

## NIA Project Registration and PEA Document

### Date of Submission

Oct 2022

### Project Reference Number

NIA\_NGGT0200

## Project Registration

### Project Title

Identification of NTS Opportunities in the Transport Sector

### Project Reference Number

NIA\_NGGT0200

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

November 2022

### Project Duration

0 years and 11 months

### Nominated Project Contact(s)

Helen Dugdale, Box.GT.Innovation@nationalgrid.com

### Project Budget

£260,758.00

## Summary

The repurposing the NTS for hydrogen gives Gas Transmission & Metering (GT&M) an opportunity to explore the potential role of the NTS in providing hydrogen for a net zero transport system. This project will investigate the requirement for hydrogen and hydrogen derived fuels within the UK. A review of the current projects underway within various transport sectors will be accompanied by forecasting the future demand for hydrogen and a consideration of the role the NTS could play in decarbonizing the UK's transport industry. It will also identify key stakeholders and provide recommendations for future projects. The transport modes of interest are maritime, aviation, heavy goods vehicles (HGVs), buses, rail and construction, alongside their associated infrastructure.

## Third Party Collaborators

Chaucer Group

## Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

The repurposing the NTS for hydrogen gives Gas Transmission & Metering (GT&M) an opportunity to explore the potential role of the NTS in providing hydrogen for a net zero transport system

Hydrogen is expected to be used directly in combustion engines, fuel cells and turbines, as well as the production of transport fuels, such as ammonia and synthetic aviation fuels. The HM Government in its UK Hydrogen Strategy estimates that this combined demand

could reach up to 140TWh in 2050.

However, in addition to the large scale of the opportunity, transport is also expected to be one of the early markets for hydrogen, due to the relative advancement of the respective technologies. This early adoption is expected to be driven by the sectors that are easily managed using a back-to-depot refuelling system, such as buses, as this allows hydrogen infrastructure to be more centralised. Transport modes, such as HGVs, that are not able to run on a centralised model are expected to be more difficult to decarbonise due to the hydrogen fuel demand being distributed over a wide geographical, fluctuating area.

## Method(s)

### Work Package 1

WP1 activities will be carried out mainly via desk research complemented with focused interviews. To perform WP1 activities, the most appropriate and suitable sources to gather relevant information will be identified, either literature review or field research.

1. Literature Review: encompasses the search, evaluation, and processing, of information available in the public domain (e.g. institutional database, research articles, papers, etc.). The methodology entails the following steps:

1.1 Literature Review Design: definition of the approach to be used for the literature review, by consulting existing literature on the specific subject matter of the study; definition of search terms aligned with GT&M's requirements and inclusion/exclusion criteria to screen the documentation that will be reviewed.

1.2 Document identification: the identification of relevant articles, publications, and any other information sources will be carried out in two phases: preliminary selection (grouping of documents into macro-categories) and final selection (application of selection criteria to identify the final sample of documents to be analysed). The following is a preliminary list of sources that will be consulted for WP1: Reference institutions documentation, publicly available sources/databases of international relevance, conference proceedings, information available from recent events, financial reports, sustainability reports, press releases. Etc.

1.3 Information analysis: use of a standardised method to abstract relevant information from selected articles and publications, by organizing data in categories.

2.1 Field research: interviews with selected experts and stakeholders aimed at: Deepening the understanding of the most interesting among the examined projects, through interviews to involved players. Completing the view on the value chains to identify the comprehensive panel of stakeholders for WP3. This activity is preliminary to proper stakeholder engagement to be performed in WP3

### Work Package 2:

2.1 Transport fleet investigation: profile the fleets across the target transport sectors by performing both a thorough literature review as well as field research analysis. A non-exhaustive indicative list of sources that will be consulted for the literature review to include: reference documentation on fleets audits published by the UK government, reference documentation on fleets audits published by other institutions and market players, other publicly available sources, databases and reports and documentation related to the most relevant stakeholders in the transport sector.

2.2 Fuel need and maximum hydrogen demand estimate: estimate, for each transport sector, the energy need in form of fuel consumption. Taking as input analysis from WP1, formulate assumptions on future transport sector trends, to forecast fuel consumption volumes per transport sector until 2050. Estimate the maximum potential hydrogen and hydrogen derived fuels demand by converting the previously estimated fuel consumption volumes for the transport sectors. Using Chaucer proprietary models, a forecast of hydrogen demand with 10-years granularity until 2050 will be prepared.

2.3 Hydrogen demand penetration modelling: estimate the hydrogen and hydrogen derived fuelled transport modes tipping points. The task will be performed through proprietary TCO calculation models based on estimation of the relevant costs (CAPEX and OPEX) associated to each specific technological alternative during its lifetime.

2.4 Hydrogen demand outlook: Once the tipping points are identified, assess the maximum potential hydrogen demand by considering multiple factors, such as: age, compliance with emissions standards, etc.

2.5 Transport trends forecast: to identify the real future need for each specific transport mode according to current mobility trends (i.e. switch to different transport categories).

2.6 Alternative fuels and energy sources competitiveness: such analysis is key for assessing the techno-economic convenience of switching to hydrogen and its derived fuels -compared to alternative low-carbon fuels and energy sources.

2.7 Map hydrogen demand Following on the hydrogen demand forecast, map into geographical clusters of interest. This will be performed by identifying both small-scale demand pivots as well as key logistics hubs, around which these could gravitate.

We will then define a scoring methodology to shortlist key clusters of interest. Finally, for each cluster Chaucer will perform an investigation of localised production land size. For the areas where localised production would not be feasible or convenient, others supply opportunities -such as point-to-point infrastructure and inland transport-will be investigated.

2.8. Assess the potential requirements for storage: analysis combining production potential and demand satisfaction, thus reaching an initial estimate of storage requirements. Firstly estimate and develop seasonality modelling for the demand of each Transport mode within each identified demand cluster. Hypotheses aiming at estimated demand satisfaction will be set on production load factors for each mapping. In order to implement such methodology, a proprietary model for storage sizing will be used based on the superimposition of production and demand trends and hypotheses. Additionally, in order to assess national and seasonal storage potential, a thorough literature investigation on the latest available documentation on the subject (e.g. salt caverns) will be performed.

### Work Package 3:

In order to conduct the activities of WP3, filter:

- the shortlist of fundamental hydrogen and hydrogen derived fuels projects currently underway or recently completed within the UK's transport industry
- the data generated during WP2 regarding their mapping and potential impact on the local business context based on a scoring model for project and stakeholder prioritisation.

Develop a scoring model by combining several indicators generated from the database analysis and weighted in accordance with the relevance for GT&M scope. Once the scoring model is developed, it will be possible to leverage on the main categories identified to develop positioning matrices to better visualise the results. The development of such matrices will allow to map the initiatives and create cluster of interest the shortlist of the most relevant stakeholders to be engaged. As direct players consultation is crucial for closing existing information gaps and validate preliminary findings thanks to their privileged access to information implying deeper insights into the subject, engagement sessions will be facilitated through semi-standardised interview guidelines. GT&M. Interviews will mostly be carried out remotely via dedicated digital communication and collaboration platforms such as MS Teams, Skype, Zoom, WebEx, Google Meet..

### Work Package 4:

Recommendations for key areas of focus: Chaucer will critically review the body of knowledge generated in WP1 and WP2 to identify the key areas of interest for GT&M. Additionally, insights, feedback, concerns and expectations emerged from the WP3 interviews with Transport sectors representatives will be considered.

A scoring weight will be assigned to subcategories in order to define the scoring of each category. Finally, a weighted average will be computed considering the resulting vote and the relative weight for each category. Once the innovation categories to focus on are identified, they will be prioritised. The recommendations on innovation categories, projects and associated requirements for the NTS will be progressively defined and iterated in close collaboration with the GT&M team before being discussed in a workshop where final results from WP4 will be presented.

### 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 NGGT / NGET 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

In Scope:

- The transport modes of maritime shipping, civil aviation, heavy goods vehicles (HGVs) construction vehicles, passenger ferries, trams, buses and rail
- The infrastructure (e.g. maritime ports, airports, depots, key service areas) associated with each of the aforementioned transport sectors.
- Hydrogen and hydrogen derived fuels (including ammonia and synthetic aviation fuel (SAF))
- UK transport industries only
- Identification of opportunities for the NTS
- Recommendations for future projects for GT&M within each transport theme

Out of Scope:

- Personal passenger vehicles (e.g. cars, taxis)
- Biomethane, bio-CNG (compressed natural gas) and carbon capture storage solutions (CCSS)
- Transport systems outside of the UK, with the exception of the potential of imported hydrogen based fuels (such as ammonia)
- Opportunities for the Gas Distribution Networks

## Objective(s)

- Develop the understanding of the current interest in hydrogen and hydrogen derived fuels in the UK transport industry
- Identification of the key stakeholders within the transport industry with an interest in hydrogen and hydrogen derived fuels
- Develop greater understanding of the demand for hydrogen in individual transport sectors
- Develop greater understanding of the size of the hydrogen demand and the timescale that the individual sectors require
- Develop an understanding of what the NTS would need to do to meet the needs of the UK transport industry
- Development of a plan for targeting the most suitable GT hydrogen innovation projects in the transport theme
- Development of a transport sector stakeholder engagement map & plan

## 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

### WP1 – Overview of Key Projects Ongoing in Transport Sector

Requirements: Desktop study report

WP Acceptance Criteria: GT Approval of cited report chapter showing the results of the evidence gathered and its sources.

### WP2 – Modelling of hydrogen derived fuels in the transport sector

Requirements: Desktop study report

WP Acceptance Criteria: GT Approval of

- Report chapter into forecast of hydrogen demand by transport sector
- Report chapter mapping the geographical areas of interest in relation to the NTS
- Report chapter considering the effects of other hydrogen supply sources, import and export and storage

### WP3 – Stakeholder Engagement

Requirements: Desktop study report

WP Acceptance Criteria: GT Approval of

- Report chapter on key stakeholders within transport industry
- Documentation of engagements and key focus/continued discussion areas

### WP4 – Recommendations for future work

Requirements: Desktop study report

WP Acceptance Criteria: GT Approval of

- Report chapter on recommendations for key transport sectors of focus
- Report chapter on requirements placed on NTS to meet demand of transport industry
- Recommendations regarding future projects for GT&M supporting the transport sector

### WP5 – Standards & Reporting

Requirements: Desktop study report

- WP Acceptance Criteria: Final report is delivered from supplier.

- GT&M review and accept final report.
- ENA Project Closure form is also populated by supplier.
- Project is then registered as complete.

### **Project Partners and External Funding**

This project will be delivered by Chaucer BIP, with National Grid Gas as the lead network

No external funding

### **Potential for New Learning**

The learning from this project will increase understanding of the current landscape for hydrogen in the UK transport sectors and identify opportunities for the NTS in the future.

### **Scale of Project**

The scale of the project is mainland UK, which is considered appropriate as the NTS covers the whole area. A smaller scale would generate insufficient information regarding the opportunities for GT&M

### **Technology Readiness at Start**

TRL2 Invention and Research

### **Technology Readiness at End**

TRL3 Proof of Concept

### **Geographical Area**

The results of this project would be applicable across the UK

### **Revenue Allowed for the RIIO Settlement**

Not applicable to this project

### **Indicative Total NIA Project Expenditure**

£260,758.00

## 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 project will identify opportunities to strengthen the business case for conversion of the grid to hydrogen. The volume of hydrogen required to support the transport industry under net zero is significant, and they are expected to be an early adopter of hydrogen technologies, helping strengthen demand for a hydrogen NTS

#### 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)

RIIO-1 Question N/A

#### Please provide a calculation of the expected benefits the Solution

This is a research project so there is no calculation of the expected benefits

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

This is a research study and it is not possible to provide indicative implementation costs before this work has concluded

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

This is a research study and it is not possible to provide indicative implementation costs before this work has concluded.

### 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

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 analysis of current and forecasted hydrogen activity in the UK transport industry is relevant for all Network Licences, as is the analysis of the geographical demand, storage demands and timescales.

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

RIIO-1 Question 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.

No projects have yet been conducted to investigate the opportunity for the NTS for the wide range of transport sectors considered here, nor has cross-collaboration across multiple transport sectors been considered in terms of hydrogen demand on the NTS

### 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

To date, the NTS has never directly supplied the UK transport industry. But with the conversion of the grid to hydrogen and the increasing interest of hydrogen as fuel in multiple transport sectors within the UK, increasingly close ties between the two seem likely. However, the transport industry is not well understood by the gas industry, so developing the understanding and relationships between the two parties is innovative

### Relevant Foreground IPR

This project and the resultant outcomes/deliverables will conform to the default treatment of IPR as set out under the agreed NIA Governance (where the default requirements address two types of IPR: Background IPR and Foreground IPR).

The foreground IP created in this project are identifying the role the NTS could play in Net Zero Transport in the UK



## Data Access Details

Data for this project, and all other projects funded under the Network Innovation Allowance (NIA) funding scheme, can be found or requested in a number of ways:

A request for information (RFI) via the Smarter Networks Portal at <https://smarter.energynetworks.org>. National Grid Gas Transmission regularly publishes much of the data arising from our innovation projects on the ENA portal, before submitting a RFI check this website.

Via our managed mailbox [box.GT.Innovation@nationalgrid.com](mailto:box.GT.Innovation@nationalgrid.com). Further data can be shared upon request through the innovation mailbox. Each request will be assessed by the GT Innovation Team for its merits and viability.

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

The opportunity with the transport industry is not applicable to a natural gas network

## 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

There is a risk that if the conversion of the NTS to hydrogen is not accepted, then this work is no longer valid. The technical, operational, and regulatory risks around hydrogen are elements being explored across the Hydrogen Grid R&D programme.

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

Yes