

## NIA Project Registration and PEA Document

### Date of Submission

Jun 2017

### Project Reference Number

NIA\_NGSO0002

## Project Registration

### Project Title

GB Non-renewable Embedded Generation Forecasting Study

### Project Reference Number

NIA\_NGSO0002

### Project Licensee(s)

National Energy System Operator

### Project Start

June 2017

### Project Duration

0 years and 8 months

### Nominated Project Contact(s)

Jeremy Caplin (.box.SO.Innovation@nationalgrid.com)

### Project Budget

£91,500.00

## Summary

The focus of the project will be on 2 to 7 days ahead forecasts and review of all embedded generation fuel types for potential categorisation according to constraints e.g. limited supply (waste), less restricted supply (diesel).

Development of specific embedded generation models for biomass, landfill gas, diesel generation. Consideration will be given to the implementation of these models within the current Energy Forecasting System (EFS) software used in National Grid. A full report with complete model specifications will be produced.

### Nominated Contact Email Address(es)

box.so.innovation@nationalgrid.com

## Problem Being Solved

The amount of embedded generation connecting to the distribution network has increased significantly in recent years. Primarily this embedded generation takes the form of wind and solar PV, though biomass, landfill gas, diesel generation have also increased. In part this is due to commercial mechanisms that make the connection of these technologies viable at lower voltages. The impact is that the electricity demand at Grid Supply Point and therefore national level is reduced. There is no obligation for such distributed technologies connected at lower voltages to install metering and National Grid has no direct visibility of this growth in generation. There is ongoing research into forecasting solar PV and developing models to minimise forecasting errors; NIA\_NGET0170 and NIA\_NGET0177 refer. However, further development is required to address how the increase in other embedded technologies correlate with wind and solar PV and their impact on demand forecasting.

This unknown quantity of non-renewable embedded generation directly relates to how much generation for reserve and response National Grid instructs in order to operate the transmission system. This balancing system cost is socialised across the industry and therefore passed on to consumers. Reducing errors in demand forecasting will bring a clear benefit in lowering these costs.

## Method(s)

For this project, The Smith Institute for Industrial Mathematics and System Engineering will utilise embedded generation data available from ElectraLink.

Embedded generation models will be developed to directly improve forecasting accuracy by accounting for types of embedded generation that are not currently included in National Grid's Energy Forecasting System (EFS) and validate these using mathematical and statistical techniques.

Further learning outcomes will provide insight into fuel type constraints faced by non-renewable embedded generation that impact their operational behaviour with respect to energy forecasting.

## Scope

The focus of the project will be on 2 to 7 days ahead forecasts and review of all embedded generation fuel types for potential categorisation according to constraints e.g. limited supply (waste), less restricted supply (diesel).

Development of specific embedded generation models for biomass, landfill gas, diesel generation. Consideration will be given to the implementation of these models within the current Energy Forecasting System (EFS) software used in National Grid. A full report with complete model specifications will be produced.

## Objective(s)

To design the embedded generation models, this project will

- Investigate how large is their total contribution, and if there characteristic generation profiles for these generators.
- Determine if there a characteristic profiles for the net effect of all the embedded generation (excluding wind and solar as these are weather dependent).
- Identify any there correlations between the net effect of the embedded generation and any other generator type.
- Identify any variables that have a significant impact on the generation profiles for each of the generators.
- Identify incremental project benefit by defining forecasting error with and without the developed non-renewable embedded generation models.

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

n/a

## Success Criteria

- Detailed models of embedded generation (other than wind and solar) resulting from data analysis. These models will be validated for implementation within National Grid's Energy Forecasting System.
- Incremental project benefit demonstrated from the developed embedded generation models.

## Project Partners and External Funding

The project partner is the Smith Institute for Industrial Mathematics and System Engineering. They provide independent advice and services based on the application of mathematical insight and techniques with technical expertise in model design, software implementation and data analysis.

## Potential for New Learning

Characteristic modelling of embedded landfill gas, biomass, and sewage generation and variables that impact their generation profiles (e.g. fuel prices).

## Scale of Project

The project will involve National Grid's Energy Forecasting, Network Planning and Control Room teams in collaboration with The Smith Institute for Industrial Mathematics and System Engineering.

## Technology Readiness at Start

TRL3 Proof of Concept

## Technology Readiness at End

TRL4 Bench Scale Research

## Geographical Area

GB network.

## Revenue Allowed for the RIIO Settlement

None

## Indicative Total NIA Project Expenditure

NIA: £91,500

## 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)

This project will reduce the demand forecast error resulting from increases in embedded generation. Overall savings to consumers are expected from the reduction in system balance costs.

National Grid publishes demand forecasts on Balancing Mechanism Reports website. This information enables industry participants to reduce their imbalance costs by adjusting their generation profiles, thereby passing cost savings onto consumers.

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

Typically National Grid spend £200m per annum on holding an average of 1200MW of generation for margin and fast reserve purposes. It is anticipated that this project will deliver a 20MW reduction in this volume through improved forecasting techniques. This will result in a saving of £3m on balancing system costs.

In addition, there are additional savings through reducing demand error associated with transmission constraints. For an average constrained power flow of 1GW it is estimated that 20% of the cost to secure the transmission network would be saved if there was zero forecasting error i.e. £50m. This project has the potential to reduce error by 20MW thereby saving £1m.

The total saving to consumers from this project is estimated at £4m equating to a return on investment of 44%.

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

The research outputs will be available at closure.

The research learning would be freely available specifically, not the input data per se as that is part of a commercial contract and not NIA funded.

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

No additional costs.

### 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

Outcomes and lessons learnt will be disseminated via project reports on the National Grid Innovation Strategy and ENA websites.

Learning from this project could be used to further understanding of correlations between embedded generation technologies and their impact on network operation.

### 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.

No unnecessary duplication will occur as a result of this project. There are no known innovation projects investigating the impact of non-renewable embedded generation on demand forecasting.

### 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