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

Feb 2024

Project Reference Number

NIA_CAD0099

Project Registration

Project Title

Customer Demand Profiling for Hydrogen Networks

Project Reference Number

NIA_CAD0099

Project Licensee(s)

Cadent

Project Start

January 2024

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Phil.gaskell@cadentgas.com

Project Budget

£75,000.00

Summary

By analysing global methods of demand forecasting in various industries (e.g, Utilities, NHS, Finance, fuel), this project aims to explore the optimum way to obtain and manage consumer demands and the optimum time period to gather those demands over (e.g. daily demand, 4hr demand etc)

The project will look at customer demand profiling for both on the day and ahead of the day change management.

It will also explore long term forecasting of up to 10 years.

Preceding Projects

NIA_WWU_02_27 - Gas Control System – Impact Assessment (Future requirements)

Third Party Collaborators

White Space Strategy

Nominated Contact Email Address(es)

Innovation@cadentgas.com

Problem Being Solved

Cadent forecasts gas demand over a 24hr balancing period (05:00 – 05:00) using several algorithms based on weather/temperature and historical gas demand data. Although an element of self-learning is embedded in to the algorithms, the method of gathering demand has not changed significantly in over 2 decades. Hydrogen networks are expected to be more commercially driven and so carry greater risks (or opportunities) to Cadent. In their infancy, hydrogen networks will consist of predominantly industrial demand,

which individually have the potential for greater impact on network balance due to the proportionately larger contribution to total demand. In time, domestic demand may also connect to the hydrogen networks.

Algorithmic demand forecasting is currently considered appropriate for the gas networks. However, the accuracy and speed of change of these forecasts should be challenged to ensure they are appropriate for hydrogen.

Inaccurate or untimely hydrogen demand forecasting may lead to system imbalance and the inability to manage safety risks and regulatory, commercial and legislative obligations. The scope of this project is to investigate different global methodologies used in customer demand profiling (e.g. algorithmic, Nominations etc), both proactive and reactive, across a broad breadth of sectors

Method(s)

The project should be split into 3 parts.

Part 1. Investigate the different methodologies used in customer demand profiling (e.g. algorithmic, Nominations etc)

Part 2. Assess the levels of accuracy in each method, balanced with the need for reactivity and currency (e.g. risks of not having enough versus commercial loss).

Part 3. Report on the various tools and recommended methods and associated ROM costs.

Scope

Inaccurate forecasting of demand may lead to system imbalances. This carries a number of risks, some of which are highlighted below.

Risk 1. A safely balanced network, operating within defined parameters (e.g. pressure, temperature) will undergo less stress/fatigue than a network that is cycled over wider parameters. This will lead to less faults/failures and potential outages which, in turn, reduces the costs of operating the pipeline as maintenance should be reduced. Reduced cycling will also extend the life of the assets.

Increased cycling through imbalance will increase the stress/fatigue and in turn increase the associated costs of safely maintaining the pipeline.

Risk 2. An imbalanced pipeline may result in customer demand having to be curtailed/isolated, or additional supply sought, potentially at short notice. These short notice changes may carry financial penalties. However, the primary risk is reputational as Cadent aim to ensure security of supply to all its customers.

Risk 3. Cadent is expected to be operating under a Code similar to the UNC (Uniform Network Code). This will include a balancing period for energy tracking. Imbalance in the Network will cause complexities in allocation and closing out that balancing period. Again, this may result in financial penalties but will result in reputational damage.

Objective(s)

- Identify different methods of forecasting customer demand.
- Assess accuracy, speed, reactivity, and currency.
- Report on findings and recommendations.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

Although not directly focused on consumer vulnerability, a more accurate demand forecast ensures appropriate levels of infrastructure and support are in place, ensuring costs are managed accordingly which in turn could offer lower bills for those in vulnerable situations.

Success Criteria

The success criteria for the project is the delivery of the following.

- A clear view of the breadth and depth of the investigation it has carried out, stretching across multiple functions and sectors where customer demand is necessary.
- An evidence based report highlighting the pros and cons of each method investigated, along with recommendations.
- Any gaps in evidence or suggestions for further analysis identified.

Project Partners and External Funding

N/A

Potential for New Learning

Cadent hasn't changed the way it forecasts gas demand in over 2 decades. Although most of the algorithms it uses have an element of self-learning, they are in the most, the same algorithms that have been in use for those 2 decades. This is mainly due to the levels of accuracy the current methods produce being adequate for the networks and strategies in place.

Hydrogen networks present new challenges in the way they operate, both physically and commercially, and so new methods of forecasting demand should be investigated. The Hydrogen systems are expected to be more commercially driven and so may carry greater risks (or opportunities) to Cadent.

Scale of Project

The project should look at forecasting methods globally.

Technology Readiness at Start

TRL1 Basic Principles

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

The project is not geographically bound.

Revenue Allowed for the RIIO Settlement

Not applicable to this R&D project

Indicative Total NIA Project Expenditure

Total cost = £45k + £20k optional extra = £65k

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:

Pipeline network pressures must be maintained within operational limits to ensure security of supply and safe operation. Forecasting demand is imperative to understanding the daily pipeline usage.

Initial studies suggest that Hydrogen will have higher velocities and lower linepacking (storage) capability meaning that the overall storage held within the pipelines will be vastly reduced (estimated at 70% reduction). This leads to a faster response requirement to maintain balance if one of the demand points changes.

Without accurate demand forecasts the pipeline risks a higher level of cycling and a shortened lifespan

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)

N/A

Please provide a calculation of the expected benefits the Solution

N/A

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

This project is applicable to all gas networks and so is replicable across the UK

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

This is the first phase or a number of projects that will be required to understand how demand, supply and storage will be managed with both hydrogen blend and 100% hydrogen networks. It is therefore not currently possible to estimate roll out costs from this early research project.

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

All hydrogen pipeline operators will be required to carry out some level of demand forecasting. The learning from this project can be used universally across all gas distribution networks.

Many of the findings may also be applicable to the current natural gas demand forecasting process with certain elements potentially applicable to other utilities.

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

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.

None of the gas distribution/transmission networks are currently investigating potential changes to demand forecasting for hydrogen pipeline networks.

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

Hydrogen pipeline networks will behave differently to natural gas networks. All of Cadent's (and the other gas distribution networks) experience is in operating natural gas networks.

Although the electricity system operators work in a much faster paced environment (due to a lack of embedded storage) this new

behaviour is not something Cadent has any experience of.

Relevant Foreground IPR

This is not applicable to this project.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

· A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. Cadent already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.

· Via our Innovation website at https://cadentgas.com/about-us/innovation

· Via our managed mailbox futureofgas@cadent.com

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

The conversion of GB's homes to run on hydrogen, and any of the associated projects which will enable hydrogen conversion cannot be considered as BAU due to their first of a kind nature and risks which go beyond BAU.

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

This project aims to uncover new and innovative ways of managing hydrogen pipelines. There are inherent risks (e.g. operational safety limits may be breached) in getting it wrong due to its first of a kind nature so it is right it should be supported using NIA funding.

This project has been approved by a senior member of staff

☑ Yes