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 2014

Project Reference Number

NIA_NGGT0056

Project Registration

Project Title

Feasibility study of onsite non-welded interlocking pipe construction

Project Reference Number

NIA_NGGT0056

Project Licensee(s)

National Gas Transmission PLC

Project Start

July 2014

Project Duration

1 year and 4 months

Nominated Project Contact(s)

Dominic Feenan, box.GT.innovation@nationalgrid.com

Project Budget

£370,000.00

Summary

National Grid Gas Transmission is already undertaking a project to investigate alternative construction materials. This project is an evolution of that project to look at one specific technology that has been identified as potentially feasible.

In order to construct a pipeline, pipes are purchased in 12 or 18 metre lengths and transported to site. These lengths are selected in order to manage the transportation challenges (tight bends, village and country roads) to get to the construction site.

In order to produce a pipe, steel plate is produced and sent to the pipe mill. At the steel mill this plate is then passed through a manufacturing process and welded to form the bare pipe. The pipe then has to be transported to a different part of the steel mill or in some circumstance to a different factory (which can be in a different country) to get internally and externally coated. The final coated pipes are then transported to the National Grid pipeline storage or construction site. The pipes are then welded together and lowered into the ground to form the pipeline.

National Grid was approached by Sustainable Pipeline Systems Limited to see if the technology that they are developing could be of interest. National Grid has undertaken early high level conversations with Sustainable Pipelines System to understand the technology and the potential applications. While the technology looks very attractive and feasible for use, for gas transmission purposes, there are a number of fundamental steps that must be undertaken to ensure that the method can be employed safely and adequately.

Some of the early key steps are being investigated as part of this project, but it is recognised that other major works will be required before this technology can be fully accepted for use by National Grid as a feasible alternative to the current methods of constructing, operating and managing their pipelines.

The emerging technology, being investigated as part of this project, allows a mobile modular production facility to be established at the pipeline construction site. This would then allow a similar steel plate to be brought to site directly and utilised by the new equipment to form the pipeline. The new equipment uses a similar production system as some of the steel mills but produces a continuous ribbon of ridged steel material which interlocks together to form the pipeline. The pipeline can then be passed through further onsite modules to

apply the internal and external coatings required, it then leaves the final module and can be placed directly into the ground without any requirement for welding pipe sections together, resulting in a significant reduction in welding overall.

Reducing the logistics associated with the pipes production and construction could also bring environmental benefits from a lower carbon footprint.

Third Party Collaborators

Sustainable Pipeline Systems Ltd

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Grid Gas Transmission utilises pipe, in various sizes and manufacturing techniques, in 12 or 18 metre lengths formed at the pipe mill and then coated in a different plant, or potentially different location completely. Each pipe length then has to transported to site and then welded together to form the pipeline. These traditional arrangements incur a significant amount of logistical and welding costs.

A new technology is being developed, for applications in remote locations, which will allow for onsite production of a spiral wound, interlocking small diameter pipe that can be produced at a rate of at least 1 kilometre per day. This technology would significantly decrease the logistical and welding costs associated with pipeline construction and potentially decrease the overall construction period.

This project wants to investigate the feasibility of utilising this emerging technology for gas transportation purposes in the United Kingdom.

Method(s)

Stage 1 – Using Finite Element Analysis (FEA) investigate how the current available small diameter pipe (6”) would perform when subjected to an impact from an excavator.

Stage 2 – Utilise FEA to develop scaled up design options for larger diameter pipes (24”, 36” and 48”).

Stage 3 – Conduct FEA on these larger diameter designs and how they would perform when subjected to an impact from an excavator.

Stage 4 – Conduct a mobile manufacturing design study for the larger diameter pipes to define costing of manufacturing equipment required.

Stage 5 – Conduct a cost benefit study into the application of the technology.

Stage 6 – Design of the physical test programme required to prove FEA.

If these stages of the project are successful further stages, including manufacturing and testing, will be required to demonstrate that the pipe will meet the requirements set out by National Grid and industry standards. These stages will be covered by extending the scope of this initial project.

Scope

National Grid Gas Transmission is already undertaking a project to investigate alternative construction materials. This project is an evolution of that project to look at one specific technology that has been identified as potentially feasible.

In order to construct a pipeline, pipes are purchased in 12 or 18 metre lengths and transported to site. These lengths are selected in order to manage the transportation challenges (tight bends, village and country roads) to get to the construction site.

In order to produce a pipe, steel plate is produced and sent to the pipe mill. At the steel mill this plate is then passed through a manufacturing process and welded to form the bare pipe. The pipe then has to be transported to a different part of the steel mill or in some circumstance to a different factory (which can be in a different country) to get internally and externally coated. The final coated pipes are then transported to the National Grid pipeline storage or construction site. The pipes are then welded together and lowered

into the ground to form the pipeline.

National Grid was approached by Sustainable Pipeline Systems Limited to see if the technology that they are developing could be of interest. National Grid has undertaken early high level conversations with Sustainable Pipelines System to understand the technology and the potential applications. While the technology looks very attractive and feasible for use, for gas transmission purposes, there are a number of fundamental steps that must be undertaken to ensure that the method can be employed safely and adequately. Some of the early key steps are being investigated as part of this project, but it is recognised that other major works will be required before this technology can be fully accepted for use by National Grid as a feasible alternative to the current methods of constructing, operating and managing their pipelines.

The emerging technology, being investigated as part of this project, allows a mobile modular production facility to be established at the pipeline construction site. This would then allow a similar steel plate to be brought to site directly and utilised by the new equipment to form the pipeline. The new equipment uses a similar production system as some of the steel mills but produces a continuous ribbon of ridged steel material which interlocks together to form the pipeline. The pipeline can then be passed through further onsite modules to apply the internal and external coatings required, it then leaves the final module and can be placed directly into the ground without any requirement for welding pipe sections together, resulting in a significant reduction in welding overall.

Reducing the logistics associated with the pipes production and construction could also bring environmental benefits from a lower carbon footprint.

Objective(s)

Feasibility of utilising onsite non-welded interlocking pipeline construction technique for UK Gas Transmission purposes.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

One of the most significant differences between operating pipelines in remote locations compared to the UK is the increased risk associated with third party interference. This increased risk means that any National Grid pipeline has to be able to deal with a third party strike without significant escalation of the resultant damage.

This project will:

Establish, by utilising computer simulation (FEA), if the unique interlocking method used can withstand a third party strike without significant escalation.

Establish if the current design for small diameter pipelines can be scaled up for larger diameter pipelines that are typically utilised for Gas Transmission in the UK.

Establish, by utilising computer simulation (FEA), if the design method for larger diameter pipelines used can withstand a third party strike without significant escalation.

Investigate the costs associated with producing a modular system capable of dealing with the larger diameter pipelines.

Carry out a cost benefit analysis study into the actual benefits that could be realised by the introduction of the technology.

Establish the physical tests that would be required to prove the technology at the next stage of this project.

The project has been broken down into six high level stages with stage gate meetings to be held at the end of each stage. If the project is not feasible at any stage the project will be halted.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The first stages of this project are desk based, focusing on Finite Element Analysis (FEA) that will then feed into a design study for both small and large diameter pipes. If the outputs indicate that the technology is cost effective and fit for purpose for use on the National Transmission System, further stages of work will be undertaken including manufacturing and testing within a training and/or working environment.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

If fully successful this technology could be employed across all UK Gas Transmission and Distribution systems. It is also noted the potential for the technology to be used for international pipeline construction projects.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

For the feasibility study described above, the total project cost is estimated at £370,000 covered by NIA funding. Depending on the outcomes of the feasibility study, additional funding will be required to physically manufacture and test the technology to prove the computer simulations.

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)

The cost benefits of introducing this technology are to be confirmed as part of this project. Cost benefit analysis produced for other companies using different construction methods/conditions has indicated savings of 20-50% of total installed costs could be achieved.

Please provide a calculation of the expected benefits the Solution

N/A - At this stage, this project is a research project.

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

This new technology, if fully successful, could be rolled out to the majority of the Gas Transmission pipeline construction projects. The technology could also be used by the Gas Distribution companies also.

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

The cost of the manufacturing technology is to be determined as part of this project.

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

If the technology is viable the learning could be used by all Gas Transmission and Distribution operators to replace their existing pipeline construction techniques.

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

This project will deal with the Strategic challenges National Grid Gas Transmission faces and sits within the the Strategic innovation 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.

n/a

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