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_SGN0002

Project Registration

Project Title

Energy Storage Strategy

Project Reference Number

NIA2_SGN0002

Project Licensee(s)

SGN

Project Start

August 2021

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Colin Thomson

Project Budget

£119,997.00

Summary

The project aims to produce an energy storage strategy for the UK based on the system transformation from a technical and engineering perspective, that is, based on practical and realsitic options rather than scenarios. The project will also define what a market stimulus for energy storage could look like for both on shore and off shore storage options. A three phased approach will cover the current storage market and rationale behind it, storage challenges for energy transition and next steps for energy storage policy for a net zero emission future.

Nominated Contact Email Address(es)

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Problem Being Solved

With the impacts of climate change becoming increasingly clear, it is vital that we respond by reshaping our energy system. We must evolve from a network dominated by fossil fuels to one with alternative low carbon sources in order to meet binding decarbonisation targets of Net Zero. The gas networks have set out a portfolio of work to deliver evidence for the transformation of the network in the form of a pathway to decarbonisation. This concerns gathering evidence illustrating the GB gas network and associated infrastructure can distribute hydrogen to supply future demand.

Energy storage is a fundamental requirement in the transition to low carbon energy, providing system resilience and ensuring security of supply for our customers. Energy storage currently is almost exclusively provided by fossil fuels. In recent years, as a direct result of a reduced oil and gas production from the UKCS, the UK has become increasingly dependent on gas imports through gas interconnectors and LNG shipment to ensure supply security in peak demand periods in winter. Therefore, long term and strategic storage sites are now limited to a few subsurface storage locations, while short term storage methods such as line pack of the NTS and LTS have all but replaced high pressure storage. For the transition of the network to 100% hydrogen, new storage technologies must replace existing methods to ensure security of supply in order for the gas network to meet its 1:20 and 1:50 demand obligations.

For the case of renewable energy from wind and solar sources, this is only available when the energy of nature is present to harvest it, and the electricity generated must be consumed via demand, otherwise it is wasted. The risk of a transition to solely renewable generation would be a period of low renewable supply occurring during a period of high demand and vice-versa. Without the ability to store energy to balance the significant variation in demand this will lead to reliability and security of supply instabilities within the UK energy systems.

In any case, for Net Zero decarbonisation through transition to 100% hydrogen or electrification of heat and transport, storage is a critical factor that must be implemented.

Method(s)

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

- Phase 1 will build upon will build on SGN's Energy Storage Challenge report and establish the current position and effectiveness on security of supply and storage and how that has evolved over time from state-run monopolies to private companies operating in a range of regulated and unregulated markets.
- Phase 2 will look at storage and security of supply options for the energy transition and beyond. This will necessarily include a "whole systems" approach and assess technical suitability, flexibility, readiness and knowledge gaps.
- Phase 3 will look forward and identify a policy framework including assumptions, infrastructure requirements and business models to support energy storage and security in the short, medium and long term

Scope

The project proposal is outlined below:

- **Phase 1-Establish the Current Position on Storage**
  - Develop upon key conclusions identified from the SGN Energy Storage Report to establish areas of project focus.
  - Explore the history of UK energy storage policy:
    - Identify origin of 1:20/1:50 peak demands and what risks were assessed
    - Describe how UK energy resilience through storage policy has changed
    - Assess market performance with the UK's gradual decrease in strategic energy stores
    - Identify how exposed the UK is to changes of ownership in gas storage assets
  - Explore current shutdown hierarchy in the BEIS Network Emergency Plan: Downstream Gas and Electricity (NEP) for a national supply emergency focusing on the role of energy storage.
  - Conduct a stakeholder exercise with energy storage operators (electricity and gas) and the wider industry to understand their current and future concerns.
  - Compare UK storage options with the Europe and Worldwide to supplement findings from the SGN report
  - Set out and explain the correct use of parameters needed to make meaningful comparisons between different energy systems (heat pump systems vs hydrogen).
- **Phase 2-Storage and the Energy transition**
  - Identify the viable options for the energy transition and the implications for storage
  - Assess security of supply for gas and electricity and the impact on energy storage
  - Utilise output of the Real-Time Networks (NIC) project to investigate the demand profiles and implications of electrification of domestic heat
  - Review likely options for repurposing on-shore and off-shore natural gas infrastructure for hydrogen transport and storage
  - Determine the impact of green hydrogen on gas storage and the relationship with renewable power generation and demand. Options include:
    - Off-shore hydrogen with subsea pipelines to existing or new beach terminals
    - New subsea power cables with hydrogen production on shore
    - Transfer of hydrogen to onshore or offshore storage
  - Assess the role of nuclear energy in hydrogen production and energy storage
  - Investigate the roles of other hydrogen transport and storage forms including:
    - Ammonia
    - LOHC
    - Liquid Hydrogen
  - Assess the role of hydrogen for electricity storage in a power-gas-power configuration
  - Investigate the future role of energy imports to the UK
  - Determine options for biomethane storage
- **Phase 3 - Next steps**

- Assess the roles of identified storage options from phases 1 and 2 and categorise them in terms of:
  - Technical suitability
  - Readiness (Evidence gaps)
  - Potential
- Identify what the energy storage industry needs from UK Government Departments such as BEIS or regulators such as HSE and Ofgem in the short, medium and long term.

Objective(s)

The objectives of the project are to categorize storage in terms of what is technical suitable and ready to roll out to support transition to low carbon energy. The project will also aim to illustrate what the energy storage industry requires from UK Government departments such as BEIS or regulators such as the HSE and Ofgem in the short, medium and long term to develop storage for the UK at scale.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not applicable

Success Criteria

Key success criteria of the project include:

- Final report at the end of the project detailing all of the findings, conclusions and recommendations around an energy storage strategy to support decarbonisation
- Two interim reports in presentation format at the end phases 1 and 2 to engage with SGN and Cadent and gain feedback on progress and direction

Project Partners and External Funding

DNV, Cadent and External Funding-Network Innovation Allowance (NIA)

Potential for New Learning

While the purpose of the UK gas networks is to provide research and development to support the hydrogen transformation programme, hydrogen is a versatile energy carrier that can be potentially service and support multiple energy vectors. In any case, for the future pathway to decarbonisation for the UK, energy storage provides the maximum recovery of energy. The project will provide key learning on storage technologies and methods that are technically feasible and ready to deploy to support decarbonisation of the UK energy system. Findings will provide regulatory and legislative recommendations to BEIS, HSE and Ofgem on the requirements to facilitate development in the storage industry.

Scale of Project

The project will be a combination of desktop study and stakeholder engagement with existing storage operators

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

The project will be assessing existing storage methods and sites within the UK. The project will then assess technically feasible and suitable technology and methods for storage and compare how storage capacity differs between ranging decarbonisation scenarios such as electrification of heat vs 100% hydrogen.

Revenue Allowed for the RIIO Settlement

Not applicable

Indicative Total NIA Project Expenditure

£119,997

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 development of an energy storage strategy will provide the opportunity to support key decarbonisation projects including Aberdeen Vision, Southampton Water, North East Industrial Clusters, HyNet etc. Although all projects currently seek to stimulate hydrogen production by accommodating up to 20% hydrogen blends, a future conversion of the network to 100% hydrogen will require strategic, large scale storage to compensate for a lack of existing natural gas storage methods. Identifying viable storage technologies and requirements for energy security guarantees a resilient transition to low carbon hydrogen.

While the purpose of the UK gas networks is to provide research and development to support the hydrogen transformation programme, hydrogen is a versatile energy carrier that can be potentially service and support multiple energy vectors. In any case, for the future pathway to decarbonisation for the UK, energy storage provides the maximum recovery of energy and will be essential in facilitating the energy system transition.

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

Not applicable

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

Initial analysis of large-scale storage has identified a number of key geological units that could support hydrogen storage that include salt caverns, depleted oil and gas reservoirs and saline aquifers. The UK is rich in geological units that have the potential to be utilized for hydrogen storage both on shore and offshore and so development of sites can be applied to any region in the UK that displays the correct geological characteristics to support subsurface storage of hydrogen.

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

Key learning from the project will identify a policy framework to support energy storage and security in the short medium and long term in addition to technically suitable and ready to roll out technology to support energy transition. The use of hydrogen storage within the UK would be highly advantageous for the supply and delivery of low cost, reliable low carbon energy even in periods of extreme network stress (1:20/1:50 scenarios).

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

Storage will be key aspect of future network operation. All findings will be disseminated to Network Licensees as part of Network Innovation Allowance (NIA) requirements. The project will provide critical insight on an energy storage strategy, illustrating available and technically feasible technologies to roll out to support transition of the network. The project will also provide key insight into the capacity of storage required for ranging decarbonisation scenarios. The project will provide a key messaging piece for Network Licensees on storage requirements for 100% hydrogen transition compared to electrification of the network and can be used to implement change in current regulation around the storage of hydrogen.

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 scope has been reviewed against all existing projects and no areas of duplications 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

The project aims to close current gaps around technically suitable technology for hydrogen storage, the capacity of storage required for ranging decarbonisation scenarios either through electrification of heat or hydrogen and to provide a policy framework to support energy storage in short, medium and long term.

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 identify the technical suitability of storage technologies and develop a policy framework to support role out of an energy storage strategy in the short, medium and long term. This research forms part of SGN's and Cadent's pathway to decarbonisation to Net Zero through transition to hydrogen from existing natural gas. As such, it 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 storage of hydrogen at scale involves potentially significant technical risks. The project will address the question of which technologies are technically suitable for deployment, how storage is impacted on the choice of decarbonisation pathway and what is required to change to support development in the storage industry.

This project has been approved by a senior member of staff

☑ Yes