national gas transmission

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

Nov 2013

Project Reference Number

NIA_NGGT0037

Project Registration

Project Title

Compressor Balance of Plant Environmental Study

Project Reference Number

NIA_NGGT0037

Project Licensee(s)

National Gas Transmission PLC

Project Start

August 2013

Project Duration

1 year and 8 months

Nominated Project Contact(s)

Neil Dawson, box.GT.innovation@nationalgrid.com

Project Budget

£175,000.00

Summary

The proposed scope of works comprises development of the novel software decision support tool, development of ten best practice guides and a limited programme of training and awareness raising in National Grid and the wider sector (facilitated via the Energy Networks Association (ENA) and as appropriate other sector bodies such as Marcogaz).

Software Tool: The development of a software tool which will allow comparison of a range of candidate technology options for each study topic area in order to assist in determining which offers the best environmental cost benefit balance for National Grid and its customers. The tool will then be used to develop a series of generic best practice / BAT case studies which will compare the environmental cost benefit of a range of existing technology options and determine which represents BAT. There is no equivalent tool in use to specifically address the challenge of environmental cost benefit analysis for compressor ancillary equipment. The proof of concept for this approach has already been established, in the form of the Compressor Machinery Train BAT Evaluation Toolkit, which has previously been developed for GTAM. That tool, which also employs environmental cost benefit modelling and assessment techniques has received positive feedback from UK environmental regulators and compressor machinery train Original Equipment Manufacturers (OEMs) for its innovative approach to addressing multi-disciplinary environmental, technical and procurement challenges.

Best Practice Guides: The objective in developing the guides is to create a published resource that can be used by National Grid (and the wider sector) to inform designers, support investment decisions, environmental permitting and planning applications and justification on technology choices required by environmental and financial regulators. A wide range of topic areas relating to ancillary equipment and will facilitate better asset specification, plant design, reduced operating costs and potential environmental impacts will be studied, including best practice guides on the following topics:

- Natural vs. VSD enclosure forced ventilation vs. forced compressor cabs ventilation (including reduced ventilation during periods of standby operation)

- Gas seal technologies (eg. CobaSeal vs. CSR Barrier vs. Liquid film (wet) separation systems)
- Venting vs. flaring vs. storage / recompression and reinjection for fuel gas systems, compressor casings and pipework
- Gas vs. electric-hydraulic vs. electrically vs. air actuated valves
- Electrical vs. Gas actuated odorant pumps on transmission assets
- Use of compressed air for seals and other utilities
- Micro Gas Turbine vs. Diesel Fired vs. Gas Engine Standby Generation Equipment
- Low energy heating / cooling for compressor cabs and welfare facilities
- Fuel gas system optimisation (recovered heat vs. electrically / gas heated fuel gas, fuel gas pressure reduction expanders)
- Inlet air preheat (recovered heat vs. electrical heating vs. bleed air) vs. non-icing filters
- Micro-renewables for on-site energy consumption
- Low energy lighting (security, cab, welfare).

Third Party Collaborators

Project Environmental Solutions Ltd

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Grid Gas operates a wide range of ancillary equipment across its gas assets in addition to primary equipment forming gas compressor machinery train, generically referred to as Balance of Plant (BoP). Due to the different age of the sites, particular characteristics and different parties involved at design stages there is considerable variety in the type of equipment installed, yet different systems often fulfil the same function and are capable of meeting duty and process safety requirements.

Given this historical variety, there is substantial uncertainty in many cases as to which option represents the most cost effective and environmentally preferable solution over the whole design life. The variability in existing asset type also complicates maintenance and spares holding requirements. Innovative practices or processes are also periodically identified through sector knowledge sharing or proposed by suppliers, but there is typically little information to compare the costs and benefits of these novel solutions with established practice.

This lack of information impacts on the ability to define engineering standards for certain BoP items, resulting in additional design costs on new projects.

Additionally, National Grid Gas has a legal obligation to ensure that all equipment on its sites subject to environmental regulation operate in line with the principles of Best Available Techniques (BAT). BAT applies to how a facility is designed, built, operated, maintained and closed, and includes consideration of affordability – the marginal environmental or efficiency benefit offered by one solution or practice over another must be proportional to its cost, annualised over the life of the equipment. Failure to satisfy the environmental regulators that BAT is being applied can result in costly retrofits.

There are established principles for conducting cost benefit analysis and for the more common industries (such as food and drink

manufacturing) there is published sector based guidance identifying those technical solutions considered to represent BAT. However, there is no guidance for gas transmission identifying sector best practice. To undertake a comprehensive cost benefit analysis study on each project where new ancillary equipment is to be specified would be time consuming, costly and inefficient for customers.

Method(s)

Site audit techniques will be used to review practice and procedure in relation to technology in use at existing facilities.

An Innovation Workshop will be held to which key National Grid stakeholders and selected technology providers would be invited. The purpose would be to provide a forum to collate and discuss conceptual approaches and issues in relation to the identified the BoP topic areas. The aim of this will be to capture the widest range of opinions on potential candidate options in the research.

Primary and secondary research to obtain data on performance, emissions and costs for the potential candidate options. This will include follow up interviews with National Grid staff, suppliers and technology providers and review of published sources and historical projects. Regard shall be given to commercial confidentiality and, where required, project specific information and suppliers will be anonymised.

In parallel to the research stage, the Environmental Cost-Benefit Assessment Tool will be developed. This will utilise software engineering techniques to develop a standalone tool using the Microsoft Excel 2007/2010 platform. The functionality will include user input, modelling and graphical / tabular output tabs. This functionality will be achieved without use of macros or visual basic programming to ensure it will be widely useable in a range of transmission organisations. There will be stakeholder design meetings between National Grid and the software developers at key project stages.

High level outline candidate technology / practice options relating to the identified topic areas will be developed for application at a generic compressor installation. This activity will be in discussion with key decision makers in National Grid Gas Transmission Asset Management (GTAM) (including investment teams, fleet management and operational representatives) and National Grid Capital Delivery. The outcome of this will be a shortlist of candidate technologies (or combination of technologies), with high level outline designs for analysis and comparison.

The cost and performance information derived through the research and outline design phase will be used to conduct an environmental Cost Benefit Analysis (CBA), in order to determine the preferred option[s]. The CBA method will be consistent with guidance provided by UK environmental regulators and European law.

The best practice / innovation guides, which will be also be developed by external environmental specialists, will use the newly developed tool to undertake a series of option appraisal comparisons. They will be written up in a summary format for maximum clarity, and will also be consistent with the methodology set out in guidance provided by UK environmental regulators

Dissemination of the findings will include training and raising awareness in National Grid and the wider sector (facilitated via the Energy Networks Association (ENA) and as appropriate other sector bodies). External stakeholder engagement to support uptake will include the UK environmental regulators, including the Environment Agency (EA), the Scottish Environment Protection Agency (SEPA) and Natural Resources Wales (NRW).

Scope

The proposed scope of works comprises development of the novel software decision support tool, development of ten best practice guides and a limited programme of training and awareness raising in National Grid and the wider sector (facilitated via the Energy Networks Association (ENA) and as appropriate other sector bodies such as Marcogaz).

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- Low energy heating / cooling for compressor cabs and welfare facilities;
- Fuel gas system optimisation (recovered heat vs. electrically / gas heated fuel gas, fuel gas pressure reduction expanders);
- Inlet air preheat (recovered heat vs. electrical heating vs. bleed air) vs. non-icing filters;
- Micro-renewables for on-site energy consumption;
- Low energy lighting (security, cab, welfare);
- Drainage and firewater management strategies;
- Efficient cooling for Control Systems; and
- Fuel gas preheating technologies

Objective(s)

The aim of this study is to research and develop a novel operational practice that has the potential to deliver environmental gain and net financial benefits, by delivering efficiencies and a better understanding of whole life expenditure. This study will help to address challenges associated with reduction in environmental Impact.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The following can be identified as potential success criteria:

- Validation that existing technology choices represent the best environmental cost benefit balance;
- Identification and evaluation of new / innovation technology options not previously considered;
- Greater auditability and justification associated with investment decisions;
- Improved development and update process for engineering standards (e.g. T/PM/COMP/20 ‘Management Procedure for Design of a Compressor Installation for the National Transmission System,’ and its subsidiary procedures);
- Time and cost savings for projects via access to a published library of case studies;
- Investment decisions being made on the basis of a consistent evaluation method taking potential environmental impacts into full consideration;
- Identification of technology options / practices with a high degree of potential viability, suitable for further evaluation under the NIA/NIC mechanisms;
- Potential whole life cost savings associated with selection of more efficient equipment;
- Potential carbon dioxide (CO_2), or carbon dioxide equivalent (CO_2e) savings associated with increased efficiency or reduced process gas losses; and
- Potential reductions in other emissions, resource consumption and environmental risks.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The tool will be flexible enough to include a wide range of environmental impact and risk criteria, allowing it to be used for a wide range of current and future gas transmission technology selection applications.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The tool and best practice studies will be applicable across the National Transmission System (NTS) in the UK.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Total project expenditure anticipated - £175k.

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)

A minimum of ~£50k in cost avoidance per annum*

* The model enables a reduction of at least 5% in Balance of Plant (BoP), thereby off-setting project investment within three years. This savings does not take into account additional direct and indirect benefits that may be achieved. Including the uptake of environmentally preferable equipment that will potentially realize benefits in terms of reduced environmental risk; such as a reduction in the use of hazardous materials, lower noise, and reduced emission of products of combustion.

Please provide a calculation of the expected benefits the Solution

Base Cost: ~£960,000k. Based on 2009 figures, the operating (energy) cost alone of running compressor BoP across the network was £0.96m (resulting in a CO2e emission of some 122,000 tonnes).

Method Cost: ~£910,000k. The outputs of this project have the potential to unlock, at minimum, a modest ~5% reduction (£50k) in overall Balance of Plant (BoP) energy consumption alone.

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

The findings of the project will be directly applicable in relation to the entire network of 24 gas compressor installations on the gas National Transmission System. There is also potential for wider applicability of aspects of the findings to other network companies.

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

The scope of this NIA project includes provision for roll-out of the findings via training, engagement with sector bodies and environmental regulators. No additional roll-out costs are envisaged for wider UK Gas Transmission.

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

Best Practice Guides will be published as a resource utilised by National Grid and the wider energy sector to inform designers, support investment decisions, environmental permitting and planning applications and justification on technology choices required by environmental and financial regulators.

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

☑ 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

- [x] Yes