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

Sep 2019

Project Reference Number

NIA_NGTO037

Project Registration

Project Title

Multi energy vector modelling

Project Reference Number

NIA_NGTO037

Project Licensee(s)

National Grid Electricity Transmission

Project Start

October 2019

Project Duration

1 year and 10 months

Nominated Project Contact(s)

Robin Gupta

Project Budget

£354,000.00

Summary

This project will develop a comprehensive whole-system methodology, and a relevant prototype tool, to quantify, with high temporal and spatial resolution, the electricity transmission network infrastructure impacts of heat and transport decarbonisation scenarios. The method, which will consider multi-energy vector modelling of heat and transport, will be demonstrated with comprehensive case studies based on Greater Manchester. The project will also explore innovative solutions to meet future energy demands to deliver cost benefits to the consumers. It will review the traditional way of bottom-up electrical network reinforcement approach.

Nominated Contact Email Address(es)

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Problem Being Solved

The Committee on Climate Change (CCC) “Net Zero” report, published in May 2019, sets out a recommendation to the UK government to adopt a new emissions target for the UK to achieve “net-zero” greenhouse gas (GHG) emissions by 2050. Heat and transport are necessary to decarbonise to achieve net-zero target. Most of the decarbonisation solutions have been proposed based on a Top-down approach i.e. first a GB wide view is developed and then an extrapolation at a regional level is carried out. Top-down approach is necessary to drive policy decisions, however this approach is not suitable for designing the regional solutions because it lacks in accuracy and regional characteristics. Additionally, there are multiple technologies and energy vectors which can deliver decarbonisation of heat and transport sector. Each of them will impact the electrical network differently. A high temporal and spatial resolution modelling is required to evaluate the network impact and for designing the innovative solutions to address the future energy demand.

In this context, the main aim of the project is to develop a comprehensive model with high temporal and spatial resolution to study the impact of various heat and transport decarbonisation solutions on electricity transmission network infrastructure. The project will focus on exemplificative case study of Greater Manchester (GM).

Method(s)

With the aim of exploring the above problems, this project will consider a whole-system approach. More specifically, a bottom-up assessment of heating and transportation energy requirements will be carried out in detail using multi energy vector modelling. A number of sensitivities will be modelled around the scenarios to estimate the impact on network infrastructure. The modelling will be carried out in MATLAB and suitable user interfaces will be designed so as to allow for a prototype tool to be delivered at the end of the project which could be used by National Grid to run more similar studies in the future. The project will review the traditional way of bottom-up reinforcement options and explore the innovative ways to meet the future energy demand resulting from decarbonisation of heat and transport.

Scope

Work Package 1: Spatial and temporal modelling of energy demand of Greater Manchester region to decarbonise heat and transport for meeting net-zero target and assessing the impact of various sensitivities.

Work package 2: Designing innovative solutions
This work package will focus on designing innovative solutions which delivers value to the consumers by reducing network reinforcement requirements, whilst delivering our decarbonisation targets. It will also include the high-level cost-benefit analysis of these solutions. Few of the solutions are supplying heat demands using heat-networks, clustering of load and connection at high voltages, utility scale storage (including hydrogen storage) to meet the energy demand for extreme weathers etc.

Work package 3: “Whole-system analysis” tool development
This work-package will develop a MATLAB tool for carrying out similar analysis for other regions in future

Objective(s)

1. Assess the impact of different solutions, for the decarbonisation of heating and transport, on the electricity transmission network infrastructure requirements by multi energy vector modelling.
2. Develop a prototype tool for whole system modelling with high spatial and temporal resolution.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be considered successful if it delivers the following:
1. Analyse the impacts of decarbonisation of heat and transport on electricity transmission network infrastructure using multi-energy vector modelling.

2. Delivers a tool to allow whole system modelling of future scenarios and technologies.

Project Partners and External Funding

n/a

Potential for New Learning

The bottom-up methodology developed in this project could be extended to cover other regions across GB to produce bottom-up regional models. It will also analyse different options to meet future energy demands effectively, which can also be used in the context of other regions.

Scale of Project

The project will assess the impact of decarbonisation of heat and transport for GM region and develop a tool to carry out whole system modelling. If required, the developed tool and the learnings from the project can be used to expand the analysis to cover other GB regions. A larger project to cover other GB regions is not presently required, and a smaller project would leave the analysis of GM region under developed.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

Desk top based project. GM will be considered as a case study.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£354,000

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:

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)

The network reinforcement can cost several billion pounds to address the need of decarbonisation of heat and transport sector. This project is aimed at examining the impact of decarbonization of heat and transport on electrical networks, which may lead to solutions thatreduces the cost of reinforcement. Therefore, the project may result in significant savings in the order of few hundred million pound, if successful.

Please provide a calculation of the expected benefits the Solution

This is a research project.

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

It is proposed that this project will have a geographical coverage of GM, however the learnings can be easily extended to cover other geographical areas. Therefore, all Network Licensees in GB should benefit from the learning from this analysis and will also be able to use the resulting geographical datasets that will be made available. The methods developed and used to carry out this work should also be replicable by all Network Licensees once documented.

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

This research project is aiming to use a software which is MATLAB based. Therefore, the costs

associated to replicate this project will largely be for human resource cost to carry out the work proposed along with the cost of MATLAB software license.

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 project is aimed at analysing the impact of decarbonisation of heat and transport on electrical transmission network infrastructure and assessment of various options to meet the demand to reduce the cost of overall network reinforcement required. All methods developed and used for this project will be applicable by all other relevant Network Licensees.

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

Efficient Build - Building new assets faster and at lower capital and whole-life costs

☑ 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.

There are number of projects which are ongoing or completed which touch upon the similar subject. NIA_NGGT0071 has explored the possibility of district heating to inform future energy scenario analysis. NIA_ENWL001 has done a significant work for modelling of heat-pump loads and analysis of the impact on distribution network. NIA_WWU_032 has reported literature review for multiple technologies for addressing heat demand. NIA_SPEN_0045 will perform postcode wide analysis for heat demand across GB. The current project will use the output and learning from these projects and other publicly available information. However, the project will carry-out multi energy vector modelling in context of Net-Zero goal and review bottom-up reinforcement requirements by exploring innovative ways of meeting future energy demand resulting from decarbonisation need of Heat and Transport sector. Therefore, there is no duplication.

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

The multiple energy vector modelling has not been tried before. The project will also explore the alternatives to bottom-up network reinforcement, to meet growing electricity demand resulting from decarbonisation of heat and transport, to reduce the cost of the reinforcement.

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

The project is long term research project and does not deliver any quantifiable cashable benefit at this stage. NGET is unable to consider research of this scale as business-as-usual. The NIA funding offers the most appropriate route for NGET to carry out multi-energy vector based regional analysis.

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 inherent risk of the project is detailed above and the learning from the project will be directly relevant to all Network Licensees. For this reason, NGET believe this project is appropriately funded through NIA.

This project has been approved by a senior member of staff

☑ Yes