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NIA Project Registration and PEA Document

Date of Submission

Dec 2021

Project Reference Number

NIA2_NGESO007

Project Registration

Project Title

Decarbonisation of Heat – Integrated Market Study

Project Reference Number

NIA2_NGESO007

Project Licensee(s)

National Grid Electricity System Operator

Project Start

December 2021

Project Duration

0 years and 4 months

Nominated Project Contact(s)

Usman Bagudu

Project Budget

£450,000.00

Summary

The newly developed spatial heat model (https://smarter.energynetworks.org/projects/nia_nggt0154) provides a powerful, peer reviewed platform for generating future GB building heat scenarios at high levels of granularity. The quality of outputs is however dependent on credible data about technology costs and fuel prices that account for whole energy market and policy interactions. Because there's little precedence for the kind of energy system architectures that net zero would require, the input assumptions that go into the existing model must continue to be revised and benchmarked against the latest available data and insight. The project will focus on the Decarbonisation of Heat, specifically heat demand, technology, markets, networks, and policy implications.

Nominated Contact Email Address(es)

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Problem Being Solved

The newly developed spatial heat model provides a powerful, peer reviewed platform for generating future GB building heat scenarios at high levels of granularity. The quality of outputs is however dependent on credible data about technology costs and fuel prices that account for whole energy market and policy interactions. Because there's little precedence for the kind of energy system architectures that net zero would require, the input assumptions that go into the existing model must continue to be revised and benchmarked against the latest available data and insight.

This project is a multi-client research study which will be conducted by Aurora Energy Research. The project will focus on the Decarbonisation of Heat, specifically heat demand, technology, markets, networks, and policy implications. The project brings together power generators, oil and gas majors, power and gas networks, investors and government. The project will provide a detailed internal report with insights and implications for stakeholders, policy and regulation. Additionally, forecast data for power, gas and hydrogen markets and for heating technology deployment in a range of scenarios.

Method(s)

This project will look to undertake the following scope of work:

Aurora will carry out the work in a multi-client study. Work programme comprise the following:

- Build up assumptions on heat demand and technology options and costs
- Develop policy scenarios and define modelling assumptions across each market
- Carry out power, gas and hydrogen market modelling plus technology deployment analysis
- Assess implications of each scenario for consumers and for generators, suppliers and networks
- Determine policy implications

In line with the ENA's ENIP document, the risk rating is scored Low.

TRL Steps = 1 (1 TRL step)

Cost = 1 (£20k)

Suppliers = 1 (1 supplier)

Data Assumptions = 3

Scope

The project will produce insights on the following key questions:

- What trajectories for the development of the heating mix will arise economically under different cost assumptions and constraints?
- What are the consequences of different future mixes of heat technologies for power, gas and hydrogen markets?
- What policy options are available, and what effects are they likely to have for different market participants and for consumer costs?
- How will heating affect the profile and flexibility of electricity demand, and how will that affect revenues for renewables, thermal generation and storage?
- How will peak energy demand be met on extremely cold days, especially if power generation from wind is low?
- How could different global decarbonisation trajectories affect gas prices and the economics of the heating mix?

Objective(s)

We currently estimate about 2.5GW growth in new heat flexibility by 2030, that is electricity demand shifted away from peak which is equivalent to avoided capacity reservation worth £45million (based on £18/MWh auction clearing price on 10/03/2021). This project will produce insight and data to help reduce the current high levels of uncertainty around these estimates. It will help assess if more or less of these savings could be achieved and how network operability will need to evolve to maximise benefits to consumers

The final outputs will be:

- Forecast data for power, gas hydrogen markets and for heating technology deployment in a range of scenarios
- A detailed internal report and more concise external summary report with insights and implications for stakeholders, policy and regulation

Following completion of the study:

- Outputs to be used (directly or indirectly) as input into the Spatial GB Clean Heat Model, the integrated tool for developing FES heat scenarios
- Insight from the project to be used to shape future FES scenario frameworks especially around heat decarbonisation but also in areas like system flexibility, industrial demand, and hydrogen supply and storage.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The ESO does not have a direct connection to consumers, and therefore is unable to differentiate the impact on consumers and those in vulnerable situations. Benefits to all consumers are detailed below.

Success Criteria

The following will be considered when assessing whether the project is successful:

- Insight into key factors that will be used to shape FES scenario frameworks around heat decarbonisation
- Sufficient forecast data which can be fed into our models and frameworks to increase confidence

- Clearer understanding of the relationship between prices and demand for electric heating

Project Partners and External Funding

Aurora Energy Research will be carrying out the work with a total project budget of approximately £450k. Several participants from a range of industries such as, power generators, oil and gas majors, power and gas networks, investors and government are also involved and will be contributing to the project.

Potential for New Learning

The newly developed spatial heat model provides a powerful, peer reviewed platform for generating future GB building heat scenarios at high levels of granularity. The quality of outputs is however dependent on credible data about technology costs and fuel prices that account for whole energy market and policy interactions. Because there's little precedence for the kind of energy system architectures that net zero would require, the input assumptions that go into the existing model must continue to be revised and benchmarked against the latest available data and insight.

Decarbonisation of heat is a growing area of research; we expect follow on projects in this area as the assumptions develop either through technological developments and/or data.

Scale of Project

The project spans 6 months with 12 project partners from a range of different industries and perspectives (regulatory/investment/oil & gas). The project will consist of desk-based research.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

Will be based upon the GB ESO area of operations.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

Network Innovation Allowance: £20,000

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:

Currently, various predictions around the decarbonisation of heat are built largely on assumptions that will depend on many external factors such as policy, markets, technology and networks. This project will produce insight and data to help reduce the current high levels of uncertainty around these estimates. It will help assess if more or less of these savings could be achieved and how network operability will need to evolve to maximise benefits to consumers.

How the Project has potential to benefit consumer in vulnerable situations:

Not required.

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)

RIIO2 project - not required.

Please provide a calculation of the expected benefits the Solution

Not required as research project.

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

As the model scope will covers the whole of GB it will be highly replicable to a high percentage of the network licensees.

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

As this is a research project, the final outputs of the project will aim to give an outline of the potential changes and costs to mitigate these risks.

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 trialed 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

Every network must deal with uncertainty in demand and generation (supply). This project is designed to give insights and recommendations to National Grid ESO and wider stakeholders.

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

Not required.

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.

NIA_SGN0144 – Assessing the Gas Network Decarbonisation Pathway

- Evaluates the decarbonisation pathway set out by the gas networks
- Uses a balanced and electrified scenario
- Does not capture feedback effects of heating pathway on fuel prices

NIA_NGGT0154 – Spatial GB Heat Pathway Model

- Quality of outputs is dependent on credible data about technology costs and fuel prices that account for whole energy market and policy interactions
- Input assumptions that go into the existing model must continue to be revised and benchmarked against the latest available data and insight

NIA_NGTO021 – Decarbonisation vision for South Wales

- Mainly focussed on South Wales Region
- Particularly focussed on the use of decarbonised gas and the reduction of industrial emissions

National Grid ESO - Future Energy Scenarios

- Gives 4 scenarios, with a wide range of possibilities for future heat mix
- Specifies the technology mix and behavioural assumptions in each
- Maps the consequences of the scenarios for fuel demand
- Does not model how market prices could affect technology uptake in different policy settings

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not applicable.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

The study will give a novel, technology-agnostic view, with integrated interaction between heating and the energy markets.

Relevant Foreground IPR

The following foreground IP will be generated from the project:

Report which includes

- Forecast data for power, gas hydrogen markets and for heating technology deployment in a range of scenarios
- A detailed internal report and more concise external summary report with insights and implications for stakeholders, policy and regulation

No Background IPR is required to use these results.

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:

1. A request for information via the Smarter Networks Portal at <https://smarter.energynetworks.org>, to contact select a project and click 'Contact Lead Network'. National Grid ESO already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.
2. Via our Innovation website at <https://www.nationalgrideso.com/future-energy/innovation>
3. Via our managed mailbox box.SO.innovation@nationalgrid.com

Details on the terms on which such data will be made available by National Grid ESO can be found in our publicly

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

Due to the nature of the project and that it is researching potential future impacts to the grid based largely on assumptions, this does not fall into current 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

The learnings from the project can be shared more widely to the Network Licensees which could not be achieved if deemed as BAU activities

This project has been approved by a senior member of staff

Yes