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

Aug 2016

Project Reference Number

NIA_NGN_167

Project Registration

Project Title

Re-Defining Failure

Project Reference Number

NIA_NGN_167

Project Licensee(s)

Northern Gas Networks

Project Start

August 2016

Project Duration

0 years and 8 months

Nominated Project Contact(s)

Keri Bunnell (NGN) – Project Manager

Project Budget

£185,524.00

Summary

This project intends to undertake Phase 1 of a potential two phase project.

The scope of this phase encompasses two work packages, the second of which is split into part a and b. Work Package 1 is concerned with summarising the state of the art approaches to statistical modelling of failure for maintainable assets.

Work Package 2a considers the modelling of asset reliability at component and site / system level of detail and Work Package 2b concerns the statistical modelling of asset fault states to arrive at a range of fault probabilities.

A potential Phase 2 would encompass a further two work packages that may be delivered if it is considered that they provide additional value over Phase 1 and extend the understanding of fault propagation and impacts through network connectivity modelling. This would be delivered as a separate project.

Third Party Collaborators

WFc

Business Modelling Associates

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

Through the development of the Network Output Measure Risk Trading Methodology (NOMs) there has been no clearly agreed methodology to calculate the probability of failure (PoF), deterioration rates, or impact of failure (IoF) for asset classes that GDNs

typically do not run to failure because of the maintenance regimes in place, e.g. LTS pipelines, or PRS regulators and slam shuts. This means, for example, that the underlying deterioration of the asset is mitigated by maintenance activity.

The current approach to assessing the PoF for maintainable assets (MAs) is to use expert knowledge to determine information about key factors, such as condition grades, time between failures, time to repair etc. These factors are then used to elicit PoF and deterioration curves.

This approach does not fully take account of the impact of maintenance regimes on the PoF of an asset or the interdependencies of risk. As such, there is the potential to over or under estimate the risk of asset failure which can lead to non-essential expenditure, inefficiency and poorly informed decision making.

In addition, the current approach does not quantify the redundancy and interdependency with asset systems (e.g. complete PRS sites) or across networked assets. This may result in risk being overestimated where system and network redundancy is mitigating risk, or underestimation of risk where failure cascades can be caused by a single point of failure

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Method(s)

This project will start by re-defining failure. There is a lack of data associated with the traditional failure of the types of asset mentioned above as they are maintained back to condition. However, if failure is re-defined to be the failure of normal functioning, then data, such as fault and current maintenance regime data, can be analysed to help inform more efficient Totex management of these assets.

This project aims to remove subjective analysis and take the analysis of ‘failure’ back to a data driven approach to determine the ‘true’ deterioration, incorporating the effect of external factors, including maintenance regimes. It is intended that the analysis will be performed at an individual asset level rather than a grouped or ‘cohort’ level. To understand the failure of systems, this project will use individual asset failure models to model the interdependencies and redundancies at an asset system level, e.g. for PRS this will be at functional location/site level.

Scope

This project intends to undertake Phase 1 of a potential two phase project.

The scope of this phase encompasses two work packages, the second of which is split into part a and b. Work Package 1 is concerned with summarising the state of the art approaches to statistical modelling of failure for maintainable assets.

Work Package 2a considers the modelling of asset reliability at component and site / system level of detail and Work Package 2b concerns the statistical modelling of asset fault states to arrive at a range of fault probabilities.

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Objective(s)

The objectives of this phase of work across work packages 1 and 2 are to:

- Establish a cross-utility understanding of asset failure
- Produce a clear and actionable definition of failure that accounts for asset maintenance
- Produce an independent peer review of good practice in deterioration modelling techniques and relevant statistical analysis
- rovide a fundamental resource and key dataset which is software agnostic and builds NGN capability
- Use an innovative dynamic representation of equipment/component level replacement/maintenance to enable 'what-if scenario' analysis
- Demonstrate the connection of models to understand within-site redundancy and failure cascades
- Establish quantitatively true failure rates for assets not run to failure considering maintenance programs
- Demonstrate the ability for rapid scenario analysis to inform investment, maintenance and resource planning to result in an improved maintenance resource utilisation
- Establish a key stepping stone that would allow future integration of a systems approach to optimising asset investment and maintenance

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be deemed successful, if

- Knowledge on advanced statistical modelling approaches to the NGN project team has been transferred
- Statistical modelling approaches that can be integrated with existing and future systems/tools have been delivered
- The potential benefit of application of advanced statistical modelling approaches developed through the project has been quantified

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

Within this project five distinct asset configurations will be modelled that will cover a range of PRS, DG and LTS assets. The five models will cover all permutations across these assets.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL7 Inactive Commissioning

Geographical Area

A collaborative approach between NGN, WRc and BMA will be taken to deliver this project. Work will be undertaken at each of the company's premises with workshops and meetings at appropriate locations, most likely to be NGN offices. The asset configurations which will be modelled in this project all form part of NGN's network.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£166,970

£139,155 total external cost (x1.3332 internal funding calculation) = £185,522

£185,522 x 90% (recoverable NIA funding) = £166,970

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)

Benefit: Saving 20 Days of Consultant Fees per year.

Assumption: £700/day (conservative)

%: 50%

Value: (£K/pa) 7.

Value over RIIO-GD2 (£k): 56

Benefit: Maintenance Expenditure saving.

Assumption: 1% per year (conservative)

%: 1%

Value: (£k/pa): 46

Value over RIIO-GD2 (£k): 368

Benefit:Capex deferral over RIIO period

Assumption: 1% per year (conservative)

%: 1%

Value (£k/pa): 152

Value over RIIO_GD2 (£k): 1,217.

Total:

Value (£k/pa): 205

Value over RIIO_GD2 (£k): 1,641

Please provide a calculation of the expected benefits the Solution

See Above.

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

The knowledge and methodologies developed through this project would be directly applicable to other GDNs. The exact statistical modelling approaches developed here would have to be configured to other GDN asset specific factors and software platforms.

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

The costs of rolling this method out across GB is difficult to outline given that there will not be a 'unit' cost against the output of the project. However, the method undertaken is directly applicable across all GDNs and it can be assumed that for a similar expenditure to this project the configuration of the specific GDN asset factors and software platforms could be achieved. It is assumed that this would be scalable by the amount and complexity of data.

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 knowledge and methodologies developed through this project would be directly applicable to other GDNs. The exact statistical modelling approaches developed here would have to be configured to other GDN asset specific factors and software platforms.

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

☑ Yes