying carbon and natural gas emissions in volumes from common operational practises across GDNs, and research on current products and technologies that currently exist to avoid venting of natural gas to air on a distribution network), and the search for solutions (means of removing the need to vent or flare to atmosphere, and to conceptualise and prototype options for addressing this challenge if existent solutions are limited in this aim).

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

A completed quantification of the carbon and natural gas emissions from common operational practises across GDNs, completed research on current products and technologies to avoid denting of natural gas to air on a distribution network, and a report on solutions to take forward for addressing the mitigation of natural gas emissions as part of common operational practises and as in the event of a network-wide conversion to hydrogen.

Project Partners and External Funding

The partner for this project is Steer Energy Solutions and the project is wholly funded via NIA. WWU are acting as lead network and NGN are partnering with a 50/50 external cost split.

Potential for New Learning

The project will help networks to quantify by volumes their natural gas and carbon emissions as part of common operational practices. The project will also provide learnings as to the existent technologies and/or procedures that enable removal of the need to vent or flare gas, on-site direct use or energy conversion of gas emissions, and techniques for improving efficiencies of existing processes. Where no existent solutions address this challenge sufficiently, the project will seek to conceptualise and prototype options.

Scale of Project

This will be a desktop study.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The project and its generated learnings will be applicable to all GDNs across the entire GB network.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External WWU = £58,775 NGN = £58,775 Internal WWU = £19,350 NGN = £14,057.28 Total WWU = £78,125 NGN = £72,832.28
Grand total = £150,957.28

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 seeks to remove the need to vent or flare natural gas (or hydrogen, in the future) into the atmosphere, as both a part of current operations and a large-scale hydrogen conversion programme. In the event of a network-wide conversion to hydrogen, large volumes of gas would require purging – the project endeavours to remove the need to vent or flare by exploring on-site direct use or energy conversion of these gases, reinjection at site or off-site, and/or techniques for improving efficiencies of existing processes.

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)

N/A

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 to evidence the major or minor role hydrogen will have in different scenarios. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to decarbonise heating with minimal gas customer disruption compared to alternative decarbonisation solutions.

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

This will be fully replicable across all networks.

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

There are no roll out costs at present, as this is a research project.

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

RIO-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

All networks are looking to decarbonise the network and switch to an alternative energy source. This project will provide valuable learnings on how natural gas (and in the future, hydrogen) emissions vented to atmosphere as part of common operational practises can be mitigated. Likewise, in the event of a network-wide conversion to hydrogen, the project learnings will enable GDNs to understand how a purging events of this kind can be minimised, with the purged gas captured and potentially reused on or off-site.

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

n/a

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.

All networks have been made aware of this project and no concerns of duplication have been raised.

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

This project seeks to remove the need to vent or flare natural gas (or hydrogen, in the future) into the atmosphere, as both a part of current operations and a large-scale hydrogen conversion programme. NGN's H21 programme has previously explored venting and flaring of natural gas but this research didn't explore the viability of recirculation or gas capturing as options.

Relevant Foreground IPR

The project report will form the relevant Foreground IPR.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC)

or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

- A request for information via the Smarter Networks Portal at <https://smarter.energynetworks.org>, to contact select a project and click 'Contact Lead Network'. WWU already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
- Via our Innovation website [here](#)
- Via our managed mailbox innovation@wwutilities.co.uk
- Details on the terms on which such data will be made available by Wales & West Utilities can be found in our publicly available "Data sharing policy relating to NIC/NIA projects" [here](#)

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

Ofgem published its final determinations which included a variety of provisions to enable necessary development work on Net Zero projects but also to ensure vulnerable customers are thought about in any decision making. This project has the potential to facilitate the energy system transition and is therefore eligible to use the NIA funding mechanism.

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 project would only be undertaken with support from NIA funding, it is in the interests of gas customers, the regulator and the UK government and the realisation of any benefits are outside the control of the gas networks. There is no allowance in BAU business plans for this type of work and there is a risk that if hydrogen is not accepted as a means to heat homes in 2050 that this work is no longer valid.

This project has been approved by a senior member of staff

☒ Yes