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

May 2017

Project Reference Number

NIA_NGGT0112

Project Registration

Project Title

Noise Mitigation Tool

Project Reference Number

NIA_NGGT0112

Project Licensee(s)

National Gas Transmission PLC

Project Start

May 2017

Project Duration

1 year and 11 months

Nominated Project Contact(s)

Owen Ariyo, Box.GT.Innovation@nationalgrid.com

Project Budget

£333,297.00

Summary

Insulation of pipework using hard cladding or soft lagging is widely used and has been carried out to reduce noise emissions, and more rarely to provide thermal insulation (e.g. compressor fuel gas lines). Although proven and effective for noise control, it can lead to issues with maintenance and corrosion further down the lifecycle of the pipework.

Issues with using cladding / lagging for pipework noise abatement include:

The ingress of water beneath the cladding / lagging - this has led to some cases of significant hidden corrosion of the pipework which also has a cost and time impact for National Grid. The ingress of water can be caused by poor workmanship or the cladding / lagging being unsuitable for the application.

The need to remove cladding/lagging in order to inspect the pipework beneath - there is an ever present risk of corrosion of pipework beneath lagging. When removed as part of routine maintenance, the cladding / lagging must be scrapped and replaced with a brand new equivalent; currently cladding that has been removed from pipework cannot be reused due to its design and the installation and removal methods employed. This has high cost implications for National Grid.

There is no robust way to compare the performance and cost of existing noise abatement methods or to evaluate novel technologies in the marketplace – The default solution applied for noise abatement is currently lagging / cladding without a proper consideration of the wider issues e.g. whole life cost, maintenance, corrosion protection, etc. Novel technologies may offer the same or better noise abatement performance, and offer the opportunity to alleviate the associated corrosion and inspection issues.

Issues with existing methods of machine train noise abatement are:

Standard OEM machine train packages default to noise mitigation at sound levels significantly higher than permitted on National Grid installations. This gives rise to requirement for bespoke noise enclosures by third parties at greater expense and with OEM

package integration issues.

These issues have had cost, time and safety implications across all National Grid Gas Transmission sites. Due to the ageing asset base these issues are likely to worsen in the future. National Grid requires a comprehensive and evidence-based approach for evaluating the different noise abatement techniques available, so that the Best Available Technique (BAT) solution for a given project can be identified.

These issues are widespread across the network of compressor installations and other above ground assets and will increase in frequency and severity as the asset base ages, bringing potential for significant future cost exposure.

Third Party Collaborators

Project Environmental Solutions Ltd

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Normal gas flow through pipelines can cause significant noise. Where the noise breaches planning limits or becomes a nuisance to site or neighbours then historically hard cladding and soft lagging have been used to try and reduce noise emissions to within acceptable limits.

However the use of lagging and cladding causes a number of corrosion, integrity and inspection issues and significant asset management costs over the whole life of the pipework. Previous research has identified a number of alternative technologies that may be more effective at mitigating noise pollution but did not go as far as making any kind of quantitative assessment.

Currently there also does not exist such a standardised method of quantitative assessment (Best Available Techniques) of noise mitigation solutions for designers designing new assets, leading to inconsistency and use of costly solutions with limited effectiveness. National Grid has experience of developing effective BAT assessment toolkits for certain aspects of Compressor Balance Of Plant but this did not include noise mitigation which is a specialist field.

This project will therefore refresh and expand on that earlier noise research and develop a toolkit including a series of cost benefit analyses and BAT assessments for a range of real-world noise mitigation scenarios for pipework systems. This will provide National Grid with a repeatable methodology for assessing the relative costs and benefits of different noise abatement techniques and their effectiveness in corrosion prevention so as minimise whole life costs of noise mitigation.

Policies and procedures will also be developed to allow the future use of any already sufficient proven alternative techniques to cladding and lagging. If the outcome of the assessments for real world scenarios conclude that alternative unproven technologies would provide lowest whole life costs then a successor or follow up project may be initiated to progress these technologies to a proven status.

Method(s)

The project will assess the feasibility of new and existing methods of noise abatement; it will look at work already done in this area and build a toolkit including a series of cost benefit analyses and BAT assessments for a range of real-world scenarios for pipework systems. This will provide National Grid with a repeatable methodology for assessing the relative costs and benefits of different noise abatement techniques and their effectiveness in corrosion prevention. The findings will explore methods of noise abatement for pipework systems and compressor machinery trains which are either, cost-effective, easily maintainable, replaceable, or allow non-invasive inspection techniques depending on the specific requirements of the section of the plant or pipework system where noise abatement is required.

Scope elements:

Confirm assumptions and detailed study objectives, including establishing a range of real world network scenarios

Survey to identify extent of cladding across all major above ground installations

Standards / Specification review around noise and cladding.

Technology review, desktop evaluation and market research of noise abatement techniques in order to identify candidate solutions, including workshops, research, internal stakeholder and market engagement (consultants, technology providers and equipment suppliers)

Gas turbine cab noise study and identification of viable improvements / solutions

Cost benefit analyses and development of BAT selection toolkits

Identify key learnings – impact on specifications, state of the market and need for technology demonstration / validation

Creation of National Grid Specifications to support implementation of BAT Toolkit

Update as required of other National Grid policy/specifications to allow use of already proven alternatives, including review and implementation of latest industry standards on noise mitigation.

Dissemination of learning, training in use of toolkit and awareness of proven alternatives.

Scope

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Objective(s)

Market engagement and development of a tool and process to evaluate and compare whole life costs and inform investment decisions on options for noise mitigation/abatement.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

1. Evaluate pipework noise abatement techniques with the potential to reduce whole life cost of asset management;
2. Produce a process and toolkit (including studies and BAT spreadsheets, to enable National Grid to evaluate whole life cost and effectiveness of pipework noise abatement techniques, using the principles of BAT;
3. Development of an accessible process to simplify and support future decision making, though a toolkit of real network scenario studies and BAT spreadsheets.

Project Partners and External Funding

Project Partners - PESL Consulting (with specialist sub-contractors)

External Funding - Nil

Potential for New Learning

Learning can be applied to any application where above ground gas pipeline systems are required which are subject to noise or temperature control.

Scale of Project

Phase one – Desk based / market engagement / toolkit development

Phase two – Trial in working environment / Specification development (outside the scope of this funding application)

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

At NGGT and PESL premises, and NGGT operational sites UK wide.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£333,297

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:

n/a

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)

Estimated total savings = £1.5m over 10 years linked to pipe noise

Estimated total savings = £750k over 6 years linked to compressor cab noise

Please provide a calculation of the expected benefits the Solution

PIPE NOISE

At two National Grid sites with cladding to reduce noise emissions recent inspections identified corrosion under insulation issues that required cladding removal, pipework remediation and cladding reinstatement. This led to costs of circa £75k (£25k for corrosion remediation works plus £50k cladding reinstatement material) at each site to rectify;

Assuming two site interventions are required every ten years of the pipework are required at each site with cladding, a cost of £150k (£75k x 2) could be saved per site by using an alternative solution shown to be BAT;

Conservatively assuming 10 sites (from around 400 above ground installations, but noting that not all of which will have noise issues or cladding) will have the same issues and require asset health or other project work over the next 5 years (2 x sites per year); then:

Total savings = **£1.5m** over 10 years (£150k x 10) plus further project programme linked cost savings.

This does not include further future cost avoidance on new build assets where alternatives to cladding may be identified as the BAT solution through use of the tool.

COMPRESSOR CAB NOISE

On two recent National Grid compressor projects, the cost of noise abatement was circa £1.4m per compressor enclosure / cab.

OEM machine package is designed for 85 dB noise level at 1m from source. This level of noise abatement in included in the standard gas turbine machine enclosure price;

Installing a basic noise enclosure to abate noise at nearest receptor (circa 78 dB) would cost circa £1m per cab.

Additional noise abatement down to stringent planning requirements at nearest receptor (usually < 78 dB) costs an average of £300k per cab;

If breakout noise sources are identified and eliminated through innovative technologies and this is integrated in the enclosure design, the cost avoidance is = ~ £150k (0.5 x £300k) per cab *(where 0.5 is a conservative efficiency factor from incorporating innovative technologies in the design*);

There are up to five compressor train investments planned in the next 5 – 6 years on the NTS. The total savings over the next 5 – 6 years is = £150k x 5 = £750k plus programme linked cost savings.

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

Potential to be rolled out to all sites with above ground equipment with cladding installed for noise or thermal insulation. Applicable to terminals, compressor installations and a number of other above ground installations.

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

The solution will be implemented during planned asset health or other project work. Hence the additional cost of implementation will be zero.

The expectation is that each project that adopts this approach should result in implementation of the most cost effective BAT solution and reduce future maintenance and remedial costs.

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 learning will be applicable to other network licencees, such as the gas distribution networks, to the extent that they have comparable pipework systems with noise issues, and assist them in making their own assessments and investment decisions to reduce the whole life cost of noise mitigation.

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

The project is aligned ot our environmental theme.

☑ Has the Potential to Develop Learning That Can be Applied by all Relevant Network Licensees

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.

A previous NIA project undertaken by National Grid (*Reviewof Best Available Techniques for Mitigation of Pipework Noise*) carried out a desktop review limited to a qualitative unspecific assessment of noise mitigation techniques. This project will incorporate and expand upon the findings of that research as a first step but go significantly beyond it by developing qualitative insights and apply Best Applicable Techniques to a range of real network scenarios and develop methodologies and policies to do this The findings of previous work will be updated and combined with new research, and compared using the Balance of Plant (BoP) toolkit on a common financial and effectiveness basis.

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

n/a

Relevant Foreground IPR

n/a

Data Access Details

n/a

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

n/a

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

n/a

This project has been approved by a senior member of staff

☑ Yes