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NIA Project Registration and PEA Document

Date of Submission

Nov 2019

Project Reference Number

NIA_WWU_060

Project Registration

Project Title

Hybrid-Hydrogen (HyHy)

Project Reference Number

NIA_WWU_060

Project Licensee(s)

Wales & West Utilities

Project Start

November 2019

Project Duration

1 year and 2 months

Nominated Project Contact(s)

Oliver Lancaster

Project Budget

£146,666.67

Summary

Research to understand the relationship between deploying domestic hybrid heating technology and hydrogen supply to achieve an optimised energy strategy.

Nominated Contact Email Address(es)

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Problem Being Solved

Many decarbonisation strategies rely upon heavily leveraging a central vector. It is widely recognised however that the lowest cost and least disruption pathway to carbon compliance will result from the deployment of a mixture of complimentary technology vectors. One such combination of bulk hydrogen supply in combination with hybrid heating technologies, has been promoted by the Committee on Climate Change (CCC) in their November 2018 report 'Hydrogen in a low-carbon economy'. The purpose of HyHy is to quantitatively explore the optimal deployment mixture of bulk hydrogen supply and hybrid heating to understand where the overall energy system optimal balance exists.

Method(s)

The project will take a collaborative approach involving a range of stakeholders to allow the wider industry to input and contribute to the progress of the project.

Utilising the outcomes of the Pathfinder Plus project (NIA_WWU_055) the recently updated Pathfinder energy system model, developed by WWU, will be leveraged to undertake the quantitative analysis of HyHy. The methodology of the project will be as follows:

1. Selection of exemplar region for analysis;
2. Evaluation of compliance metrics with respect to national decarbonisation targets;
3. Mapping of regional demographics and energy demands in 2050, using the National Grid FES 2019 steady progression baseline scenario and an alternative net-zero baseline scenario;
4. Technical modelling of region to techno-economic implications of deploying domestic hybrid heating in combination with bulk hydrogen supply;
5. Analysis of wider implications and requirements to technically deploy strategy e.g. supply and storage of hydrogen;

6. Exploration of scenario which seeks to understand potential optimal balance of HyHy strategy deployment;
7. Evaluation of hydrogen-only and full electrification net-zero strategy as counterfactuals of analysis.

It is envisaged that bilateral stakeholder engagement events will be conducted at milestone moments throughout the project to provide a platform of engagement and a route for informed entities to contribute to the project. Learning from Green City Vision (NIA_WWU_051) will be utilised to enable accurate and effectively energy system modelling. Relevant reference material such as the Navigant Pathways project and the CCCs May 2019 Net Zero report will also be used to inform the technical analysis and ensure the HyHy project is broadly consistent in its technical methodology.

Scope

The scope of the project will consist of employing the methodology described above to provide intelligence on the potential optimal balance of deploying a hybrid-hydrogen decarbonisation strategy to achieve regional net-zero compliance, against the bounding counterfactuals of hydrogen-only and full electrification net-zero scenarios. One key outcome of the project will be to increase understanding of the UK energy system with regards to how bulk hydrogen supply in combination with hybrid heating technology provides a pathway to compliance. This increased intelligence will then be disseminated and used to engage with wider stakeholders and policy makers. The analysis of a HyHy strategy will largely be through quantitative evaluation of the resulting energy system, examples of such outputs are:

1. Percentage of time each vector is utilised;
2. Peak and annual demand for hydrogen;
3. Renewable generation requirements;
4. Coupling benefits with an industrial cluster and transport;
5. Hydrogen production & storage requirements;
6. Estimate of carbon emissions;
7. Relative cost, reviewing investment and operating costs implications.

The deliverables of the HyHy project are:

1. Technical report outlining the methodology employed and details of the feasibility study;
2. Summary report outlining the key outputs of the feasibility study.

Objective(s)

The objective of the project is to assess the combined energy demands of a select region within GB and understand how the deployment of hybrid heating technology in combination with bulk hydrogen supply is able to achieve carbon compliance with respect to national carbon targets.

The primary outcome of the work will be to provide intelligence on how these two technology vectors interact within a compliant energy system to inform business plan development and allow wider regulatory/policy stakeholders to be engaged.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

To understand the underlying energy system interactions of hybrid heating technology and bulk hydrogen supply.

Project Partners and External Funding

The project will be wholly funded by NIA with Progressive Energy Ltd as project partners

Potential for New Learning

1. Providing clear evidence and intelligence on the impact of hybrid heating technology in combination with bulk hydrogen supply to contribute towards carbon compliance of GB regions. The evidence generated would then be applicable to other geographically and demographically similar regions within GB.
2. Understanding the potential optimal balance of hybrid and hydrogen technology vectors based on implications for the whole energy system.

Scale of Project

Being a modelling-based feasibility study, the scale of the project is a desk top study, which is appropriate for the project.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

A city within the WWU network that is representative of other cities within GB (to provide appliance learning for other regions within GB).

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

External: £110,000.00

Internal: £36,666.67

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 HyHy research project will provide long term savings to GB customers by providing better long-term planning decisions. Optimising capacity management and network design through the use of improved evidence has the potential to reduce the risk of unnecessary investment.

Please provide a calculation of the expected benefits the Solution

Research project

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

The selected region will be typical of a GB city, therefore the outcomes and conclusions from the project should be replicable for other cities across GB.

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

Through dissemination events and stakeholder engagement the learnings and outcomes of the project, as they relate to investment planning and network design, will be socialized across gas and electricity networks to ensure cost saving is maximized throughout GB energy networks.

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 learning generated will inform planning and business case development and provide evidence for investment of the Network Licensee.

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.

To the best of our knowledge, no other project has utilised an hourly energy balancing model to understand the energy system interactions of deploying hybrid heating technology alongside bulk hydrogen supply. This work will be seminal in nature as it utilises recommendations from the recent CCC report on hydrogen deployment within an energy system. Through strategic stakeholder engagement and dissemination, the wider industry will be informed of the learning generated to minimise the risk of future projects replicating the work undertaken in this project.

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 project involves the whole energy systems modelling of heating demand, where hydrogen provides the source of flexibility from linepack storage balanced with hydrogen production and further storage options. This work builds on the work already delivered in H21, with the benefit of already having an outline conversion design for Cardiff, and also the work being carried out for the South Wales Industrial Cluster to fuel switch to hydrogen and act as a catalyst for wider hydrogen deployment. The modelling will include sensitivities with the ratio of hybrid uptake, which is expected to show the network, cost and carbon benefits from a wide, large scale deployment of hybrid hydrogen heating within a balanced energy system to reduce the volume of hydrogen production. It could also be used to optimise the degree of building fabric retrofit.

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

This is a feasibility study to understand the balance of technologies that are currently not deployed at bulk scale. As the outputs are unknown this is a risk to Wales & West Utilities.

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 project is to undertake research which will be applicable to a number of stakeholders including, other energy networks, policy makers, local authorities and informed entities. As the outcomes of the project are valuable to a wide number of stakeholders and not just applicable to gas consumers NIA funding is most appropriate to allow sufficient project delivery capacity to maximise industry learning.

This project has been approved by a senior member of staff

Yes