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

Jan 2014

Project Reference Number

NIA_NGGT0031

Project Registration

Project Title

Direct Replacement Preheat Package (DRPP)

Project Reference Number

NIA_NGGT0031

Project Licensee(s)

National Gas Transmission PLC

Project Start

July 2013

Project Duration

0 years and 11 months

Nominated Project Contact(s)

Simon Cowling (box.GT.innovation@nationalgrid.com)

Project Budget

£36,000.00

Summary

The traditional solution to replace inefficient and in some cases obsolete WBH pre-heat systems is to install a new condensing package boiler house system. This replacement option requires that, for the package boiler system to provide the required pre-heat to the gas, a separate heat exchanger system must be installed along with the associated fuel gas system to provide low pressure gas to operate the boilers. The installation of new heat exchangers usually requires major modification to the existing site pipework. The efficiency of standard condensing boiler gas preheat systems is circa 97% at ambient conditions.

The Direct Replacement Preheat Package (DRPP) solution will be contained within a single unit. Supplied with its own, self-contained, pressure breakdown system the proposed DRPP will utilise a combination of condensing boilers in conjunction with Gas Absorption Heat Pumps (GAHP) to provide heat to its 'EU type' heat exchanger system, allowing huge improvements in efficiency (around 130%), subject to ambient conditions. The DRPP will be designed and built specifically to utilise existing pipework connections and hard standings to minimise site disruption and maximise fabrication time within controlled workshop conditions.

Third Party Collaborators

Premtech Ltd

Armstrong Integrated Limited

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Replacement of inefficient, potentially obsolete water bath heater (WBH) pre-heat systems located at Pressure Reduction Installations

(PRIs) with a more efficient (>100%), fit for purpose, compact single-unit solution.

Method(s)

- Liaise with manufacturers and suppliers to develop the concept design, utilising existing and new technologies:
  - Initial concept meetings between various equipment suppliers and the project supplier, Premtech, established commitments to participate in development of the direct water bath heater (WBH) replacement system.
- Develop and detail the concept design for the DRPP, including outline arrangement drawings, Process Flow Diagrams and 3D isometric views.
- Develop a Building Information Modelling (BIM) strategy and Best Available Technology (BAT) assessment.
- Assessment of the concept against three typical sites, each with different operating profiles.
- For each of the three typical sites the following shall be carried out:
  - Technical review, with efficiency and emissions assessment and comparison with the traditional WBH and condensing package boiler house replacement systems.
  - Develop a constraint and opportunities matrix against each preheat system.
  - Whole Life Costing (WLC) comparison of the direct water bath heater (WBH) replacement verses traditional condensing package boiler house replacement and the new system.
  - Reliability assessments.
  - Include generic HAZOP study to address process safety requirements fully in accordance with T/SP/HAZ/7.
  - Challenge & review meetings with appropriate stakeholders.

Scope

The traditional solution to replace inefficient and in some cases obsolete WBH pre-heat systems is to install a new condensing package boiler house system. This replacement option requires that, for the package boiler system to provide the required pre-heat to the gas, a separate heat exchanger system must be installed along with the associated fuel gas system to provide low pressure gas to operate the boilers. The installation of new
heat exchangers usually requires major modification to the existing site pipework. The efficiency of standard condensing boiler gas preheat systems is circa 97% at ambient conditions.

The Direct Replacement Preheat Package (DRPP) solution will be contained within a single unit. Supplied with its own, self-contained, pressure breakdown system the proposed DRPP will utilise a combination of condensing boilers in conjunction with Gas Absorption Heat Pumps (GAHP) to provide heat to its ‘EU type’ heat exchanger system, allowing huge improvements in efficiency (around 130%), subject to ambient conditions. The DRPP will be designed and built specifically to utilise existing pipework connections and hard standings to minimise site disruption and maximise fabrication time within controlled workshop conditions.

Objective(s)

The primary objective of this project is to research and develop a highly efficient Direct Replacement Pre-heat Package (DRPP) to replace existing in-efficient, obsolete systems at Pressure Reduction Installations (PRIs).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The identification and learning that will allow application of a suitable water bath heater (WBH) pre-heat system replacement that offers a more efficient, compact solution.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Development of the DRPP concept and design will be aligned to three (3) typical Pressure Reduction Installations (PRIs). Each DRPP will be a single unit that contains all required supporting hardware, fits within the footprint of existing Water Bath Heaters (WBH), and

ties into existing connections.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

The solution would be applicable at Pressure Reduction Installations (PRIs) across the National Transmission System (NTS).

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£36k

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 efficiency of WBH pre-heat systems is circa 65%, the efficiency of standard condensing boiler gas preheat systems is circa 97% and the efficiencies of a GAHP system, as proposed here, is circa 130%, subject to ambient conditions. Fuel gas usage and CO2 emissions will therefore be reduced compared to existing systems. An estimate of fuel savings has been calculated as roughly 50% for current installations. For a typical National Grid site this equates to 450,000kWh or £20,511 annually per installation. This fuel usage is billed to the downstream party and therefore the benefits of this project are passed directly to the customer.

The proposed DRPP will be designed and constructed using current technical knowledge and will utilise modern materials to optimise its longevity thereby reducing maintenance cost and effort and increasing safety and reliability. Other Benefits include:

- Reduced emissions.
- Commonality of design, leading to reduced design/appraisal (G17/G35), installation and operating costs.
- Reduced Health Safety and environmental risks associated with traditional on site activities.
- Increase in speed of heating response and modulation of heat to match demand.
- The proposed DRPP will be a self-contained single unit, designed and fabricated to utilise existing site connections reducing fabrication work and thus time on site during installation.

Please provide a calculation of the expected benefits the Solution

Not required- research

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

Development of the DRPP system will be measured against three typical Pressure Reduction Installations (PRIs) to capture design features and fitness for purpose across PRI sites on the NTS.

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

Installation costs should be far less than that of traditional pre-heat solutions. For a direct replacement, installation costs are estimated to be in the region £400K per site, depending on the size of the equipment and the existing site layout.

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 project results will be disseminated through the National Grid website and ENA learning portal.

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 is aligned to Optimising Asset Management within the Reliability 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