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

Feb 2016

Project Reference Number

NIA_WWU_032

Project Registration

Project Title

Assessment and bench marking of low carbon heating technologies

Project Reference Number

NIA_WWU_032

Project Licensee(s)

Wales & West Utilities

Project Start

February 2016

Project Duration

0 years and 3 months

Nominated Project Contact(s)

Steve Harding (Project Manager)

Project Budget

£29,333.00

Summary

Compare the marginal cost of carbon abatement, cost and ecological economics for a defined set of technologies by doing a literature review of existing published studies and presenting the findings in a report. The intent of the initial phase is to provide factual evidence that can be used in WWU and the other Gas Distribution Networks (GDNs) interactions with the different regulatory agencies (DECC, DEFRA and OFGEM).

Technical Scope: As the study is based on the existing literature review, the study will be limited to the available published reports. We will only consider credible sources for our review, which will be documented and clearly referenced. The study will include those technologies on which published reports exist, but will maintain special focus on the following technologies used for space heating:

1. Electric heating (e.g. ASHP) powered by offshore wind (taking into account any back up generation and storage)
2. Biomethane from anaerobic digestion distributed using existing gas infrastructure
3. CHP running on natural gas (traditional extractive technologies and no fracking) to feed district heat networks

Nominated Contact Email Address(es)

innovation@wwutilities.co.uk

Problem Being Solved

The GB gas distribution networks (GDNs) are operating against an uncertain backdrop. The UK's carbon reduction policies coupled with increasing energy efficiency measures may result in a gradual decline in gas demand. The Government's position is to move away from gas as the primary fuel for heating, with a target of zero percent fossil fuel usage in the provision of heat for buildings by 2050. Nevertheless, the demand for gas still exists; it remains the most cost effective solution for heating homes and commercial premises and consequently there are over 200,000 new connections annually.

There are a plethora of low carbon options available and, although they are presented as a significant opportunity to reduce energy bills and carbon emissions, there is often a lack of evidence and reliable information on their performance. The higher

levels of risk and uncertainty that emerge as a result of this lack of reliable information can be a major barrier to action, making it hard to develop a political, business or social case for investment in low carbon options.

Legal commitments in the form of the Kyoto Protocol, the European Union 20-20-20 goals, the Climate Change Act and the Paris climate deal create a challenge for policy makers, regulators and the private sector to reduce carbon emissions in a cost-efficient way. The energy trilemma must be considered so that a balanced solution is achieved.

Wales & West Utilities (WWU) Context

WWU have sought to clarify the feasibility of the Government's strategy for decarbonising heat through an in-depth analysis of alternative heating solutions and a recently completed exercise to analyse the impact of low carbon heating solutions on a town in Wales.

Due to the lack of evidence about these technologies WWU is not clear about the best way to deal with the energy trilemma. WWU would like to take this study further by including more detailed ecological, environmental and economic aspects of renewable technologies as it exists today.

Method(s)

The study will provide a macro level analysis and evaluation of the key heating technologies, both established and emerging, to show medium and long term impacts on cost, reliability and carbon emissions. The study will be underpinned by a literature review.

A key requirement is to determine the impact on carbon emissions if these new technologies were adopted on a macro scale. The initial study will enable initial policy discussions with regulators. The output of this study will also highlight the gaps in the current studies done on this topic and will help to define any future phases of work.

Scope

Compare the marginal cost of carbon abatement, cost and ecological economics for a defined set of technologies by doing a literature review of existing published studies and presenting the findings in a report. The intent of the initial phase is to provide factual evidence that can be used in WWU and the other Gas Distribution Networks (GDNs) interactions with the different regulatory agencies (DECC, DEFRA and OFGEM).

Technical Scope: As the study is based on the existing literature review, the study will be limited to the available published reports. We will only consider credible sources for our review, which will be documented and clearly referenced. The study will include those technologies on which published reports exist, but will maintain special focus on the following technologies used for space heating:

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Objective(s)

The objective of this study is to :

- Enable WWU to compare a range of carbon mitigation measures (either alternative heating sources or interventions within the existing asset base)
- Aid the understanding of the impact of various renewable solutions on the energy trilemma and thus create a reliable evidence base to underpin WWU's strategy and planned investment in carbon abatement measures
- Enable WWU to engage in policy discussions that impact the heating solutions for the UK as envisaged by the regulatory agencies (DECC, DEFRA and OFGEM)

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The output of the study will be a report that summarises the literature review. It will enable the development of a clear view of the carbon intensity of various heating solutions to allow WWU and other GDNs to engage in initial policy discussions with the Government and regulators. The output of this study will highlight the gaps in the current information available on this topic and

will thus help to define the additional research that is required in order to develop well informed policy and support investment decisions related to heating solutions and the use of gas in the long term plans for energy distribution.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This is a desktop study that will analyse existing data identified through a literature review.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL2 Invention and Research

Geographical Area

The project will consider technologies and scenarios that are relevant to the UK

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total project expenditure is £29,333 of which 90% (£26,400) is eligible under NIA

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 research project will provide long term savings to GB customers by providing better information on which to base long term planning decisions.

The assumptions to be used within the project for an air source heat pump for an average household are

Assumptions
Gas price: 4.36p/kwh
Electricity price: 13.46p/kwh
Gas usage for space and water heating using condensing boiler: 16,000 kwh
Seasonal Performance Factor = 4.0 – 2.5
Gas carbon footprint: 0.185kg/kwh (carbonindependent.org)
Electricity carbon footprint: (0.527kg/kwh (2015); 0.250kg/kwh (2030); 0.00kg/kwh (2050))

Example CBA inputs
Investment to install ASHP - £10,000
KWH used by heat pump = 16,000/4.0 = 4,000kwh (SPF 4.0)
Electricity cost for heat pump = 4,000 x 0.1346 = £538
Gas cost for condensing boiler = 16,000 x 0.0436 = £697
Saving to consumer = 697-538 = £159
RHI PA (for 7 years) = (16000 – 4000) x 7.3p/kwh = £876
Carbon saved per annum (2015) = (16,000 x 0.185) – (4,000 x 0.527) = 0.852 tonne
Carbon saved per annum (2050) = 16,000 x 0.185 = 2.96 tonnes

Sensitivities
Future gas and electricity costs
SPF (Range 2.5 – 4.0)
Carbon footprint of electricity over time

Please provide a calculation of the expected benefits the Solution

Not required for research projects

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

Not required for research projects

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

The project in itself is a GB wide study, thus there would be no need for replication. It may illustrate or demonstrate the need for further research in specific geographic regions or technical areas and could influence future energy policy.

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 outputs will enable the Network Licensees to engage in initial policy discussions with the Government and regulators about future heat strategy, which has a direct impact on future investment in Network Assets.

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.

n/a

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