

## NIA Project Registration and PEA Document

### Date of Submission

Sep 2017

### Project Reference Number

NIA\_NGGT0115

## Project Registration

### Project Title

Valve Care Toolbox

### Project Reference Number

NIA\_NGGT0115

### Project Licensee(s)

National Gas Transmission PLC

### Project Start

September 2017

### Project Duration

0 years and 9 months

### Nominated Project Contact(s)

Mick Jarvis; Josh Eades (PMC);  
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### Project Budget

£182,740.00

## Summary

National Grid is seeking to respond to a set of valve related problems, initially thought to be caused by the widespread ingress of water into valve stem extension assemblies. This water ingress can lead to:

- Internal corrosion of the torque tube and of the valve stem.
- Corrosion debris fouling the lower quadrant mechanism.
- Internal seal/flange damage. These effects can lead to failure of the valve to operate on demand having serious implications on the safe management of the National Transmission System (NTS). This water ingress is likely to come from one or more of:
  - Weather seal failure on the actuator or stem.
  - Rain water entry through the breather / vent cap or vent hole (where the vent plug has been removed or damaged).
- Condensation inside the valve stem accumulating in the bottom until it fills up.
- Through a combination of a high water table and a leaking bottom flange.

The annulus between the stem and the torque tubing, with a ready supply of water, oxygen and untreated metal, is therefore an ideal environment for corrosion to occur.

Periodic inspection is carried out on the valves every 12 months (critical infrastructure) or 24 months (noncritical). This work usually starts with closure of the valves and a vent down of the system; if the valves are passing and the pressure cannot be bled off this indicates that a valve is passing. This may be due to incomplete valve closure.

The full spectrum of valve failure scenarios that could be caused by corrosion in torque tubes is very broad. It is extremely unlikely that a single solution will be appropriate for all cases, and inconceivable that any such solution will be universally applicable. With the Valve Care Toolbox approach, there will be a number of engineering solutions available thus improving the effectiveness of the remedial actions taken.

## Third Party Collaborators

Steer Energy

## Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

## Problem Being Solved

National Grid is seeking to respond to a set of valve related problems, initially thought to be caused by the widespread ingress of water into valve stem extension assemblies. This water ingress can lead to:

- Internal corrosion of the torque tube and of the valve stem.
- Corrosion debris fouling the lower quadrant mechanism.
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These effects can lead to failure of the valve to operate on demand having serious implications on the safe management of the National Transmission System (NTS).

## Method(s)

The proposed solution is a phased using a focused feasibility and evaluation approach to develop a Valve Care Toolbox (VCT) of options for addressing valve stem corrosion. Where practical, the work will seek to propose a range of suitable methods so as to provide multiple layers of protection and assurance for each valve asset. The initial set of solutions to be covered in this phase of the programme can be grouped in the following topic areas:

- Assessing the condition of infrastructure and the corrosion environment.
- Cleaning out the environment within the torque tube.
- Protecting the valve stem assemblies by:
  - Prevention of the onset of corrosion.
  - Arresting further degradation.
  - Remediation where degradation has already occurred.

The feasibility of providing ongoing non-intrusive condition monitoring for repairs could be investigated. This would provide an earlier and less disruptive indication of the condition of the mechanisms leading to valve failure and complement the periodic inspection and maintenance carried out by National Grid.

Some valve remediation techniques and technologies already exist; however these generally rely on costly and disruptive excavation. There is a strong desire to look to develop a new toolbox of 'no dig' valve options. The initial focus will be on valve sizes from 24" (600mm) to 36" (900mm) diameter as these constitute the majority of the NTS valve population.

It is proposed that the initial solution set developed will:

- a) Not require excavation.
- b) Ideally be deployed without the use of lifting equipment, such as a crane. (N.B. the actuator can be removed from the system whilst it is still on-line).
- c) Be adaptable in its deployment so as to suit a variety of access points.
- d) Allow for verification and continued monitoring of the protection measures, as well as permitting routine maintenance.
- e) Permit free movement of the valve stem.
- f) Work across the wide temperature range found in the UK.
- g) Any assessing measures will focus on determining the degree of corrosion.
- h) Any cleaning measures will remove the significant fouling which can be found at the valve quadrant stops.
- i) Any protecting measures must prevent continued corrosion.

This project is structured to identify new ideas and then challenge their appropriateness using basic engineering tools and techniques. The project will also encompass a work-package to carry out early-stage prototype testing in the field.

Following the completion of the programme, National Grid will review the candidate valve care options developed and look to enhance and promote these through the business where appropriate. Those solutions that require further development or analysis will be formulated into other work packages for consideration to provide the best set of options to meet future business needs.

## Scope

National Grid is seeking to respond to a set of valve related problems, initially thought to be caused by the widespread ingress of water into valve stem extension assemblies. This water ingress can lead to:

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## Objective(s)

The key objectives from this feasibility and evaluation phase will be:

1. The development the of technical valve care toolbox concepts.
2. Feasibility assessments of concepts, likely to include some prototyping and testing.
3. Validation exercise, including physical testing of key ideas/concepts/technologies.
4. Interim Reports outlining:
  - a. Technical Requirements of any solution to be developed.
  - b. Concepts hierarchy and descriptions of the individual concepts.
  - c. The process behind the development of the shortlist of concepts.
  - d. An initial assessment of the feasibility of these concepts and the technical challenges.
5. Final Report outlining:
  - a. Overview of full project
  - b. Learnings from Validation Exercise
  - c. Recommended ways forward and technology developments to be proposed for future phases.

## Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

## Success Criteria

The programme has been structured (via a Work Package (WP) Stage Gates) to ensure the respective benefits outlined below are demonstrated:

WP1: Confirm the challenges of the solution and develop a screening process to choose the most appropriate techniques to move forward.

WP2: Provide a full view of potential solutions (idea generation) and outline a long list of solutions (initial screening).

WP3: Carry out an Engineering Screening Process to determine the initial feasibility of the long list of solutions.

WP4: Recommend an initial list of solutions to be taken forward with appropriate costs.

WP5: Validate and Test initial concept ideas.

## Project Partners and External Funding

n/a

## Potential for New Learning

n/a

## Scale of Project

The programme will provide a toolbox of options and field trial an initial set of potential solutions.

## Technology Readiness at Start

TRL4 Bench Scale Research

## Technology Readiness at End

TRL6 Large Scale

## Geographical Area

All work will be conducted in the UK and only involve Gas Transmission (valve) assets.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

£182,740

## 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)

Projected cost savings: £265,000/valve where the Valve Care Toolbox provides a remediation solution negating the need for total valve replacement.

#### Please provide a calculation of the expected benefits the Solution

Background:

Total number of NTS valves which could exhibit valve stem issues during working life: 9,988

Projected values to be replaced in 2017/18: 143

Average Unit cost of valve replacement: £300,000 (Base cost)

Projected percentage of effective valve stem remediation due to Valve Care Toolbox, negating valve replacement: 15%

Projected average cost of Valve Care Toolbox remediation: £35,000/valve.

Potential projected average cost saving due to Valve Care Toolbox: £265,000/valve.

Potential cost savings due to Valve Care Toolbox: £6.3M (Base) – £750k = £5.55M (for case presented above)

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

The development of a robust Valve Care Toolbox capability, with the approach incorporated within the respective National Grid standards set would make the techniques portable to other Network Licensees. The value issues experienced between Licensees are likely to be compatible.

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

Full implementation of the Valve Care Toolbox is projected to be via webinars, and standard update briefings with some provision for the development of appropriate training material and modules. Projected roll out cost across the NTS is considered to be ~£500,000.

### 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 programme will offer insight into the potential utilising a range of valve stem redial options. While the work will concentrate of NTS valve assets, it is envisaged that the concepts and solutions around valve stem repair will be applicable to all gas network Licensees.

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

The programme will address the issues around valve stem and provide a toolbox of options to assist with effective repair.

- 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