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NIA Project Registration and PEA Document

Date of Submission

Jun 2022

Project Reference Number

NIA2_SGN0020

Project Registration

Project Title

Leakage Management in the Energy System Transition

Project Reference Number

NIA2_SGN0020

Project Licensee(s)

SGN

Project Start

June 2022

Project Duration

0 years and 9 months

Nominated Project Contact(s)

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Project Budget

£99,317.00

Summary

The LRMM captures all the potential areas for leakage and shrinkage of natural gas from the network. This project proposes to undertake a sensitivity analysis of the LRMM, review leakage rates of above ground installations (AGIs), review SGN's cathodic protection (CP) records, review the CISBOT programme and its impact and assess assumptions around asset records of cast iron and spun iron. These elements will be factored into a CBA to determine the most cost-effective next steps, maximising the reduction of leakage and therefore emissions, for both natural gas in the existing network, and for hydrogen in the future network.

Finally, the project proposes to assess the application of the LRMM to the energy system transition and the future hydrogen gas network.

This opportunity will assess the best options for maintaining the network for future use and potentially lead to a reduction in methane and future hydrogen leakage, providing financial and environmental benefits.

Third Party Collaborators

DNV

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

Shrinkage from the networks represents 98% of SGN's greenhouse gas emissions in 2020, with leakage of natural gas from the networks representing 93% of total shrinkage. Reducing leakage is therefore the most powerful tool in reducing SGN's business carbon footprint. Reducing methane emissions, which carry a global warming potential (GWP) of 25 over a 100-year timescale, is critical in the overall journey to net zero, across GB and Globally, with agreement reached at COP26 to reduce global methane

emissions by 30% by 2030 by over 100 countries. Exploration, production and transportation of natural gas represented 1% of all GHG emissions from the UK economy in 2020, emitting 3.7 Mt CO₂e, of which leakage from SGN's networks accounted for 0.671 Mt CO₂e (18% of sub-sector emissions), as reported by the business.

The Leakage Reduction Management Model (LRMM) captures all the potential areas in the network where leakage of natural gas could occur and shrinkage in the network could occur, applying factors of leakage to different asset types to estimate the total leakage of the networks. In recent years, investment into the network, primarily through the iron mains replacement programme, has occurred to help to improve some of these areas where leakage or shrinkage may occur. Where these improvements have been made, they should be captured in the LRMM to better understand how they affect the potential leakage and shrinkage and therefore understand the carbon emissions savings that have been made.

An update to the LRMM will also allow SGN and the other GDNs to better understand where further improvements may be made and ensure the estimation of leakage is accurate accounting for network improvements, providing potentially significant environmental and financial benefits. A further requirement in the analysis of leakage from the networks is the consideration and facilitation of the energy system transition to a 20% hydrogen blend and ultimately 100% hydrogen; hydrogen has the potential to leak at an increased rate than methane and must be accurately monitored and reduced in same way as natural gas, for financial and environmental reasons (as hydrogen is an indirect greenhouse gas).

Method(s)

The ultimate objective of this project is to assess and review the Leakage Reduction Management Model (LRMM) to understand where improvements can be made, how and where the model can be updated and its role in the energy system transition. This project has the potential to provide significant environmental and financial benefits to SGN, and provide savings to customers through reduced leakage, and therefore reduced cost of leakage.

The project proposes to undertake a sensitivity analysis of the LRMM, review natural gas leakage rates of above ground installations (AGIs), review SGN's cathodic protection (CP) records, review the CISBOT programme and its impact and assess assumptions around asset records of cast iron and spun iron. These elements will be factored into a CBA to determine the most cost-effective next steps, maximising the reduction of leakage and therefore emissions. Finally, the project proposes to assess the application of the LRMM to the energy system transition and the future hydrogen gas network.

Scope

Work Package 1 – Overview of the LRMM

The current version of the LRMM will be subject to a sensitivity analysis to understand which factors most affect the outputs. Following this analysis, the top three factors (in addition to those identified separately below) will be reviewed in more detail to understand accuracies and whether amendments to the model in these areas may be justified and viable. The factors under consideration include, but are not limited to, the proportions of different types of services (PE-PE, PE metal etc.), the MEG concentration calculation, the proportion of lead yarn joints, and the changing profile of ferrous main failures.

A cost benefit analysis (CBA) will then be undertaken, using the RIIO-2 CBA methodology, to determine the most cost-effective options for maintaining the network and managing leakage. Carbon emission calculation will be included in this analysis to better understand the savings that could occur whilst working towards the net-zero targets. Recommendations will then be made for potential updates to the LRMM.

Work Package 2 – Review of AGIs

A review of the natural gas leakage rates of Above Ground Installations (AGIs) will be carried out. This will start with a review of the Above Ground Installation Shrinkage report to examine the work carried out by DNV (Advantica) in 2003.

An assessment of the following will then be undertaken:

- AGIs with water bath heaters, especially those with immersion tube heaters. SGN will provide a report giving details of analysis in this area. The impact of the findings of this report on the LRMM will be documented.
- The location of the leakage from the AGI will be considered and leakage rates revised on the basis that leakage from vents will not be relevant for newer units which do not vent.
- The treatment of own use gas within the LRMM, and allowance for sites that have heat pumps and so no own use gas
- The impact of AGI upgrades on LRMM.

Analysis of SGN AGI asset data will be carried out to determine the impact of any changes. The calculations and leakage rates within the LRMM will be revised and updated as necessary.

Work Package 3 – Cathodic Protection

Cathodic protection is used to ensure that metal pipelines and assets do not corrode and leak. SGN cathodic protection records will be reviewed and matched to the asset failure records to determine the correlation (if any) between CP systems and asset deterioration. The type of system and maintenance regime will be included in the analysis. A cost benefit analysis will then be undertaken to determine the relative merits of maintaining CP systems or allowing more failures to occur. This will feed into the main CBA.

Work Package 4 – CISBOT

Remediation of joints using CISBOT is likely to reduce leakage but is not currently accounted for in the LRMM. A review of the recent SGN CISBOT programme will be undertaken and analysis undertaken to determine an appropriate modification for the CISBOT-remediated pipes in the LRMM.

Work Package 5 – Comparison of Cast and Spun Iron Leakage Rates

Different leakage rates for cast iron and spun iron are used in the LRMM, and there is a substantial difference for larger assets. A review of the historical development of the two materials will be undertaken. The SGN asset and failure database will then be interrogated in the light of the historical review to determine the accuracy of pipe material assignments and data cleansing applied where appropriate. Fracture and joint failure analysis will then be undertaken to determine whether there is an identifiable difference in failure rates and whether this aligns with the values in the LRMM. Recommendations will be made, including the usefulness of any supplementary fieldwork and any proposed amendments to the LRMM.

Work Package 6 – Feasibility Study of the Application of Hydrogen in the Gas Networks to the LRMM

As part of the UK government net-zero strategy, the introduction of low carbon alternatives for fuel sources such as hydrogen is being investigated. With this in mind, SGN would like to better understand the impact of hydrogen being introduced into the gas network and how this may affect the outputs of the LRMM.

DNV proposes, as part of this project, to include an innovative feasibility study to gain a better understanding of the potential impact of hydrogen on emissions. Using the current LRMM for natural gas, an initial study will be completed to evaluate the existing model to determine the number and scope of updates that need to be made to ensure the model is correct for use with hydrogen. The report will detail each factor in the model and identify the number of factors that will require updating, to enable the changes to the existing model to be fully scoped.

The report will also include a view on what the leakage management for network operators will likely need to look like with the introduction of 100% hydrogen into the network. This will include, but will not be limited to, mitigation actions such as the focus of leakage surveys (e.g. where PE pipe has been implemented there is likely little need to focus on the pipe itself rather more on the joints) and frequency of leakage surveys.

Objective(s)

The ultimate objective of this project is to assess and review the Leakage Reduction Management Model (LRMM) to understand where improvements can be made, how and where the model can be updated and its role in the energy system transition to 100% hydrogen. The project aims to provide recommendations on the requirements for hydrogen leakage modelling and management.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Not Applicable

Success Criteria

Success Criteria for this project will be as follows:

- Clear outcomes from each work package
- Clear recommendations as an output from the CBA considering work packages 1-5
- Clear recommendations as to the requirements for monitoring, quantifying and managing hydrogen leakage in a future 100% hydrogen gas network

Project Partners and External Funding

Project partners for the study will be DNV

Potential for New Learning

This project has major potential for significant new learning, including, but not limited to; the factoring in of recent improvements to the network impacting on leakage, the assessment of cathodic protection records, potentially impacting on leakage, the factoring in of the CISBOT programme to the LRMM and most significantly, a greater understanding of the potential impact of hydrogen on emissions. A key new learning will be a view on what the leakage management for network operators will likely need to look like with the introduction of 100% hydrogen into the network. A comprehensive understanding of the quantity and source of end-to-end whole system greenhouse gas emissions will be critical in ensuring net zero is achieved.

Scale of Project

The project will be primarily desktop based but will provide recommendations potentially leading to targeted works on the network. This work is of appropriate scale in terms of investment relative to the potential benefits it could lead to. The CBA this project will carry out will assess target areas for improvements on the network, balancing benefit to the customer and cost. Work Package 6 represents a feasibility level assessment of management of 100% hydrogen from the networks, and therefore has the potential to provide significant benefits in its outputs and recommendations for further development.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This project will primarily assess the LRMM covering SGN's network area (Work Packages 1-5). However, the outputs and approach developed will be broadly applicable across GB, depending on the composition of each respective network. The outputs of Work Package 6 (hydrogen feasibility assessment) will be applicable across GB.

Revenue Allowed for the RIIO Settlement

NA

Indicative Total NIA Project Expenditure

£119,810

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 in ensuring natural gas leakage is correctly estimated in light of recent improvements to the network and help ensure further work to reduce leakage from the networks is optimised, critical in reducing methane emissions. This project will also assess the management and quantify leakage of 100% hydrogen from the networks (post conversion through the energy system transition), a critical element of the energy system transition, and the evidence base for the conversion to hydrogen as a means for the decarbonisation of the energy supply through the gas networks.

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

N/A

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

N/A

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 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

Network Licensees will potentially be able to utilise learning areas from the project through applying a similar approach to that derived and demonstrated through the project, which will focus on SGN's network through the LRMM. It is anticipated that network licensees will particularly benefit from the outputs and recommendations from work package 6, which will assess the feasibility of leakage management of hydrogen in the gas networks.

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.

No other project is currently live or in development pertaining to the LRMM and the energy system transition. The DPLA SIF project is seen as materially different to this project, as it proposes to assess technologies for physical leakage monitoring across the networks. Both projects have the potential to compliment each other's respective outputs.

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

This project is innovative because it seeks to develop an existing BAU process to facilitate and operate during and after the energy system transition to hydrogen gas. This project aims to futureproof the methodology to accurately quantify and monitor leakage of hydrogen in the future, which will require an innovate approach beyond BAU

Relevant Foreground IPR

N/A

Data Access Details

The project will assess leakage data outputs from the LRMM and any changes as an output of this work. The project will consider data from AGI records, cathodic protection records, CISBOT remediation records and asset records of spun and cast assets. The data analysed will be summarised in the project reporting, with further detailed data available on request. Only data pertaining to specific asset locations and names will be redacted, as per CNI guidelines.

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

This project represents a key element of the overall end to end assessment of greenhouse gas emissions of the current natural gas networks and future hydrogen networks, a critical evidence piece as part of the energy system transition for the conversion of the networks, due to the importance of reducing methane emissions and accurately accounting for and reducing the leakage of hydrogen gas from the networks of the future.

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. However, the outputs of this project have the potential to strengthen the case for hydrogen in the gas networks.

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 low TRL and relevance to the energy system transition, particularly through work package 6. Work packages 1-5 will provide outputs tangibly linked and applicable to hydrogen leakage in addition to natural gas leakage.

This project has been approved by a senior member of staff

Yes