

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

Jan 2021

Project Reference Number

NIA_NGN_276

Project Registration

Project Title

H21 - Hydrogen Ready Components

Project Reference Number

NIA_NGN_276

Project Licensee(s)

Northern Gas Networks

Project Start

January 2021

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Russ Oxley

Project Budget

£399,488.00

Summary

The UK was legally bound to make ambitious carbon reductions under the terms of the Climate Change Act (2008). However, the UK government signed legislation on 27th June 2019 committing the UK to a legally binding target of Net Zero emissions by 2050. This means the UK must tackle decarbonisation at pace and change the way energy is produced, transported and consumed to meet this new target.

NGN have committed to work with stakeholders and the government to work towards a strategy to convert the gas distribution networks to hydrogen, including the H21 100% hydrogen project.

The current network components are designed and specified to be compatible with natural gas. In order to confirm that the current components are compatible with hydrogen, a review of the impact of the change in hydrogen characteristics on the materials that make up these components is needed to confirm if there are any issues of compatible or not and make recommendations if further research and testing is required.

Preceding Projects

NIA_NGN_302 - H21 - Wider Impacts of Hydrogen

NGN_NIA_344 - H21 Ignition Consequence Research

NIA_NGN_348 - H21 Occupied Trials Phase 1 - Safety Case

NIA_NGN_425 - Hydrogen compatibility of components - Phase 2: Further analysis

Third Party Collaborators

HSE Science Division

QEM Solutions

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

The UK was legally bound to make ambitious carbon reductions under the terms of the Climate Change Act (2008). However, the UK government signed legislation on 27th June 2019 committing the UK to a legally binding target of Net Zero emissions by 2050. This means the UK must tackle decarbonisation at pace and change the way energy is produced, transported and consumed to meet this new target.

NGN have committed to work with stakeholders and the government to work towards a strategy to convert the gas distribution networks to hydrogen, including the H21 100% hydrogen project.

The current network components are designed and specified to be compatible with natural gas. In order to confirm that the current components are compatible with hydrogen, a review of the impact of the change in hydrogen characteristics on the materials that make up these components is needed to confirm if there are any issues of compatible or not and make recommendations if further research and testing is required.

Components & materials would include such items as:

- Various types of pipe (PE, Steel etc)
- Valves
- Filters
- Regulators
- Governors
- E&I Equipment
- Heat Exchangers
- Bursting disc
- Sealants
- Greases
- Pastes
- Grouts
- Diaphragms
- Gaskets

There is existing research available on the effect of hydrogen on a lot of the materials in these components which needs to be reviewed to assess their compatibility. This will include communicating with the supply chain to assist with reviewing the existing and new component materials and making recommendation for further improvements and testing. It will also, for example, assist with reviewing component parts that are not compatible to see if they can be retrofitted with replacement parts to become compatible rather than fully replaced.

From this research a methodology tool is needed to allow assessment of the NGN component materials for compatibility with hydrogen.

Method(s)

The project will be delivered in four phases:

- **Phase 1A** - Review of all network components that will come into contact with hydrogen.
- **Phase 1B** - Review of the current research and literature, including co-ordination with other hydrogen projects, such as H100, HyDeploy and Future LTS.
- **Phase 2** - Generate methodology tool to allow the review of component materials based upon the findings from the current available research.
- **Phase 4** - Review and assess the impact of hydrogen on the materials in the network components and categories them as being compatible or not with hydrogen and make recommendations.

Scope

Overall this project will:

- Review the current literature and research on the compatibility of materials with hydrogen, including co-ordinating with the H100, Future LTS & HyDeploy projects.
- Review the current Gas Industry Standards.
- List the existing network components that are less than 7 bar and categorise which will have direct contact with hydrogen. This will include pipework, fittings, inline equipment such as valves, governors etc. and consumables, such as greases, sealants etc. This will involve utilising asset management and operations personnel utilising their knowledge of equipment components spares and consumables.
- Review the materials used in these components which will have direct contact with hydrogen including obtaining information from manufacturers as required.
- Develop a methodology tool to allow a review of the components materials and apply the current research to determine compatibility with hydrogen.
- Utilise the methodology tool to review the components and categorise the material/component as for example:
 1. Suitable for use with Hydrogen.
 2. Unsuitable for use with Hydrogen and require replacement.
 3. Further Testing/Research Required.
- Reporting on the findings and make recommendations.
- Identification of any further testing requirements to prove compatibility of untested materials.

The scope of the project will include below 7 bar components only which will include everything from the IP-MP pressure reduction equipment through to the emergency control valve (ECV). The project will review compatibility with current literature and research, it will not undertake any testing of materials not already researched but will make recommendations for any further testing that is required.

Objective(s)

To review the existing gas network components for compatibility with 100% hydrogen, provide a methodology tool for reviewing materials compatibility and produce an output report/schedule detailing the findings.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project must ascertain if materials within network components are suitable or not for use with 100% hydrogen and make recommendations for further testing/research. The project will be measured successful if a methodology tool is developed to undertake assessments and a report produced detailing materials used in the various components and their suitability or not for use with 100% hydrogen.

Project Partners and External Funding

NGN will lead the project, Cadent will be a key collaborator. The HSE Science Division will undertake the required hydrogen materials research and develop the methodology tool that will be utilised by NGN to review the component materials. QEMS will project manage the project and will undertake the assessment of NGN components using the methodology tool produced by HSE Science Division.

Potential for New Learning

The elements of the H21 NIC projects will only provide the controlled environment testing results to support a 100% hydrogen gas grid conversion. Further investigation is required into the gas network components material compatibility with 100% hydrogen, reviewing the key functionality of critical components, the demands on the materials from which they are constructed and how hydrogen could affect these properties.

Scale of Project

This project inputs into the success of the H21 Project which will provide critical information applicable to the entire UK gas system when considering conversion to 100% hydrogen incrementally over time.

Technology Readiness at Start

Technology Readiness at End

Geographical Area

The project will be based on components from the NGN network but the methodology tool will be transferable to the other GDNs network components.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

Total Project

External funding = £319,590

Internal cost = £79,898

Total Cost = £399,488

NGN

External funding = £137,423

Internal cost = £34,356

Total Cost = £171,779

Cadent

External funding = £182,167

Internal cost = £45,542

Total Cost = £227,709

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)

This project is one of a suite of projects to enable a conversion of the UK gas grid to hydrogen. Repurposing the UK gas networks with hydrogen to support the challenge of the climate change act has the potential to save £46 billion with minimal gas customer disruption verses alternative decarbonisation solutions

Please provide a calculation of the expected benefits the Solution

N/A

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

The research and learning undertaken as part of the services testing is applicable to all GDNs within the UK as the networks have the same construct and design parameters and so will assist with future Hydrogen conversion projects. The methodology tool produced by the HSE Science Division can be utilised by all GDNs and by component manufacturers to assess compatibility with hydrogen.

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

N/A

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 trialed 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

The components material compatibility project is part of the delivery of the overall H21 Innovation project. All evidence associated with the conversion of the UK gas distribution networks to 100% hydrogen is applicable to all GDNs within the UK as the networks have the same construct and design parameters.

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

Future of Gas

- 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.

Some research of components compatibility with 100% hydrogen has been undertaken by the H100 project, but for new materials only. This project will develop a tool that will be utilised to assess the existing assets and confirm compatibility.

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 will build on the original work of the H21 Leeds City Gate project and the H21 Phase 1 & 2 NIC projects and provide valuable knowledge and learning to inform some of the next steps identified in the H21 road map.

Relevant Foreground IPR

n/a

Data Access Details

n/a

Please identify why the Network Licensees will not fund the project as part of its business and usual activities

This project is in the interests of UK and is not specific to business as usual operations of the network with no allowance within regulatory business plans. Whilst the benefits are undeniable there is no guaranteed benefit back to gas customers without regulator and government support– projects associated with 100% hydrogen are at the cutting edge of gas network innovation.

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 realization 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 the commercial benefits and technical/operational risks associated with these type of 100% hydrogen projects are outside the traditional environment of any gas distribution network or its shareholders.

This project has been approved by a senior member of staff

Yes