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

Dec 2014

Project Reference Number

NIA_NGGT0066

Project Registration

Project Title

Meter Validation Assessment Tool (MVAT)

Project Reference Number

NIA_NGGT0066

Project Licensee(s)

National Gas Transmission PLC

Project Start

January 2015

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Quentin Mabbutt

Project Budget

£425,000.00

Summary

Unaccounted for Gas (UAG) accounted for £57m and £50.86m commodity costs in 2012/13 and 2013/14 respectively. In 2013/14, this equated to ~£1.12/domestic gas householder/annum. Reduction in UAG has a holistic impact on all gas customers.

UAG is a function of meter error that is normally described in terms of measurement uncertainty. All measurement is commercially referenced in terms of meter uncertainty although during normal service operation, there is no requirement to establish absolute meter uncertainty as a part of the regular meter validation process.

National Grid Gas Transmission is responsible for the management of UAG, although it has limited ownership of the meter asset base. While it has visibility of all meter validations, these are provided in many forms (& sometimes media). The number (over 260) and range of sites make efficient analysis very difficult. This is also compounded by the timeliness of the validation data that makes tracking meter error very problematic.

National Grid has been developing numerous desk based UAG analytical techniques to assist in the day to day management of UAG. These have met with limited success, as any holistic analysis of UAG will include the error in the data. This pollution of the data makes individual site detection very unlikely unless the error is profoundly significant. However, it has long been realised that the annual meter validation data will contain valuable uncertainty information. Unfortunately due to widely differing validation approaches, albeit within the basic framework of the ME2 requirements (tolerances), makes accurate uncertainty and meter performance assessments difficult.

The Measurement Validation Assessment Tool (MVAT) will unify the entire meter validation process for gas transmission, distribution and all direct connected parties either at NTS or DN pressure tiers2. The software will standardise template for the validation process providing uncertainty and a set of gas composition calculations. Users will have a standard user interface (irrespective of platform) and will be provided a unique, secure data portal to which their reports will be uploaded and can then be analysed by National Grid.

MVAT is a unique offering, providing a meter validation capability as yet unavailable and provides the meter asset owner community a universal facility that will provide a level field in terms of data provision. National Grid will also utilize the data to better manage

meter/UAG husbandry by incorporating the uncertainty analysis into the current UAG analysis tools. As MVAT will provide a true set of flow metrics (uncertainty v flow characteristics) it will be possible to begin to map 'true meter uncertainty' with observed UAG behavior. This has not been possible before as there has never been the opportunity to standardise the validation results on a common platform.

Note 2: Some low pressure (<15BarG) meter types (diaphragm, rotary) will not be included in the initial version of MVAP.

Third Party Collaborators

Oxford Computer Consultants

Nominated Contact Email Address(es)

Box.GT.Innovation@nationalgrid.com

Problem Being Solved

National Grid is responsible for the management of Gas Transmission Shrinkage of which the major component is the Unaccounted for Gas (UAG) element and contributed £50.86m to total shrinkage (community) costs in 2013/14. UAG is attributed to meter error as a consequence of measurement uncertainty. Determining the uncertainty profile, across the meter flow range, is only possible when a meter validation is performed and thus this foot printing of the meter provides important information concerning its performance and possible contribution to NTS UAG.
All meter asset owners connected to the gas transmission system (NTS) are obligated to demonstrate compliance with the T/PM/ME2 validation processes. However the presentation of the test results is variable in terms of media and test sets.

Currently the validation results are presented as a static data set which makes dynamic analysis of the results not available to either the asset owners or National Grid. It is the dynamic evaluation of the validation results in terms of the absolute meter measurement against the total reconciliation tolerances (0.1% of daily flow) across its flow range that provide key meter performance information

It is the development of the flow behaviour across the meter range that will enable National Grid to map out potential measurement anomalies which are potential sources of UAG. The development of the Meter Validation Assessment Tool (MVAT) will provide standard validation templates, which will harmonise the ME2 procedure giving more transparency and analysis of the results and thus improving UAG management.

Method(s)

The project will develop a comprehensive meter validation and analysis software to be available for mobile platforms (iOS and Android) that will allow for the easy collection of appropriate meter validation data inclusive of simultaneously performing the necessary and gas property calculations (ISO 6976, AGA8, AGA10), flow equations (ISO 5167, ISO 9951) and established uncertainty assessment (ISO 5168). The application will also provide a detailed build up of the meter performance in terms of the individual validation test tolerances. Upon completion of the validation the data will be automatically uploaded to the dedicated secure server. Each non UKT, user will be restricted to access their respective meter data only via a dedicated login feature.

A desktop application (exclusive to National Grid) will allow all uploaded data to be analysed and the key meter metric data to be exported for further analyses external to the Measurement Validation Analysis Tool.

The mobile interface will ensure standardisation of data entry inclusive of the expected validation tests to be completed. Free text fields and simultaneous gas composition calculations will allow the user to provide a detailed and stardardised validation report. The desktop application will be configured to interface with HPMIS[1] (GMIST) and will thus still enable both systems to be utilized for meter validation data.

Deliverables: Technical

1. Development of the tablet based application "app" (iOS & Android) to include:

- Common code for tablet & desktop
- Calculation engine (Gas Properties)
- Mobile User Interface

2. Development of Desktop & Customer Portal

- Desktop User Interface and HPMIS/GMIST functionality

- Customer data portal and data handling functionality

3. Testing

- Desktop beta testing
- Field based beta testing
- Review and modification following beta testing

4. Deployment

- User Acceptance testing
- Rollout to customer base
- Training & Documentation

Deliverables: Commercial

1. Development of a robust commercial/legal framework to protect data and ensure data analysis freedom.

Note 1: HPMIS High Pressure Meter Information System is the repository of the meter and Calorific Data for the NTS. It's replacement is GMIST that will perform the same functionality but will utilise the SAP portal.

Change Control – July 2015

During the development of the Validation App there have been a number of new features that were not covered in the original scope but have subsequently been considered as offering a high end improvement to the final product. These improvements and additional features allow the application to take advantage of the latest security features, improved user functionality and data input capability. These enhancements include:

{C}· Improved handling of site and configuration details to accommodate variations in validation techniques.

{C}· Improved handling of site assets and calibration equipment details allowing easier user access to upload and store documents within the App.

{C}· Enabling for full functionality off-line validation capability with subsequent automatic portal upload. Not seen as an initial requirement but was considered desirable following user feedback.

{C}· Support customer request to accommodate ME2 spreadsheet submission. This will allow users to upload ME2 data which will then be formatted to be compatible with MVAT for future data storage, analysis and retrieval. This is seen as future proofing the App during the period of user take up.

{C}· Provide a dedicated keypad interface to improve data input. Concerns were raised during the initial testing that the iOS/Andriod default keypads were reducing the user experience. A dedicated keypad will be tailored to appropriate data field input reducing potential data error and increasing usability.

{C}· Increasing validation test number to cater for non-standard ME2 user defined requirements. This is seen as broadening the App's appear and reflects the growing need to record addition data within the validation framework.

{C}· Security enhancements to align with latest Cloud hosting requirements.

{C}· Enhancing data extract from the User Portal and improving Validation test management for all users.

{C}· Packaging the Gas Properties Calculation engine into a standalone dedicated App. Builds on the excel add-in but provides a unique gas property offering which incorporates the user interfaces (look & feel) of the main Validation App.

The change control request increases the original budget by £62,650. This new scope and cost will enable the project team to deliver a robust and enhanced functioning Validation Tool which will be compatible and improve the user experience for all meter asset owners across the Gas Transmission Network.

Change Control – February 2016

The development of the Meter Validation App (NGage) and its attendant spin out offerings, the gas property calculators NGageCALC App (freely available to download from the iTunes App Store and the Android Playstore) and excel add-in has continued apace. Despite some development difficulties, the generic Apps were launched at the LCNI Conference in November 2015.

To complete the final stages of the App development and support a rigorous User Acceptance Testing (UAT) phase additional time is required. This Change Control request pushes out the final delivery date to September 2016. This will ensure the validation tool has undergone comprehensive testing and evaluation during the 2016 meter witnessing programme.

Change Control – June 2016

During the final stages of product development, there were three key areas where there were some inconsistencies between the requirements and the final product. These were:

- The necessary background tables to allow all users to conduct their validations with all degrees of freedom were required to be added.
- The Tolerance calculator was requiring additional resource to provide the complete calculation engine as expected.
- The NGageCALC App required some small enhancements to improve the user experience (printing and saving analysis for future reference).

Scope

Unaccounted for Gas (UAG) accounted for £57m and £50.86m commodity costs in 2012/13 and 2013/14 respectively. In 2013/14, this equated to ~£1.12/domestic gas householder/annum. Reduction in UAG has a holistic impact on all gas customers.

UAG is a function of meter error that is normally described in terms of measurement uncertainty. All measurement is commercially referenced in terms of meter uncertainty although during normal service operation, there is no requirement to establish absolute meter uncertainty as a part of the regular meter validation process.

National Grid Gas Transmission is responsible for the management of UAG, although it has limited ownership of the meter asset base. While it has visibility of all meter validations, these are provided in many forms (& sometimes media). The number (over 260) and range of sites make efficient analysis very difficult. This is also compounded by the timeliness of the validation data that makes tracking meter error very problematic.

National Grid has been developing numerous desk based UAG analytical techniques to assist in the day to day management of UAG. These have met with limited success, as any holistic analysis of UAG will include the error in the data. This pollution of the data makes individual site detection very unlikely unless the error is profoundly significant. However, it has long been realised that the annual meter validation data will contain valuable uncertainty information. Unfortunately due to widely differing validation approaches, albeit within the basic framework of the ME2 requirements (tolerances), makes accurate uncertainty and meter performance assessments difficult.

The Measurement Validation Assessment Tool (MVAT) will unify the entire meter validation process for gas transmission, distribution and all direct connected parties either at NTS or DN pressure tiers2. The software will standardise template for the validation process providing uncertainty and a set of gas composition calculations. Users will have a standard user interface (irrespective of platform) and will be provided a unique, secure data portal to which their reports will be uploaded and can then be analysed by National Grid.

MVAT is a unique offering, providing a meter validation capability as yet unavailable and provides the meter asset owner community a universal facility that will provide a level field in terms of data provision. National Grid will also utilize the data to better manage meter/UAG husbandry by incorporating the uncertainty analysis into the current UAG analysis tools. As MVAT will provide a true set of flow metrics (uncertainty v flow characteristics) it will be possible to begin to map ‘true meter uncertainty’ with observed UAG behavior. This has not been possible before as there has never been the opportunity to standardise the validation results on a common platform.

Note 2: Some low pressure (<15BarG) meter types (diaphragm, rotary) will not be included in the initial version of MVAP.

Objective(s)

To develop a comprehensive meter assessment tool. This will provide the user with a detailed set of functionality (uncertainty calculations/gas composition property determination) on standard mobile (iOS, Android) platforms. The MVAT suite will also provide a customer server portal for the storage of validation data.

The MVAT will standardise the meter validation process providing a ready source of analysis data for both further analysis in the management of UAG (National Grid) and meter asset performance (owner).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

It is proposed to evaluate the project in terms of the following success criteria:

1. **Meter Uncertainty** - The introduction of MVAT will provide a range of data currently unavailable to improve the management of UAG. The consistency of the validation approach will provide a clearer view of meter performance in real time and this is expected to encourage a more proactive re-basing of meter components. This re-trimming will be captured by the validation process and will result in meter systems with a reduced uncertainty range following validation.
Success Criteria: - Increase of 50% in number of meters with improved measurement uncertainty following validation.

2. **UAG Volumes (Energy)** - MVAT will enable a greater control over the annual UAG volumes, particularly in relation to significant movements (bias) in behavior as a consequence of meter error. MVAT will help National Grid to maintain the current diminution of annual UAG levels over the last few years. Success Criteria: Continued reduction in UAG levels but MVAT assists in the determination of any measurement error identification.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

The proposed project is the development of a complete meter validation and analysis package. To realise the full potential of MVAT, all aspects and functionality will be required at roll out. It is proposed that there will be no variants of the code, each prospective user will be using the same version as this eases customer support and maintenance.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

UK based application. Available to all transmission and distribution[3] meter asset owners.

Note 3: Some low pressure (<15BarG) meter types (diaphragm, rotary) will not be included in the initial version of MVAP.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£425k

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)

MVAT will enhance National Grid's management of UAG while also supporting the meter asset owners to demonstrate compliance with their meter validation obligations.

The roll out of MVAT will be from mid-2015 (early adopters) and through 2016 and it is forecast that the 2016 validation period will see the full impact of the software suite.

Please provide a calculation of the expected benefits the Solution

Base cost (2013/14): £50.86m (UAG cost to the community)

Method cost (2015/16) : £46.83m

The £4.03m reduction in UAG community costs is attributed directly to MVAT (cost base @ 2013/14 average)

The Method cost is related to a forecast 400GWh reduction in UAG for 2015/16 year as a consequence of enhanced meter asset owner behavior and improved meter uncertainty as a consequence of the use of MVAT.

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

Estimated take up:

DNOs :- 100% Rollout Potential (Likely uptake 75%)

Third Party Validation Houses:- Roll out potential:- 100% (4) Likely uptake 100%

Other Third Party Validation:- Roll out potential :100% (40 sites) Likely uptake 30-100%

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

The MVAT "app" will be freely distributed and fully supported by National Grid through the provision of support and customer data handling portal.

MVAT Roll Out Costs

1. Provision of web based app portal and support: £10,000

2. Provision of dedicated server for customer portal: £24,000

MVAP annual running costs

1. Provision of Web based app portal and support: £10,000

2. Provision of Customer Web portal and support: £40,000

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 MVAT will be available to all meter asset owners connected to the NTS and will provide a standard meter validation data set. Analysis of this data will offer considerable insight into the efficiency of transmission measurement while improving asset management and cost minimisation through control of UAG and meter reconciliations.

MVAT will be applicable for the validation process of all industrial gas measurement equipment thus providing a standard validation regime across the gas community.

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

MVAT will enhance NTS measurement and cost apportionment by improving the data quality of validation of measurement assets. The software suite will be an enabler to improve meter asset management, promoting a consistent approach across the community. The tool will enhance system reliability and optimise meter asset management. The customer data hub will also improve technical engagement and information exchange with all meter asset owners.

☑ 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