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

Jun 2015

Project Reference Number

NIA_SGN0075

Project Registration

Project Title

Combined Fuel Cell – Heat Pump Research Study

Project Reference Number

NIA_SGN0075

Project Licensee(s)

SGN

Project Start

June 2015

Project Duration

1 year and 1 month

Nominated Project Contact(s)

Alexander Webb, Innovation Project Manager

Project Budget

£144,833.00

Summary

This project will conduct a comprehensive research study surrounding the potential development of a hybrid Fuel Cell – Heat Pump domestic heating system. This will include the following work conducted by Delta-ee:

1. **Review of current technology and products**
   Conduct a review of available heat pump and fuel cell products along with options for boreholing during installation, preferred system design options with pros and cons of each and the current and future likely cost and performance data.

1. **Market research**
   Key barriers, incentives and drivers for the product will be assessed and ranked. The leading potential market channels and business models will be identified. Customer attitudes to the technology will be explored through interviews with householders.

1. **Review of Housing Stock**
   Identification and characterisation of key housing segments that would accept/ benefit from such a system.

1. **Carbon, cost and energy system modelling**
   Review of customer capex (up-front cost) and opex (on-going costs), carbon savings, and an assessment of the possible cost/value to the electricity system, and the amount of flexibility and value of this flexibility in each key segment.

1. **Review of competing low carbon heating systems**
   Assessment (with key sensitivities) of where a fuel cell – Heat Pump product can out-perform other low carbon, domestic energy system options in each identified housing segment.

1. **Opportunities, Barriers and Next steps**
   A report will be compiled identifying and characterising opportunities and barriers, including (but not limited to) technological, policy, physical fit, householder acceptance, market size and routes to market and this will recommend next steps (or options with pros and cons of each).

A decision was made to include the specific learning from work package 1 to influence the questions to be used in the focus groups in work package 2. Previously the intention had been to submit the customer engagement plan while work package 1 was being conducted. The revised project timeline saw the customer engagement plan submitted to Ofgem for approval in October with the focus groups planned to take place in January. This resulted in a 3 month extension to the project duration.

Following our initial change request it became apparent that SGN had not properly anticipated the time required by Ofgem to complete the review of the Customer Engagement Plan (CEP) and Data Protection Strategy (DPS) documents that were submitted for approval. This approval is required prior to any interaction with, or data extraction from, the public - which the focus groups would require. Approval of the CEP and DPS was granted on the 22nd February 2016. The new project timeline has seen the focus groups pushed back to March 2016. This has resulted in an additional 2 month extension to the project duration. Resulting in a revised end date of June 2016.

Nominated Contact Email Address(es)

sgn.innovation@sgn.co.uk

Problem Being Solved

The UK currently faces the challenge of reducing carbon emissions and energy costs for customers while guaranteeing security of supply.
Gas is used in the vast majority of GB homes and gas boilers are close to the theoretical limit of their efficiency, with only incremental improvements possible. Therefore there are limited options by which domestic consumers can keep using gas while furthering GB on its path to meeting affordable and secure future carbon reduction targets.

Hybrid energy systems that combine a low carbon or renewable heating system with a traditional gas fired boiler have been available for some time; however, there is not currently a combined fuel cell – heat pump system on the market. There are potential financial and environmental savings to be made by increasing the efficiency of domestic heating appliances but this is also likely to have an impact on consumer demand trends.

Developing a domestic hybrid energy system that is significantly more efficient and more widely accepted than what is currently available may have an impact on the individual consumers' gas demands thus having an impact on network strategic investments across the GB with a potential for reduced carbon emissions as well as a range of benefits for the GB gas customer both environmentally and economically.

Method(s)

With Deta-ee's assistance we will undertake a research project to determine the potential configurations, benefits and impact of a hybrid, low carbon, domestic product combining a fuel cell and a heat pump for use in GB homes.

This research will be broken down into six segments:

1. Review of current technology and products
2. Market research
3. Review of housing stock
4. Carbon, cost and energy system modelling
5. Analysis of competing low carbon heating systems
6. Opportunities, barriers and next steps

By assessing and ranking the potential system configurations, and analysing the potential benefits of this technology combination, we can place the energy industry in a better position to understand the potential –and barriers - to a system that could facilitate the potential realization of more efficient, low carbon heating. Determining the benefits and drawbacks of renewable domestic energy systems that are currently available will allow us to assess the feasibility of taking a project forward whilst providing learning to ensure the successful implementation of a system that adds maximum value to the network.

Scope

This project will conduct a comprehensive research study surrounding the potential development of a hybrid Fuel Cell – Heat Pump domestic heating system. This will include the following work conducted by Delta-ee:

1. **Review of current technology and products**

   Conduct a review of available heat pump and fuel cell products along with options for boreholing during installation, preferred system design options with pros and cons of each and the current and future likely cost and performance data.

2. **Market research**

   Key barriers, incentives and drivers for the product will be assessed and ranked.
   The leading potential market channels and business models will be identified. Customer attitudes to the technology will be explored through interviews with householders.

3. **Review of Housing Stock**

   Identification and characterisation of key housing segments that would accept/ benefit from such a system.

4. **Carbon, cost and energy system modelling**

   Review of customer capex (up-front cost) and opex (on-going costs), carbon savings, and an assessment of the possible cost/value to the electricity system, and the amount of flexibility and value of this flexibility in each key segment.

5. **Review of competing low carbon heating systems**

   Assessment (with key sensitivities) of where a fuel cell – Heat Pump product can out-perform other low carbon, domestic energy system options in each identified housing segment.

6. **Opportunities, Barriers and Next steps**

   A report will be compiled identifying and characterising opportunities and barriers, including (but not limited to) technological, policy, physical fit, householder acceptance, market size and routes to market and this will recommend next steps (or options with pros and cons of each).

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Objective(s)

The key objectives of this project are:

1. To determine the possible system configuration for a combined fuel cell – heat pump product, and to identify the preferred configuration(s).

2. To determine the proportion of GB households for which such a product would potentially be suitable.

3. To determine the potential environmental benefits (carbon reduction), consumer benefits (reduced heating costs) and assess the potential value to the electricity system.

4. To assess these benefits against benefits from alternative low carbon heating products.

5. To identify the key challenges in developing such a product and bringing it to market and to identify what actions are required to overcome these challenges.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The success criteria for the project are to:

1. Produce comparative assessment of potential for a combined fuel cell - heat pump product (against other low carbon heating options) to potentially decarbonise heat, reduce consumer heating costs, and bring energy system benefits to GB.

2. Outline scope for further work that may help to bring such a product to market, including key partners to involve, barriers that need to be overcome and an indication of the investment required.

3. Learning to be disseminated to all key stakeholders and licensees through full project reporting via the Smarter Networks Portal and project reporting on request.

If successful the project could support the future development and network integration of a new low carbon energy technology.

Project Partners and External Funding

n/a

Potential for New Learning

n/a

Scale of Project

This project is a research study conducted by an external project partner, Delta-ee, who may contact other stakeholders, councils, manufacturers or authorities to carry out the research.
By conducting this initial study as a research project we are ensuring GDNs are best placed to make a decision to take this concept further or pursue an alternative solution, ensuring efficient expenditure of resources.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL3 Proof of Concept

Geographical Area

This is primarily an office based research project by SGN and Delta-ee, both located in Edinburgh

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The total predicted expenditure is £144,833, 90% of which is allowable NIA expenditure (£130,350).

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 is a research project and will not directly realise financial benefits however, the research has the potential to deliver net financial benefits to customers in the future if the outputs show that a hybrid domestic heating system such as this could result in lower domestic demand over peak periods, which may have an impact on network strategic investments – further supporting the gas networks role as part of the low carbon energy future.

Please provide a calculation of the expected benefits the Solution

NA

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

Domestic properties constitute approximately 65% of the demand across GB and the benefits from the system resulting from this research could be rolled out across all GDNs.

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

The costs associated with implementing such a system, either individually or on a larger scale (as part of an estate for example) will be estimated during this research. This estimate could then be applied to similar sites across GB and an estimate for GB rollout could then be obtained.

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 gained by this project aims to inform GDNs as to whether a hybrid low-carbon heating system combining a fuel cell and a heat pump would be beneficial to customers and the industry as a whole and could form the foundations of a future project to develop/trial the recommended system configuration.
All learning will be disseminated as per the NIA governance document.

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