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

Nov 2019

Project Reference Number

NIA_NGTO040

Project Registration

Project Title

Zero-2050: South Wales (Whole system analysis)

Project Reference Number

NIA_NGTO040

Project Licensee(s)

National Grid Electricity Transmission

Project Start

November 2019

Project Duration

1 year and 9 months

Nominated Project Contact(s)

Linwei Chen

Project Budget

£1,288,150.00

Summary

The most efficient way to meet “Net Zero” target is a whole system design approach and cross-sector collaboration. ‘Zero-2050: South Wales’ will bring diverse stakeholder groups (utilities, industry, academia, SME, consultants, Government, regional experts etc.) together to design a pathway to address decarbonisation needs of the South Wales region. A multi-energy vector modelling exercise will be carried out to estimate the impact on utilities’ networks for different scenarios.
The project will recommend a pathway to decarbonise South Wales supported by solid analytical work and taking in to account the regional socio-economic aspects.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

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. The Welsh government formally accepted the recommendation of the CCC in June, 2019. While the national goal is critical for driving the policy direction, a due consideration must be given to regional individualities and aspirations before planning any regional pathway to meet the national goals.

The most efficient way to meet “Net Zero” target is a whole system design approach and cross-sector collaboration. The multiple energy vectors should be modelled together to find an optimum solution and mix of technologies for the consumers. The impact assessment of any ‘net-zero’ pathway on utility infrastructure is equally important to make any key policy decision.

There have been multiple pathways proposed by various forums and organisations to meet decarbonisation targets. They all provide a solution to meet the end goal. However, the reports lack in unanimity.

‘Zero-2050: South Wales’ will bring diverse stakeholder groups (utilities, industry, academia, SME, consultants, Government, regional experts etc.) together to design a pathway to address decarbonisation need of South Wales region. It will critically review and challenge the technical options and will quantify them with facts and analysis. It will be a first ever activity at this scale to design a regional blueprint by incorporating whole system design and cross-sector collaboration.

Method(s)

Considering there are multiple technical options to meet the net-zero goal, the first step would be to consolidate the options and shortlist a reasonable number of scenarios based on wider stakeholder consultation backed with evidences and analysis. All the scenarios will be designed by including extensive regional insights and making use of the data available from previous projects from Welsh Government, CCC, National Grid future energy scenario (FES), WPD regional FES, WWU regional FES, Pathfinder and Green city vision will serve as the background information for this project. A further project led by WPD with WWU will develop the necessary data for distribution scenarios.

A multi-energy vector modelling exercise will be carried out to estimate the impact on utilities’ networks for different scenarios. The modelling and analysis will include the energy needs and technology mix to address the decarbonisation of South Wales cities, transport and industries. A holistic solution will be designed, which optimally meets the future energy needs of different sectors. Several sensitivities will be considered around the scenarios and Innovative solutions will also be explored to create value to the consumers.

The alignment of work packages, technical review, programme management and challenge will be undertaken by a project board consisting of all project managers. Additionally, a project integration team will be responsible for reviewing the project outcomes and providing direction to produce the final solution.
Ultimately, the project will propose a roadmap and recommend an initial pathway to decarbonise South Wales supported by solid analytical work and taking in to account the regional socio-economic aspects.

Scope

The project has the following work-packages (WPs):

Work Package 1: Generation and regional analysis

A demand estimation study will be carried out to cover the South Wales region based on the demand data coming from other work-packages. Both embedded and non-embedded generation profiles and their potential for South-Wales will be estimated, including the effect of weather data.

The UK will be divided into regions and the regional understanding will be developed to assess the impact on South Wales in terms of import / export of energy during extreme weather days. Based on the outcome, it will inform the amount of flexibility requirements including seasonal storage for security of energy supply.

Work-Package 2: Temporal and spatial city modelling

A detailed bottom-up model will be developed for Swansea, Newport and Cardiff cities. For each scenario, the energy demand of a city, will be estimated to address the impact of decarbonisation of heat, power and transport.

Work Package 3: Electrical network reinforcement requirement and cost-benefit analysis

This work package will evaluate the technologies that might be required to meet net-zero targets. It will estimate network solutions for various scenarios. This work package also includes the cost-benefit analysis of various innovative solutions e.g. district heating, clustering of loads and direct connection to HV networks and smart charging. Cost-benefit analysis will also cover Utility-scale storage options including both electrical storage and hydrogen.

Work Package 4: South Wales transport sector decarbonisation

This work-package will cover evidence-based transport sector decarbonisation needs. It will include heavy good vehicles (HGVs), marine, aviation and railways sectors. It will estimate the future electricity, gas and hydrogen requirements of the transport sector.

Work Package 5: Industrial cluster decarbonisation

South Wales industries will be categorised based on energy usage, industry type and size and at least one industry will be selected

from each category. A detailed evaluation will be carried out to assess the options to decarbonise those industries e.g. fuel switching, technology changes, and carbon capture. The findings will be presented to and agreed with the South Wales industrial cluster. The analysis derived from sample industries will be extrapolated to cover South Wales. The output of this work package will provide the industrial electricity and gas requirements to meet the net-zero ambition and how the profile is expected to change over time. It will also inform the minimum carbon capture, usage and storage (CCUS) requirements to meet net-zero targets.

Work package 6: Socio-economic analysis

This work-package is to understand the socio-economic aspects of decarbonisation pathways for the South Wales region. It will start by undertaking baseline analysis of the current context e.g. employment, GDP, industries, demographics etc. It will present the cost of doing nothing by reviewing national and international reports on the cost of climate inaction (from the Stern Review onwards) to determine the potential for extrapolation to South Wales. A high-level analysis of the socioeconomic impacts of up to three decarbonisation scenarios will be undertaken.

Work package 7: Iterative optimisation and pathway design

Taking the outputs from all of the work packages, this work package will take the multiple scenarios to build and test scenarios and enable the development of an optimised solution for whole system modelling.

Work package 8: Communication and stakeholder management

This work-package will be responsible for managing various stakeholders and consortium partners, designing a proper communication channel, managing information sharing platform, organizing dissemination workshops and producing content.

Work package 9: Gas network reinforcement including for Hydrogen

WP9 will consider the future requirements of gas networks in South Wales considering a range of decarbonisation scenarios. WP9 has three main focuses including the need for a decarbonised hydrogen supply network, CO2 gathering network, and liaison with other work packages to better understand the requirements on the gas networks considering decarbonising heat, industry and transport in South Wales.

Work package 10: Carbon Capture and Storage

Techno-economic assessment of CO2 capture for smaller emitters. Comprising assessment of emissions, potential for aggregation of sources (including scope for clustering, addressing metering and quality issues), cost estimation for localised carbon capture and outline of carbon capture and transport infrastructure. Further development of costing for carbon transport infrastructure. Further work is required to confirm no duplication with existing work packages or other projects to mitigate the risk of duplication. No costs are included in the PEA for the work.

Work Package 11: Pathfinder modelling

WP11 will use the WWU's Pathfinder tool to integrate the findings of all the project Work Packages in order to identify a system-wide optimal solution for a Net Zero South Wales.

Objective(s)

To bring diverse stakeholder (utilities, industry, academia, SME, consultants, Government, regional experts etc.) views together, adopt a whole system view and technology neutral perspective, critically review and challenge the options, quantify them with facts and analysis, and then design a pathway to meet South Wales net-zero target which delivers the best value to consumers.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The project will be considered successful when it designs a pathway to decarbonise South Wales by consolidating multiple stakeholder views, assesses the impact on utility networks and submits its finding to key stakeholders.

Project Partners and External Funding

This project will be wholly funded through the Network Innovation Allowance.

Potential for New Learning

There is a huge potential of new learning in this project. The process and framework developed in this project can be extended to cover other regions across GB.

Scale of Project

The scale of the project has been chosen appropriately. The project covers the analysis of decarbonisation needs of multiple sectors and impact on utility networks.

Technology Readiness at Start

TRL4 Bench Scale Research

Technology Readiness at End

TRL5 Pilot Scale

Geographical Area

This is a desk based project. However, the project is aimed at having a geographical coverage of South Wales.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£1,154,000

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)

Even though it is difficult to predict the precise cost of decarbonisation of the UK economy, it is going to be in the order of hundreds of billions of pounds. Out of this a significant proportion may be required to reinforce or redesign gas and electricity networks. A whole system design approach which takes in to account regional perspective and cross sector collaboration may potentially reduce this investment requirements. Even if this coordinated effort results in 1% savings, it will have huge cost benefit for the consumers.

Please provide a calculation of the expected benefits the Solution

N/A

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

It is proposed that this project will have a geographical coverage of the South Wales region. However, the process, framework and models developed in this project will be replicable by all Network Licensees once documented.

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

The project is focusing on the South Wales region and will be costing around £1m. If GB is divided in to similar regions based on population, the approximate cost of rolling out would be £20m. However, based on the learnings from first few projects, the rolling out cost can be reduced to one third.

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 will develop detailed models for future energy needs of the cities including transport and industries. It will also evaluate the innovative solution using detailed CBA. This learning is directly applicable to other 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)

Corporate Responsibility - Doing the right thing (whole system solution for Net Zero)

☑ 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.

Several projects have estimated load demands for decarbonisation of heat and transport and the results of these projects will be used in net zero context. However, Zero-2050 has a much wider scope and it will be a whole system design considering multiple sectors together and modelling multi-energy vector to meet the future energy demands.
This project will build upon the outputs of other NIA projects as referenced in the method section.

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

This is the first-in-kind effort to bring multiple stakeholders together and develop a regional pathway by extensive whole system modelling. Similar activities have been tried before for smaller geographical areas but not at this extent. Also, the project will be focused on the impact of net-zero target on gas and electricity network infrastructure.

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

There is a huge risk associated with the project as the outcome may or may not be acceptable to key stakeholders. This project covers multiple sectors and assesses the impact of deep decarbonisation on utility networks in context of South Wales.

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 nature of a research programme means it inherently carries a risk that the research may be unsuccessful and/or identify unforeseen barriers to implementation and National Grid is unable to consider research of this scale as business-as-usual. The NIA funding offers the most appropriate route for NGET to evaluate the risk associated with control interaction.

This project has been approved by a senior member of staff

☑ Yes