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

Sep 2021

Project Reference Number

NIA2_SGN0003

Project Registration

Project Title

H100 'town' Expansion-Storage Solution: Balgonie Feasibility Study

Project Reference Number

NIA2_SGN0003

Project Licensee(s)

SGN

Project Start

September 2021

Project Duration

0 years and 11 months

Nominated Project Contact(s)

Stephen Tomlinson

Project Budget

£333,333.00

Summary

A fundamental obligation of H100 Fife development for transition to 100% hydrogen is to ensure consumers have security of supply. Therefore, it is imperative for us to identify strategic, long-term storage sites to provide assurance to regulators and consumers that a hydrogen network is compatible with our obligations. Large scale subsurface storage is one of a number of important ingredients in the larger deployment of hydrogen to support conversion of the gas network in Fife and the East Coast of Scotland.

This project will provide invaluable insight into the roadmap for development of subsurface large-scale hydrogen storage in the Balgonie field that will support the development of hydrogen in the Fife region. The project will provide a critical demonstrator methodology for the storage of hydrogen, with the ability to scale the Balgonie anticline hydrogen storage site to other regions of the UK Continental Shelf (UKCS).

Nominated Contact Email Address(es)

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Problem Being Solved

The UK has committed to a target of Net Zero emissions by 2050, with Scotland committing to 2045. To achieve these ambitious decarbonisation targets, the energy system must evolve from current fossil fuel dependency to low carbon alternatives. Hydrogen has been recognised as an essential component of Net Zero Britain. There is an urgent need to evidence the role that hydrogen can play across all sectors, especially its role in decarbonising domestic heat. Our H100 Fife Project, demonstrating a 100% green hydrogen network in Levenmouth Fife has achieved funding for Phase 1, the development of a 300-home hydrogen neighbourhood. Phase 2 of the project (the 'village' under the ten-point plan) will offer opportunities to expand H100 Fife to 1,000 properties. Future phases involve developing options for fully converted hydrogen town.

A fundamental obligation of H100 Fife development for transition to 100% hydrogen is to ensure consumers have security of supply. Therefore, it is imperative for us to identify strategic, long-term storage sites to provide assurance to regulators and consumers that a

hydrogen network is compatible with our obligations. Large scale subsurface storage is one of a number of important ingredients in the larger deployment of hydrogen to support conversion of the gas network in Fife and the East Coast of Scotland.

Method(s)

The project will follow a four-phase approach as follows:

Phase 1

Phase 1 will cover geological investigation of the Balgonie anticline site. Existing borehole data will be gathered to understand the characteristics of target sandstones and seals both in terms of their porosity and sealing capacity. In tandem, a 3D model of the site will be developed to calculate the potential storage volume and injectivity to the site. Shallow borehole analysis and non-intrusive seismic analysis have also been proposed for initial site investigations.

Phase 2

Phase 2 of the project will look to identify licencing requirements for the site and determine the pathway to planning permission with Fife council. A licencing model for site operation will be developed for hydrogen storage based from natural gas experience. Detailed seismic analysis programmes will be developed for future phases of the project, in addition to the design and cost estimation of a drilling programme to fill current gaps in understanding.

Phase 3

Phase 3 of the project will develop a risk register for the technical, regulatory, commercial and stakeholder risks and mitigations for the project.

Phase 4

Phase 4 will include the delivery of project outputs in a final report format, outlining all findings and recommendations for further development. A roadmap for development of the site including steps and decision gates will also be provided in addition to stakeholder engagement for policy makers to outline the potential for hydrogen storage at the Balgonie site and the scalability to other regions in the UK and network operators.

Scope

The project proposal is outlined below:

- **Work Package 1-Geological Site Investigation**
  - Gather geological data (e.g. borehole records).
  - Geological description of target sandstones and seals (porosity and sealing capacity).
  - Geotechnical sample analysis to evaluate potential hydrogen loss (if can be sourced).
  - 3D model of working storage volume and injectivity.
  - Shallow borehole investigation for overburden rock analysis
- **Work Package 2-Site Development Investigation**
  - Identify licencing requirements for site investigations using seismic surveys and drilling.
  - Determine pathway to planning permissions with Fife Council.
  - Propose licencing model for site operation as a hydrogen storage site based on Natural Gas experience.
  - Identify licencing requirements for site development, operation, decommissioning and abandonment.
  - Design a seismic survey-along roads, vibroseis contractor-timescales and costs will be identified
  - Identify actor to designs survey, supervises and manages the practicality and delivery of the survey.
  - Design and cost a drilling program to fill in the gaps in current understanding.
- **Work Package 3-Risk Management**
  - Develop a Risk Register of Technical risks and mitigations.
  - Develop a Risk Register of Regulatory risks and mitigations.
  - Develop a Risk Register of Stakeholders risks and mitigations.
  - Develop a Risk Register of Commercial risks and mitigations.
- **Work Package 4-Project Delivery**
  - Final report presenting results from all tasks, with recommendations.

- Roadmap to demonstration indicating steps and decision gates.
- Peer-reviewed publication on the use of the Balgonie anticline as a hydrogen storage site.
- A summary for policy-makers document to highlight the key recommendations and findings.

Objective(s)

Project objectives include an initial feasibility study of the Balgonie anticline site to assess its viability for hydrogen storage and understanding design and costs for the site to become operational. This project is an important component of the business case for future phases of our H100 Fife project, the national hydrogen conversion programme, and aligns with the UK Governments ambitions for a hydrogen town. Project outputs will also be invaluable to other gas network operators, with the ability to scale the Balgonie anticline hydrogen storage site to other regions of the UK Continental Shelf (UKCS).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

Success Criteria

Success criteria for the project will be as follows:

- Delivery of the final project report outlining results from all tasks with recommendations to potential future phases of the project
- Roadmap to demonstration indicating the steps and decision gates
- Peer-reviewed publication on the use of the Balgonie anticline site as a geological hydrogen storage site
- A summary for policy makers document to highlight the key recommendations and findings

Project Partners and External Funding

Project partners for the study will be Edinburgh University.

Potential for New Learning

With plans for the system transformation of the network to 100% hydrogen from existing natural gas dependency, initial studies have illustrated the importance of hydrogen storage sites to ensure we continue to fulfil our obligations as gas network operators for security of supply in a hydrogen end state. We are aware of the potential capacity offered through methods such as geological storage, however the route to demonstration and operation of these sites is still uncertain. The project will provide invaluable insight into the roadmap for development of subsurface large-scale hydrogen storage in the Balgonie field that will support the development of hydrogen in the Fife region. The project will provide a critical demonstrator methodology for the storage of hydrogen, with the ability to scale the Balgonie anticline hydrogen storage site to other regions of the UK Continental Shelf (UKCS).

Scale of Project

The project will be a combination of desktop study, on site investigation and stakeholder engagement to develop a robust roadmap for development.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The geographical area for the project will be the Balgonie anticline site located less than 5km from the H100 Fife development in Scotland.

Revenue Allowed for the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

£333,333

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 carry out initial feasibility works to understand the viability of the Balgonie anticline field located in Fife for the subsurface storage of hydrogen. A fundamental obligation of network operators is to ensure security of supply for our consumers. It is critical for us to evidence and develop solutions for large scale, long term hydrogen storage, enabling us to capture the maximum economic recovery of energy with an increasing capacity of intermittent renewable power supply. Identifying a design and development programme for the Balgonie anticline site will prove invaluable for the scale up of H100 Fife, a critical project in supporting our national hydrogen programme and stimulation of the hydrogen market. Project findings will also be invaluable to other gas network operators to develop plans for subsurface hydrogen storage ensuring a resilient and cost-effective hydrogen network end state.

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

Not applicable

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)

Not applicable

Please provide a calculation of the expected benefits the Solution

Conversion of the gas network to hydrogen has shown to be considerably less costly than conversion to alternative energy sources. The development of hydrogen storage ensures that we capture the maximum economic recovery of energy. In the context of offshore wind, this means we require fewer turbines generating all of the time with availability of hydrogen storage in comparison to considerably more turbines generating intermittently and curtailed in periods of low demand for an electrification pathway. The development of storage solutions such as the Balgonie Feasibility Study are low regrets investments ensuring low cost, resilient energy for customers on the network.

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

The Balgonie Feasibility Study will act as a critical demonstrator for the storage of hydrogen in the subsurface, identifying the methodology required for development of the site. Recent academic publications by Edinburgh University have illustrated that the UK has potential for hydrogen storage that is between 3 to 7 times the capacity of UK annual consumption through development of subsurface depleted gas fields (Mouli-Castillo et al., 2021). Project learnings will be invaluable to other gas network operators with the ability to use the blueprint for development of the Balgonie site to develop storage sites in other regions of the UKCS.

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 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 Balgonie Feasibility Study will provide critical learnings for the development of hydrogen storage solutions. The project can act as a critical demonstrator for subsurface hydrogen storage, with outputs that can be scaled to other regions in the UKCS that network operators can develop to support end state hydrogen plans.

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

Not applicable

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.

The project scope has been reviewed against all existing projects and no areas of duplication have been identified.

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

Not applicable

Additional Governance And Document Upload

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

Hydrogen is being considered as a viable alternative to natural gas however there are still technical aspects to be investigated. A critical component of the transition to 100% hydrogen is to evidence viable storage solutions to ensure security of supply. Subsurface

storage in porous media can offer large scale and long-term storage of hydrogen to ensure that we fulfil obligations for energy security. There are still knowledge gaps in the viability of the Balgonie site and a development programme for operation of the site. This project will provide critical insight into demonstration of a hydrogen storage site to support development in the H100 Fife region for 100% hydrogen supply.

Relevant Foreground IPR

Not applicable

Data Access Details

Any consumer data gathered throughout this project will be anonymised and will be compliant with General Data Protection Regulations (GDPR) and the UK Data Protection Act. Any compliant data can be made available for review upon request.

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

The project aims to assess the viability of the Balgonie Anticline site for the subsurface storage of hydrogen. This work forms a key part of SGN's pathway to decarbonisation to Net Zero ensuring security of supply for our customers with transition from natural gas to 100% hydrogen. The project also has wider benefits of acting as a critical demonstrator for subsurface hydrogen with outputs scalable to other regions in the UK further stimulating and support the hydrogen economy. As such, the project is not part of the 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. The development and assessment of subsurface hydrogen storage Balgonie site involves potentially significant risks. The project will address the viability of the site, identify risks and provide necessary mitigations.

This project has been approved by a senior member of staff

☑ Yes