

NIA Project Registration and PEA Document

Date of Submission

Aug 2014

Project Reference Number

NIA_NGGT0060

Project Registration

Project Title

Gas Generator Preservation Assessment

Project Reference Number

NIA_NGGT0060

Project Licensee(s)

National Gas Transmission PLC

Project Start

August 2014

Project Duration

2 years and 9 months

Nominated Project Contact(s)

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Project Budget

£120,000.00

Summary

Gas turbine engines (gas generators) are used by National Grid to provide power for natural gas compressors which are used in turn to maintain pressures on the transmission network. Gas generators use atmospheric air as part of the internal combustion process during operation. When the units are not operating moist atmospheric air accelerates corrosion of internal engine components.

Gas generators can spend prolonged periods out of operation, leading to equipment degradation requiring early overhaul. The current preservation techniques can be difficult to fully implement and a major element of ensuring ongoing engine reliability is an engine 'test run' performed every 28 days. This test run increases environmental impact through direct engine emissions and gas venting.

Gas generator preservation techniques involve a combination of solutions. Most short term measures involve injection of substances into the engine in order to reduce the impact of moisture upon metal alloys.

While this can provide adequate results it requires significant resources to implement and reverse. As such these standard techniques are not usually implemented on our gas generators.

The aim therefore is to improve on these techniques by providing a solution which is effective, quickly reversible, environmentally responsible and safe. This will focus on the reduction of air humidity below an advised 40% threshold. This will be achieved by integration of an instrument air flow into the engine wash system. Instrument air is produced at a relative humidity of around 1% and when mixed with atmospheric air within the engine will reduce humidity to the desired levels. In order that sufficiently low humidity levels are reached, sealing of the gas generator air intake may be required. This solution should also remove our requirement for a full 28 day compressor 'test run'.

This solution is an innovative method of using existing site equipment in a different way in order to improve our asset longevity and reliability.

Nominated Contact Email Address(es)

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Problem Being Solved

Gas generators are used by National Grid to provide power for natural gas compressors, and can spend prolonged periods out of operation, leading to equipment degradation. Gas generator preservation techniques to alleviate this degradation involve a combination of solutions. Most short term measures involve injection of substances into the engine in order to reduce the impact of moisture upon internal components. While this can provide adequate results it requires significant resources to implement and reverse. As such these standard techniques are not usually implemented on our gas generators.

Method(s)

The project seeks to reduce the rate of corrosion within gas generators by implementing new preservation techniques. To that end, this innovation project will be divided into several key phases with stage gates:

- 1) Further research of preservation solutions and expected costs
- 2) Implementation of short term solution for reduction of engine air humidity
- 3) Trial possible for longer term engine preservation techniques

The central aim of the first stage is to establish full costs and scope for the works. The project will then move to installation and testing of a chosen solution to implement:

- Measured humidity below 40% throughout engine
- Air usage below 20% site capacity
- Solution executable and reversible within 1 hour

If it is seen as necessary, further solutions will be trialed to improve upon current long term engine preservation.

Change control – July 2016

-Initial tests have proved inconclusive due to an error in the method of conducting the test. Operations are due to rerun this test but site operational constraints on running these tests could mean they can't be run until the end of the year. -No additional cost on top of budget as there will just be internal time incurred for carrying out the test. -If this further test also proves inconclusive, then there will be a need for an alternative approach, looking at a supplier conducting a study and / or producing a report which could result in additional cost. -This Change Control is therefore to extend the only the time of the project to March 2017 (currently registered to complete in August 2016).

Scope

Gas turbine engines (gas generators) are used by National Grid to provide power for natural gas compressors which are used in turn to maintain pressures on the transmission network. Gas generators use atmospheric air as part of the internal combustion process during operation. When the units are not operating moist atmospheric air accelerates corrosion of internal engine components.

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Objective(s)

Knowledge from this project will allow National Grid to update the gas generator preservation strategy which will effect a reduction of natural gas venting associated with preservation techniques.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

Identify fit for purpose preservation technique to effect the reduction in humidity of gas generators and carry out a trial of the solution(s) to determine long term engine preservation.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The project will commence with desk based research in order to fully establish a technical solution. This will be followed implementation of the chosen solution on site.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

This project will include a combination of desk based research at the National Grid offices and onsite field trials at a compressor station on the Gas Transmission System. The compressor station possesses two compressor units, both are driven by Siemens SGT 400 gas generators and Siemens will provide technical input throughout the project wherever required.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£65,000

Project Eligibility Assessment Part 1

There are slightly differing requirements for RII0-1 and RII0-2 NIA projects. This is noted in each case, with the requirement numbers listed for both where they differ (shown as RII0-2 / RII0-1).

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 RII0-2 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 (RII0-1 projects only)

An estimated saving of £1m over the RII0 T1 period could be realised once a fit for purpose solution is identified.

Please provide a calculation of the expected benefits the Solution

Current costs associated with corrosion mitigation and 28 day testing cost will cost in the region of £1m / annum. This includes engine overhaul due to corrosion, asset replacement due to corrosion and gas vented from the compressor cabs during the 28 day run process. This technique is expected to reduce engine degradation and overhaul frequency over long term operation, and will manifest in a percentage saving proportional to percentage of critical units equipped with new system. It is estimated that applying this technique to 5 units (10% of the fleet) would save in the region of £1m over the remaining six years of RII0 T1.

There will also be an expected improvement in compressor unit availability after long periods of inactivity with reduced likelihood of high expenditure events on units.

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

This method could be established on all NG compressor sites which have dry air supply. For those without this supply provision can be made by installation of additional equipment.

Any licensee who seeks to improve asset preservation for rotating equipment will find this technology valuable.

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

Cost per gas generator following innovation project approx. £30k. Cost for five compressor units £150k.

Requirement 3 / 1

Involve Research, Development or Demonstration

A RII0-1 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

Learning from this project could be applied to all other rotating equipment operators utilizing various engine types.

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 Optimizing Asset Management under the Reliability theme. It is also aligned with the environmental and strategic themes.

☒ 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