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

Jun 2022

Project Reference Number

NIA2_SGN0021

Project Registration

Project Title

Hydrogen Navigator

Project Reference Number

NIA2_SGN0021

Project Licensee(s)

SGN

Project Start

July 2022

Project Duration

0 years and 3 months

Nominated Project Contact(s)

Kirstin Gardner

Project Budget

£350,000.00

Summary

This project will utilise McKinsey's powerful hydrogen and natural gas balancing and optimisation tool, Navigator™, to analyse hydrogen demand, supply, storage and import developments across SGN's networks in Scotland and the South-East of England. This project will detail and assess indigenous and international hydrogen supply options and projects under development and quantify the supply required in time to ensure the Energy System Transition of the gas networks to 100% hydrogen can be delivered in an affordable, practical and energy secure way. This project is critical in the system transformation planning of the conversion of SGN's networks.

Third Party Collaborators

Mckinsey and Company

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

The Energy System Transition of the gas networks from natural gas to 100% hydrogen is the only credible pathway to establish a net zero energy supply through the UK's extensive gas network infrastructure, thereby establishing, as part of the whole energy system, the availability of hydrogen as an energy vector and option to customers and policy makers for the decarbonisation of heating, industry, transport, and electricity generation. The UK Government Heat Policy decision, anticipated in 2026, will map the UK's approach for the decarbonisation of heat, and will therefore have major implications for the gas industry and the future role of the gas networks in energy delivery.

The conversion of the gas networks to hydrogen will require the bottom-up conversion of the end-to-end gas network system, from final demand (appliances) and up the pressure tiers to transmission assets and production and storage. As the majority of gas network

connections are for heating demands, a Heat Policy decision supporting the use of 100% hydrogen as an option for domestic, commercial and industrial heating is critical in unlocking the Energy System Transition to hydrogen and the resultant hydrogen economy. The decarbonisation of heat through the conversion to hydrogen has the potential to provide a low disruption, low cost, fair and practical pathway to customers and stakeholders. The establishment of hydrogen as an energy vector in the whole energy system will also be crucial in daily and intraseasonal energy storage in a net zero world, as a direct replacement for the natural gas storage the UK has become so reliant on.

The transition to hydrogen and establishing hydrogen as a vector is of critical importance in the overall transition to net zero, and it is therefore critical, for customers, to the energy sector and for the gas networks, the strongest possible evidence is put forward to policy makers feeding into the 2026 Heat Policy decision. SGN have so far made strong progress with the UK and Scottish Governments through the development of a net-zero compliant pathway to decarbonisation and compliant pathway to decarbonisation and national hydrogen evidentiary programme that has secured a 'committed path' in policy to evidence a hydrogen system transformation. This is enshrined in a number of key policy publications including inter alia; Ten-point plan (UK); Hydrogen Strategy, Heat and Buildings Strategy, (both UK and Scottish Gov); Hydrogen Action plan (Scottish Gov). These policies have unlocked funding both regulated and unregulated that can de-risk the evidentiary requirements. To maintain the 'committed path' in policy and unlock a hydrogen system transformation, SGN need to deliver the evidence as set out collaboratively with both Governments and industry. Part of the evidence required is to demonstrate how the system transformation could be achieved, what sources could be available and how the gas networks can safely, economically and practically accommodate. This project has the potential to address knowledge gaps in this area.

A number of key projects are being undertaken, in parallel to critical R&D workstreams, to plan the system transformation, considering the complex design and needs of the gas network infrastructure and the customers reliant on the energy supply they deliver and the supply requirements for net zero energy. This includes where on the network hydrogen would ideally be injected and how much would be required to ensure security of supply obligations are met. Almost all of these projects are underway or are being planned in close collaboration with prospective producers, who require the technical and commercial progression through TRL and CRI milestones of the required gas network infrastructure adaptations, blending infrastructure, and 100% conversion planning, in line with the technical and commercial progression of the proposed developments. These projects include the Aberdeen Vision Pre-FEED, the Fife Pre-FEED, the Edinburgh Pre-FEED, the Southampton Water Pre-FEED and Project Cavendish. Current and future projects, once physically delivering energy, will impact on each other and the gas networks and its connected customers, and this interface must be fully understood by the network operators.

This project has the potential to address knowledge gaps in holistically linking and rationalising cluster and other hydrogen production developments together as part of the energy system transition of SGN's networks in a secure and practical manner, as well as highlighting any shortfalls in production and storage development at an early stage in the overall system development. This project has the potential to be particularly important in assessing supply and demand developments in SGN's Southern Networks, an area increasingly reliant on energy imports, to ensure future security of supply obligations can be met, possibly supplemented by hydrogen imports from the emerging international hydrogen market or from elsewhere in the UK, such as green hydrogen from the North of Scotland.

Method(s)

Using McKinsey's hydrogen and natural gas balancing and optimisation tool, this project seeks to deliver holistic mapping of different supply and demand opportunities, including but not limited to, the UK's own indigenous potential, rather taking a pan European and international view recognising the likely competition for hydrogen sources. This project proposes to begin to fill this knowledge gap and ensure future developments and projects are optimised in terms of scale and location in line with the needs of the networks and connected customers.

At a high level, this project proposes to:

- Analyse hydrogen supply developments to determine there is sufficient supply to future network demands in Scotland the South-East of England (at a competitive price).
- Evaluate alternatives for the optimal way to transport and export hydrogen and the relevance/role of the NTS.
- Review the implications of the recently published "Hydrogen Strategy" and other key policy initiatives and consult with key stakeholders to understand how the hydrogen economy is evolving in practise.
- Provide evidence of international and indigenous hydrogen resources available to give confidence to key stakeholders.

This piece of work is strategically important for strategic net zero planning and is likely to impact on SGN's suite of energy system transition project.

Scope

This proposal is a desktop exercise utilising McKinsey's powerful hydrogen and natural gas balancing and optimisation tool (Navigator™) and will deliver the following outputs:

Work-Package 1: Demand

- High level validation of Hydrogen demand for sectors such as residential, industrial and transport based on publicly available sources.
- Residential and commercial electrification of heat and uptake of hydrogen. Sensitivities on substitution of natural gas with hydrogen assuming government directive from 2026 onwards.
- Sensitivity analysis of global industry remaining within the UK or shifting, and potential increase in industry due to hydrogen availability including illustration of key factors

Work-Package 2: Supply and Technology

- Scale of opportunity for Green and Blue Hydrogen, target price and locations. Particular focus on evaluating whether there is adequate supply potential and whether the demand can be met through indigenous sources vs import, with resilience sensitivity analysis for geopolitics and market factors.
- Green and blue hydrogen supply and costs: Cost of Electrolyser; Cost of CCS; Carbon Dioxide price; suitability of pipelines for transportation versus other modes; potential demand and supply centres and projection of infrastructure needed.
- Optioneering on UK landing locations/key sources particularly in South East/Scotland.
- Flows and utilisation levels of existing pipelines and potential for blending and retrofit for Hydrogen. Repurposing sensitivity of NTS including potential for offshore pipeline and implications of no NTS availability scenario.
- Storage requirements.
- CAPEX required to retrofit infrastructure and incremental OPEX to manage infrastructures with blended gases.
- Characterisation of sources of hydrogen from indigenous to import, including green, blue, turquoise, nuclear, biohydrogen etc.
- Implications of technology scale up (e.g., renewable generation and storage, CCS, heat pumps, batteries) and changes to share in energy production and transmission.
- Projection of import/ export flows including shipping and piping costs. Identification of critical current and future assets in the upstream supply chain, include EU (particularly Italy) and North Africa for pipelines and high output, low-cost international supply opportunities.

Work Package 3: Policy, Implementation, Regulation and Financing

- Incorporate key information and learnings from SGN (e.g., Southampton, London and IoG).
- Align forecasted view with external stakeholders and sources.
- Prepare document for discussion with 3 5 key stakeholders to make the case for a hydrogen system transformation from 2026.
- Timeline to availability and characterisation of dependencies such as major port upgrades, new pipelines etc.
- High level assessment of investment opportunities in hydrogen infrastructure in the UK.

Key Deliverables and Outcomes

- Provide materials and analyses to SGN for stakeholder presentations and management (e.g. UK and Scottish Governments) to effect hydrogen enabled system transformation,
- Identify investment opportunities that emerge on H2 transport as a consequence.
- Deliver a presentation in SGN's template with a clear and compelling narrative of the case for investing in hydrogen

Objective(s)

At a high level, this project has the following objectives:

- Provide materials and analyses aligned with the detailed scope to SGN for stakeholder presentations and management (e.g. UK and Scottish Governments) to effect hydrogen enabled system transformation and strategic planning.
- Identify investment opportunities that emerge on H2 transport as a consequence.
- Deliver a presentation in SGN's template with a clear and compelling narrative of the case for investing in hydrogen

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not Applicable

Success Criteria

Success Criteria for this project will be as follows:

- Clear evidence of the completed work under each task as outlined in the proposal.
- Fully reviewed and accepted summary report at the conclusion of the project.
- Clearly justified modelling outcomes and recommendations for next steps.

Project Partners and External Funding

Project partners for the study will be McKinsey and Company

Potential for New Learning

This project has significant potential for new learning. The application of McKinsey's Navigator Tool to assess hydrogen supply and demand across SGN's networks will enable detailed modelling of pan-European and International natural gas and hydrogen flows and developments.

The detailed scope outlines the expected outputs of the project, the majority of which are likely to provide learnings for SGN informing System Transformation strategy and projects such as the Southampton Pre-FEED, Aberdeen Vision, the Fife Pre-FEED and the Central Belt Pre-Feed.

Final reporting materials will be produced as an output of this project, which will be the main avenue for dissemination

Scale of Project

The project will be primarily desktop based

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

The geographical area for the project will SGN's networks areas, with some outputs potentially applicable across GB.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£420,000

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 will provide critical outputs informing specific pre-FEED work relating to the energy system transition (such as Aberdeen Vision, Southampton, Fife and Edinburgh/Central Belt) and the overall whole system design required to facilitate the energy system transition. Ensuring sufficient hydrogen production, storage and imports will be available to deliver the EST is essential in delivering the transition in line with Government Targets and providing confidence in the pathway to decarbonisation of the gas networks.

How the Project has potential to benefit consumer in vulnerable situations:

NA

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)

NA

Please provide a calculation of the expected benefits the Solution

NA

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

This project will provide a strong case study of McKinsey's Navigator tool applied to the UK. The model is likely applicable to the rest of the UK, with some outputs from this project potentially applicable to UK, such as insights into the global hydrogen market and price projections.

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

Further use of the model would be subject to a quote from McKinsey to utilise the Navigator Tool.

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

New learning, specifically insights, data and projections on the development of hydrogen production and the availability of imports/exports indigenously, pan-Europeanly and Globally, as well as hydrogen and CCS price projections and the review of optimal hydrogen transmission strategy could be particularly useful for network licensees, as these aspects are not specific to SGN's network areas.

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

NA

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.

This model has not previously been used on the GDNs and is therefore not duplicating work

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

NA

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

This project is Innovative because it seeks to address key knowledge gaps pertaining to the energy system transition planning using powerful modelling software. This is novel in its indigenous and global assessment of hydrogen production, storage, and import/export in relation to optimising planning for the energy system transition of the gas networks in Scotland and the South-East. This project will be critical in holistically mapping and analysing the overall end-to-end proposed 100% hydrogen system, the ultimate end goal NIA funding is strategically supporting in RIIO-GD2.

Relevant Foreground IPR

Modelling outputs will be shareable and disseminated, with background IP not required to use outputs.

Data Access Details

The publication of final reporting and material will be the primary method of dissemination of modelling/project outputs.

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

This project is directly linked to SGN's energy system transition planning to enable the safe and practical transition to a net zero gas network and is therefore not part of the business as 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. There are risks associated with development of the outputs from this project if hydrogen is not accepted as a means to heat homes in 2050. The technical, operational and regulatory risks around hydrogen are elements currently being explore across the networks providing mitigation to this potential risk. This project is suitable for NIA funding due to its first of a kind application to the gas distribution networks and relevance and strategic importance to energy system transition planning.

This project has been approved by a senior member of staff

☑ Yes