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

May 2014

Project Reference Number

NIA_NGGT0022

Project Registration

Project Title

National Transmission System (NTS) Constraint Modelling

Project Reference Number

NIA_NGGT0022

Project Licensee(s)

National Gas Transmission PLC

Project Start

May 2014

Project Duration

3 years and 1 month

Nominated Project Contact(s)

Toby Thornton, box.GT.innovation@nationalgrid.com

Project Budget

£330,000.00

Summary

National Grid has a need to identify capacity constraints inherent in the operation of the NTS that may lead to significant financial penalties in certain supply and demand scenarios and the likelihood that these scenarios may arise.

The current approach is based on a knowledge database approach in which scenarios are first checked against a database of historical experience and previous calculations to seek a match with a previously encountered scenario. If so, experience or previous calculations will be a good indicator of whether capacity constraints could cause problems. If no such previous example is found, an assessment is conducted using full set of network calculations (SIMONE) driven by manual interventions of an expert analyst. The results of such assessments are then added to the database.

While the current forecasting approach requires a manageable computational overhead, as the number of inputs to the model increase this overhead may become unrealistic. To maximise the efficiency of the forecast process and to take cognisance of the latest statistical and forecasting management techniques a more holistic innovative solution needs to be considered. This programme aims to deliver some of these objectives by imbedding current best practice within the current processes offering improved NTS capacity management.

Third Party Collaborators

University of Warwick

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

One aspect of the safe and efficient operation of the gas transmission system (NTS) is the ability to accurately forecast the network capability to maximise its operational effectiveness. This is particularly important in the area of network capacity as it is imperative that all users have unimpeded access to the NTS. System capacity constraints have to be imposed when the amount of gas users wish to flow onto or off the NTS would result in operation outside its allowed safe design limits. Improved capacity forecasting tools would give National Grid greater capacity management flexibility of the NTS.

Method(s)

The programme will have two inter-related deliverables as follows:

1. National Grid's current procedure will be compared with the latest theoretical and practical techniques employing statistical emulators and algorithms to improve the current procedure. This will include analysis of the following:

o Refine end-of-day analysis to within-day transient.

o Create a dashboard with potential risks (such as supply losses or compressor trips) that might cause constraints identified for chosen timescale e.g. day-ahead.

o Include linepack changes within the analysis.

o Optimise compressor fuel usage.

2. The automation potential of some of the solution strategies used by the analysts in seeking to achieve feasible flows for a particular supply-demand scenario will be reviewed. Methods such as knowledge-based or rule-based expert systems or neural nets will be considered for this purpose.

Change requirement to extend the project completion date is due to a delay in appointing the postdoctoral research fellow at Warwick University to undertake the above deliverables.

Scope

National Grid has a need to identify capacity constraints inherent in the operation of the NTS that may lead to significant financial penalties in certain supply and demand scenarios and the likelihood that these scenarios may arise.

The current approach is based on a knowledge database approach in which scenarios are first checked against a database of historical experience and previous calculations to seek a match with a previously encountered scenario. If so, experience or previous calculations will be a good indicator of whether capacity constraints could cause problems. If no such previous example is found, an assessment is conducted using full set of network calculations (SIMONE) driven by manual interventions of an expert analyst. The results of such assessments are then added to the database.

While the current forecasting approach requires a manageable computational overhead, as the number of inputs to the model increase this overhead may become unrealistic. To maximise the efficiency of the forecast process and to take cognisance of the latest statistical and forecasting management techniques a more holistic innovative solution needs to be considered. This programme aims to deliver some of these objectives by imbedding current best practice within the current processes offering improved NTS capacity management.

Objective(s)

This programme will provide a unified set of automated NTS capacity forecasting tools, utilising the latest statistical methods and algorithms enhancing National Grid's capacity management of the NTS with attendant benefits for all users.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The programme will enhance the future capacity management of the NTS, providing a suite of flexible forecast tools that dovetail with National Grid's existing network modelling software.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The programme will be a desk top review with a formal report as output, for the research and learning, to facilitate internal development of working tools as part of a close collaborative approach to the project.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

These standards documents provide the safety, legislative and operational framework for the National Transmission System (NTS) in the UK.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£330,000

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 key benefits of the project are associated with reducing disruption and costs to customers. Supply disruptions to direct connections (power stations, industrial sites, distribution networks) on the NTS are extremely costly and disruptive. Estimates of the impact of costs are difficult to calculate accurately but each incident is likely to cost at least £100k but can run into millions of pounds.

This tool will improve capability in terms of managing capacity and the process for identifying capacity constraints inherent in the operation of the NTS. Improved identification of these scenarios will result in enhanced operation of the NTS, increased customer satisfaction and reduced risk that constraint scenarios may arise.

Please provide a calculation of the expected benefits the Solution

N/A Research Project

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

The programme will provide a specific NTS constraint forecasting tool for National Grid Gas Transmission. It is not envisaged that the tool will have any additional applicability outside the gas transmission business, however the research and learning could find applicability in instances where risk based analysis would be advantageous.

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

No implementation costs are envisaged.

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 provide a clearer identification of matching network behaviour using methodologies such as Monte-Carlo Markov Chain Generalised Linear Models. Development of these techniques could find applicability in instances where risk based analysis would be advantageous.

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