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

Jul 2024

Project Reference Number

NIA_NGT0239

Project Registration

Project Title

Hydrogen & Carbon Ready Electrical and Instrumentation Assets

Project Reference Number

NIA_NGT0239

Project Licensee(s)

National Gas Transmission PLC

Project Start

July 2024

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Alistair Carvell - Box.GT.Innovation@nationalgas.com

Project Budget

£449,427.00

Summary

This project, “Hydrogen and Carbon Ready Electrical and Instrumentation Assets” focuses on assessing current E&I systems within the gas transmission network, evaluating their readiness for hydrogen applications and understanding the impact of potential replacements necessary for hydrogen compatibility. While carrying out assessments on hydrogen content, similar assessments for carbon content will also be completed.

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Gas Transmission (NGT) are actively engaged in developing the gas network to support the future decarbonisation of the National Transmission System (NTS) by transporting low-carbon gases like hydrogen, as part of the broader energy transition. NGT are also considering whether the NTS could be used for transporting CO2 – to support carbon capture, utilisation and storage projects in the UK. An essential part of this transition will be to ensure the quality of the gas and so assess if the current Electrical and Instrumentation (E&I) assets will be suitable for hydrogen and carbon dioxide.

Method(s)

Table 1 Data Sources Data type
Description
Database inputs
NGT Databases (e.g. Ellipse, ECM)

CAMS Database

Human Inputs
Discussions/Interviews with NGT Subject Matter Experts (SMEs) / suppliers / original equipment manufacturers
Policy Inputs
E&I Policies (MAINT/12, MAINT/11, MAINT/6).
Manufacturer Data inputs
Product Handbooks
Public Data
Electronic data obtained from the National Gas website
The project will take a data science based approach to the assessment of the available data on E&I assets. As part of this approach, Element Digital Engineering (EDE) will employ data science techniques to provide an interactive communication to National Gas SMEs for the purposes of gaining feedback on the findings of the data analysis.

The method proposed by EDE for the first phase of the work is described in the steps below:

Phase 1 begins with a site visit to National Gas to meet key contacts and subject matter experts (Step 0), establishing an understanding of the project goals. In Step 1, data from various NGT and CAMS databases, along with supporting documentation, is extracted, loaded onto EDE's IT infrastructure, and transformed for analysis. This prepares the asset data for evaluation. Step 2 assesses the data's coverage and quality, ensuring it is suitable for further analysis and commercial feasibility.

Step 3 involves a risk assessment of each asset, determining its suitability for hydrogen blends, pure hydrogen, or carbon dioxide, and assigning prioritization scores based on the associated risks. In Step 4, geographical data is used to create an interactive map of existing E&I asset data, providing a critical resource for the project's remaining phases. Finally, Step 5 involves gathering feedback from NGT SMEs and suppliers through interviews or questionnaires, depending on the number of SMEs. This feedback is used to refine and improve the accuracy of the interactive map.

Phase 2 – Review of hydrogen ready E&I assets

Phase 2 Methodology :

In Phase 2, the project begins with a review of findings from Phase 1 (Step 0). This review allows National Gas and EDE to forecast resource requirements and decide whether to proceed with the current plan or adjust the scope. Step 1 uses preliminary outputs from Phase 1 to categorize network assets, prioritizing high-risk assets.

In Step 2, details about these asset types are determined through methods like web-scraping, direct OEM contact, and manual research, resulting in manufacturer data associated with asset type groups. If Step 2 is inconclusive, Step 3 involves direct OEM contact to assess their hydrogen readiness plans, providing insights into supply chain availability and costs of hydrogen-ready assets. Finally, Step 4 compiles these findings into a formal report summarizing the hydrogen readiness of the NGT E&I asset supply chain, ensuring quality through Element QA system.

Phase 3 – Commercial Feasibility of Implementing Hydrogen Compatible Solutions

Phase 3 Methodology

In Phase 3, the project begins with a review of the outputs from Phase 2 (Step 0). This step assesses whether the information gathered is sufficient for a meaningful cost-benefit analysis, ensuring value for money and leading to a decision to proceed or replan the project.

In Step 1, based on data from Phase 2 and additional supplier data, an estimation of the asset replacement cost is conducted. This involves confirming the total number of assets to be replaced, calculating upgrade costs for specific equipment groups, and summing up all hardware costs, resulting in an estimation of E&I asset hardware replacement costs. Step 2 evaluates the feasibility of these cost estimates against the detailed deliverables from Phase 2, considering factors like procedural and maintenance issues, data and system compatibility, and safety considerations for the transition. This evaluation culminates in a report and presentation on the

commercial feasibility assessment findings.

Phase 4 – Standards & Reporting

Method

Collate deliverables from phases 1 to 3 to support NG compliance with NIA reporting requirements, described in RIIO-2 NIA Governance Document dated 12 October 2021.

EDE understand compliance to these requirements is essential in order for NG to be awarded funding for the project. EDE understand that the outputs of this phase will be made public.

Standards Review:

The EDE System Safety Capability includes knowledge of regulations and standards which are relevant to this project, specifically:

- Pipeline Safety Regulations 1996 (PSR)
- Health and Safety at Work etc Act 1974 (HSWA)
- Control of Major Accident Hazards Regulations 1999 (COMAH)
- Dangerous Substance and Explosive Atmospheres Regulations 2002 (DSEAR)
- BS EN 60079 – Explosive Atmospheres - Mulit-part Standard for electrical devices
- EN ISO 80079 – Explosive Atmospheres – Multi-part standard for mechanical devices

Knowledge of these regulations and standards can be used to provide the expert opinion required for deliverable 2) in section 6.8.4.

In addition to the ability to support standards and regulation updates, EDE are fully informed of the research published in support of the transition to hydrogen, for example:

- RR1133 - Maintaining the integrity of process plant susceptible to high temperature hydrogen attack. Part 1: analysis of non-destructive testing techniques
- RR1134 - Maintaining the integrity of process plant susceptible to high temperature hydrogen attack. Part 2: factors affecting carbon steels
- RR1169 - Hydrogen in the natural gas distribution network: Preliminary analysis of gas release and dispersion behavior
- RR1047 - Injecting hydrogen into the gas network – a literature search

Phase 5 – Carbon Dioxide

EDE understand the need for consideration of the effects carbon dioxide on E&I assets and that the gas presents a different set of issues compared to the effects of hydrogen and hydrogen blends. EDE believe that considering the effects of carbon dioxide while considering the effects of hydrogen is the most efficient way to achieve the objectives of the project.

Phase 1 activities will be largely unchanged by the additional consideration of carbon dioxide.

Phases 2, 3 and 4 are expected to be affected by the additional consideration of carbon dioxide.

Measurement Quality Statement

The measurement approach used to meet Data Quality objectives will be through the identification of high calibre project partners who are experts in their given field. The methodology used in this project will be subject to our supplier's own ISO 9001 certified quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and made available for review.

Data Quality Statement (DQS)

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document and NGT internal policies. 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 sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared with the relevant stakeholders.

Scope

Operational impact of 2%, 20% blends of hydrogen/methane on E&I assets on the NTS

Operational impact of 100& hydrogen on E&I assets on the NTS

Operational impact of carbon (gaseous phase) on E&I assets on the NTS

Out of Scope: Actuators, electric drive compression

Objective(s)

· Establish what E&I systems are on the NTS and identify assets that require further investigation based on risk and criticality.

· Identify components and systems that may require replacement or modification.

· Undertake an OEM review of hydrogen ready E&I systems.

Carry out a cost benefit analysis to determine the financial implications of implementing hydrogen/carbon-compatible solutions.

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. This is because it is a transmission project.

Success Criteria

· Provide an independent view on the impact of hydrogen and carbon on the NTS E&I systems/assets, including the recommendations, potential for re-use/replacements of the existing E&I systems/equipment, and procedural changes needed.

· Completed work package reports outlining the findings and recommendations for compatibility of E&I assets with 2%, 20% ,100% hydrogen and Carbon.

Cost-benefit analysis of replacing hydrogen/carbon ready assets

Project Partners and External Funding

Element Digital Engineering (EDE) are the sole supplier for this project.

Potential for New Learning

This project will provide an independent view on the impact of hydrogen and carbon on the NTS E&I systems/assets, including the recommendations, potential for re-use/replacements of the existing E&I systems/equipment, and procedural changes needed.

Scale of Project

The scale of this project allows it to cover all available information and data on E&I assets on the NTS. This is required to inform NGT of the impact of hydrogen and CO2 on E&I assets and provide a cost benefit analysis of replacing/repurposing the assets. The scale has been set based on learnings from past projects and supplier engagement. Previous projects have shown that carrying out a market analysis and receiving responses from OEMs can take longer than expected. Furthermore, along with assessing the impact of hydrogen on E&I assets on the NTS, the project also includes an assessment of the impact of carbon on E&I assets.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

United Kingdom. Warwick and supplier location.

Revenue Allowed for the RIIO Settlement

N/A to this project – Hydrogen focused innovation project.

Indicative Total NIA Project Expenditure

Total project costs: £445,198.75.

Which consists of:

EDE cost of £356,159.

NGT total internal and admin costs £89,039.75

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 Hydrogen & Carbon Ready E&I Assets project has the potential to significantly facilitate the energy system transition by ensuring the reliability and safety of critical National Transmission System assets.

The project will provide NGT with the knowledge required to understand the impact of replacing/repurposing E&I assets on the NTS for hydrogen and carbon compatibility, which will be vital in the energy system transition and for a hydrogen, or CO2, transmission network.

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

Category
Description
Scoring
Maturity
TRL 2-3
Research to prove feasability
Opportunity
100% and multiple asset classes
Wide range of assets and types effected
Deployment costs
£0
Unknwon at beginning
Innovation cost
£445,198.75
Total project cost
Financial Saving
0

Safety

100%
Required for safe operation of networks
Environment
na
No immediate benefit – enablement activity
Compliance
Ensures compliance

Skills & Competencies
Group

Future proof
Must have for business strategy

Project Score: 18

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

The findings of the project, while research based, will provide a good understanding of the hydrogen and carbon impact on the E&I assets across the entire National Transmission Network and provide a framework into the requirement for replacing/repurposing assets for hydrogen & carbon readiness. The first work package involves collating information and data regarding all E&I assets on the NTS from various different data sources/databases. This will be useful for other future projects and also BAU activities.

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 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 assets assessed as part of this project are components utilised on other gas transmission and distribution networks and the findings can be used by the networks to make informed decisions for their specific network configurations through the outputs of this project.

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

Findings will be shared through the ENA portal to prevent duplication.

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

There is currently a knowledge gap for the impact of hydrogen & carbon on the E&I assets on the National Transmission System and the impact needs to be understood. Such assessment of hydrogen and carbon on E&I assets on the entire network to understand the impact and cost-benefit has not been carried out before.

Relevant Foreground IPR

No foreground IPR is being shared on this. Due to Ofgem funding rules, knowledge and learning is shared.

Data Access Details

Details on how network or consumption data arising in the course of an NIA funded project can be requested by interested parties, and the terms on which such data will be made available by National Gas can be found in our publicly available “Data sharing policy relating to NIA projects” at www.nationalgas.com/gasinnovation. National Gas data access is managed IAW provisions under 2.15-2.18 for the current NIA Governance Document.

National Gas already publishes much of the data arising from our NIA projects at www.smarternetworks.org. You may wish to check this website before making an application under this policy, in case the data which you are seeking has already been published.

Data Quality Statement (DQS):

The project will be delivered under the NIA framework in line with the agreed Energy Networks Innovation Process document NGT internal policies. 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 sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal SharePoint platform ensuring backup and version management. Relevant project documentation and reports will also be made available on the ENA Smarter Networks Portal and dissemination material will be shared

with the relevant stakeholders.

Measurement Quality Statement (MQS):

The methodology used in this project will be subject to our supplier's own ISO 9001 certified quality assurance regime and the source of data, measurement process and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and made available for review

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

Hydrogen related work is not currently funded by business-as-usual activities, therefore innovation funding must be used for this project.

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

Hydrogen projects cannot be funded as part of BAU activities. NIA also enables sharing of the results and methodology.

This project has been approved by a senior member of staff

☑ Yes