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NIA Project Registration and PEA Document

Date of Submission

Oct 2015

Project Reference Number

NIA_NGGT0075

Project Registration

Project Title

Enhanced Operational Forecasting

Project Reference Number

NIA_NGGT0075

Project Licensee(s)

National Gas Transmission PLC

Project Start

September 2015

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Rhys Ashman, Ben Parkinson, Abhijit Dash

Project Budget

£322,200.00

Summary

Historically, the short-term operational planning process has used forecasting tools developed using algorithms and data appropriate for the provision of sufficiently accurate end-of-day supply and demand volumes over the week-ahead time horizon, the results of which have aided in the development of effective operational strategies for the GNCC as well as market facilitation through external publication.

Whilst these tools were fit for purpose in more ‘traditional’ gas years, the gas market has become increasingly volatile in recent years. Drivers of this change include, but are not limited to

- decreasing UK continental shelf supplies
- increasing price sensitive European and global imports (e.g. interconnectors and liquefied natural gas)
- increasing price sensitive demands (e.g. interconnectors and storage)
- increasing and more volatile power station demand in response to increased wind generation
- decreasing reliance on low pressure gas storage by distribution networks
- increasing system access requirements

all leading to increasing day-to-day and within-day supply and demand volatility. As a result, current forecast accuracy has become limited by an inability to model the gas market in sufficient detail and there is risk that, without research and development into enhanced forecast methods, GSO’s ability to sufficiently plan and prepare the NTS will be compromised, leading to an increase in consumer costs through inefficient asset operation and increased constraint management and trading costs.

To mitigate this risk, this project aims to gather detailed requirements for and subsequently research, develop and deliver a new prototype solution capable of providing sufficiently accurate combined supply and demand forecasts over the week-ahead time

horizon. In particular, to address those challenging market behaviours detailed above, the project aims to include within the tool

- an improved treatment of price sensitive supplies and demands
- enhanced modeling of gas and electricity market interactions
- forecast confidence levels to better quantify the level of uncertainty
- forecast within-day flow rates in addition to end-of-day volumes
- the ability to be easily or automatically updated such that it remains fit for purpose

all of which are new and as yet unproven capabilities for GSO's short-term planning process.

Third Party Collaborators

baringa

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

Short term supply and demand forecasting is a critical first step in the safe, efficient and reliable operation of the gas National Transmission System (NTS), used to prepare operational strategies for the Gas National Control Centre (GNCC) and to facilitate the market via external publication. Financial incentives on forecast accuracy further underline their importance.

However, forecasting to sufficient accuracy over the week-ahead time horizon is becoming increasingly difficult as a direct result of an increasingly volatile gas market. Decreasing UK continental shelf supplies, increasing price sensitive supplies and demands, greater and increasingly volatile gas-fired power station demand and decreased reliance on low pressure storage are all contributing to increasing day-to-day and within-day supply and demand volatility.

The result then is a significant risk that existing forecasting tools, which provide a limited treatment of the effects listed above, will become unfit for purpose. This in turn would compromise Gas System Operation's (GSO's) ability to adequately prepare the network, leading to rising consumer costs both through inefficient day-to-day and within-day utilisation of assets and commercial options as well as increased constraint management and trading costs associated with unforeseen, and therefore unprepared for, market conditions.

Method(s)

This project aims to gather detailed requirements for, research, develop and deliver a new prototype solution capable of providing sufficiently accurate combined supply and demand forecasts over the week-ahead time horizon given an increasingly volatile gas market.

In particular, the project will investigate enhanced modelling of those behaviours that limit current forecast accuracy (e.g price sensitive supply and demands and interactions between gas and electricity markets) as well as provide new, more detailed and computationally intensive outputs (e.g forecast confidence levels and within-day flow rates), all of which are new and as yet unproven capabilities for GSO's short-term planning process. If successful, the outcomes of this project could then form the basis of a systematized, online tool through the iGMS Evolution Project to allow greater access to the tool, for instance within the GNCC.

The prototype tool will be developed with Baringa Partners LLP, who have a proven record of gas market modelling. Detailed requirements will be gathered with key stakeholders within National Grid, followed by periods of approach definition, prototyping and calibration before the tool can be fully embedded and tested against the current suite of supply and demand forecasting tools.

Scope

Historically, the short-term operational planning process has used forecasting tools developed using algorithms and data appropriate for the provision of sufficiently accurate end-of-day supply and demand volumes over the week-ahead time horizon, the results of which

have aided in the development of effective operational strategies for the GNCC as well as market facilitation through external publication.

Whilst these tools were fit for purpose in more 'traditional' gas years, the gas market has become increasingly volatile in recent years. Drivers of this change include, but are not limited to

- decreasing UK continental shelf supplies
- increasing price sensitive European and global imports (e.g. interconnectors and liquefied natural gas)
- increasing price sensitive demands (e.g. interconnectors and storage)
- increasing and more volatile power station demand in response to increased wind generation
- decreasing reliance on low pressure gas storage by distribution networks
- increasing system access requirements

all leading to increasing day-to-day and within-day supply and demand volatility. As a result, current forecast accuracy has become limited by an inability to model the gas market in sufficient detail and there is risk that, without research and development into enhanced forecast methods, GSO's ability to sufficiently plan and prepare the NTS will be compromised, leading to an increase in consumer costs through inefficient asset operation and increased constraint management and trading costs.

To mitigate this risk, this project aims to gather detailed requirements for and subsequently research, develop and deliver a new prototype solution capable of providing sufficiently accurate combined supply and demand forecasts over the week-ahead time horizon. In particular, to address those challenging market behaviours detailed above, the project aims to include within the tool

- an improved treatment of price sensitive supplies and demands
- enhanced modeling of gas and electricity market interactions
- forecast confidence levels to better quantify the level of uncertainty
- forecast within-day flow rates in addition to end-of-day volumes
- the ability to be easily or automatically updated such that it remains fit for purpose

all of which are new and as yet unproven capabilities for GSO's short-term planning process.

Objective(s)

This project aims to research, develop and deliver an offline, prototype, supply and demand forecasting tool with the as yet unproven functionality described in the *Scope* (above) to continue to provide effective operational strategies to the GNCC, as well as facilitate the market through external publication, in light of an increasingly volatile gas market. The tool will also be fully compatible with NGGT's simulation and decision support packages, used to develop such physical and commercial strategies.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The delivery of an offline, prototype, supply and demand forecasting tool with the functionality described in the *Scope* (above), tested and assessed against the current range of operational forecasting tools in terms of accuracy (including against the demand forecasting incentive already in place), ability to recreate market behaviours and functionality (including compatibility and ease of use with existing downstream processes/tools).

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The prototype tool will be an offline, desktop application that will be trialed and, if successful, integrated into the ahead-of-the-day operational process, preparing physical and commercial strategies for the safe and efficient operation of the NTS as well as publishing externally to industry.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL6 Large Scale

Geographical Area

The development of the prototype tool will be largely undertaken at the London offices of Baringa. Engagement with relevant NGGT stakeholders (e.g. meetings, workshops etc.) will be required either onsite or at Baringa's offices to scope, design, test and eventually embed the tool within GSO.

Revenue Allowed for the RIIO Settlement

NIL

Indicative Total NIA Project Expenditure

£322,200

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)

Supply and demand forecasting is the backbone of National Grid's gas transmission operational processes, driving efficient asset utilisation and facilitating physical and commercial management of the NTS.

Anticipated Changes in the future

Based on 'Change Driver' analysis carried out in 2015 by National Grid, using a new scenario-forecasting methodology based on its Future Energy Scenario data, the following statistics were obtained;

{C}1. Total NTS supply volatility will increase by more than 25% by the year 2020, with number of days in a gas year where there is a day to day supply difference greater than 35 mcm, increasing to 48 days, compared to 38 days forecast to occur in 2016 (Gone Green - FES)

{C}2. The number of days where day to day supply difference is more than 10mcm at key terminals (i.e. Bacton, Easington, St Fergus) will increase dramatically over the years, for example Milford Haven (Up to 100%) by 2020.

{C}3. By 2020, CCGT demand volatility is expected to increase by more than 75%, with the number of days in a gas year where the Day to Day difference in EOD CCGT demand is 15 mcm forecast to increase to 64 days, compared to 36 days forecast for 2016 (Gone Green - FES)

Key Benefits of the Project

Improved preparedness – Proactive avoidance or reduction in disruption and costs to customers

{C}1. Over the last 4 gas years, there have been on an average ~2500 instances where a balancing trade was undertaken by National Grid amounting to more than £100 million of shared- industry costs spent to balance the NTS every year. Both the number and cost of trades could have be reduced if there had been more accurate ahead of the day and within day (i.e. profiles) information available from forecasting models.

{C}2. There is an element of compressor fuel cost expenditure which is due to the least efficient utilisation of assets. On average more than £35 million of shared-industry costs are spent on compressor fuel every year, which could potentially be reduced with improved within-day forecasting in conjunction with forecast end of day information (the accuracy at which forecasting is currently carried out within National Grid), leading to both improved strategy production and utilisation of assets by National Grid.

{C}3. Improved forecasting for the market – The prototype will be calibrated and tested against existing operational forecasting models, with an objective to outperform them, and be more effective in the provision of demand forecast information to the market to assist with gas nominations.

Please provide a calculation of the expected benefits the Solution

N/A

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

The tool will be suitable for offline NTS supply and demand forecasting performed by the Operational Delivery team but could, if successful, be embedded in an online process to facilitate wider access (e.g. the GNCC).

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

N/A

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

If successful, the outputs and new learning from the tool could also be used by distribution networks to better understand their own ahead-of-the-day demands, which in turn could also feed into their own downstream modelling and strategy formation processes

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

Based on the National Grid SO innovation strategy, the following would be supported by the development of this tool: *Reliability and Availability* (aiding the safe, reliable and efficient operation of the NTS through enhanced preparedness), *Market Facilitation*

(facilitating the market through external publication) and *Financial Performance* (helping to outperform on SO incentive schemes including, but not limited to, demand forecasting).

☑ 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