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

May 2018

Project Reference Number

NIA_WPD_032

Project Registration

Project Title

Hydrogen Heat and Fleet Viability Assessment

Project Reference Number

NIA_WPD_032

Project Licensee(s)

National Grid Electricity Distribution

Project Start

May 2018

Project Duration

0 years and 9 months

Nominated Project Contact(s)

Faithful Chanda

Project Budget

£60,000.00

Summary

When a new generation connection is requested at a constrained site, current practice is to either reinforce the network or offer the generator alternative network connection arrangements. Novel techniques for reducing constraint issues have been explored by WPD, including the use of batteries to shift load and the use of active network management technologies. However, to date, these practices have not extended to hydrogen and fuel cells.

Third Party Collaborators

Delta-EE

Problem Being Solved

An increase in intermittent renewable generation has pushed networks within the WPD license areas to capacity and no further renewable generation can be connected without reinforcement. Consequently solutions that can effectively smooth this intermittency and as a result allow further connection of generation are being explored.

The UK Government has placed huge emphasis on decarbonising the electricity system through a number of initiatives such as heat pumps and the displacement of conventional fossil-fueled generation such as coal by cleaner sources like solar and wind. Adding to that list is the claim that hydrogen can be used as another source of cleaner energy. DECC's H21 project has recently (June 2016) claimed that entire cities can feasibly be converted to Hydrogen mains gas. Yet the impact of hydrogen fuel cells on the electricity grid has yet to be evaluated.

As part of the UK H2 Mobility programme, Hydrogen vehicle Refuellers are being installed across the UK, a large proportion of which have local electrolyser-based H2 production. Sixty five are expected before 2020 with the numbers increasing exponentially thereafter.

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Method(s)

The delivery of the project has been structured around a number of work tasks detailed below:

1. Project initiation:
Ensuring that the overarching project aims and objectives are understood, with a set of clear outcomes. It will be important to clearly identify how the trial project aims to address some of the network challenges and how the project can provide genuinely new innovative insight for WPD and other network companies.

The project will seek to address key metrics such as the approximate size of plant (fuel cells, electrolyser, number of vehicles, etc.) and potential trial programme.

2. Technical and economic feasibility:
Following on from the project proposal we will be keen to produce an outline technical specification. This will provide shape to the project, enable some indicative cost analysis to be conducted, and will be used to help identify comparable projects / case studies, and technology providers. Key components of this task are:
· Develop high level project specification. Identify the key technical components and boundary conditions to the project based
· Produce a simple technical model which will assess energy flows (renewable electricity supply, building energy demands, and transport demands) and provide a high-level estimate of equipment sizes (for the electrolyser, and fuel cell), hydrogen storage volumes, and vehicle capacity.
· High level financial analysis of the project / trial taking into account capital and operational costs. This will help identify indicative project investment costs, lifetime cost benefits, and provide comparison with any alternative network reinforcement costs.

3. Market study:
This task is designed to help understand the capability of the market to deliver a project like this. Specifically, this task will assess the level of maturity of the hydrogen market (to support building a view as to the deliverability of a trial project), and the likely future market for larger scale role out / getting to business as usual.

4. Refinement of project scope and identification of potential partners:
The final task will draw together the high level feasibility work with the market research to refine the scope of the project. The analysis will consider:
· The feasibility of the project and whether there are sweet spots in terms of project size and configuration.
· The level of innovation in the project – is it new, what questions is it trying to answer, and where can it add new insight over existing trials.
· The learnings from existing projects – how should this trial building on these to add new insight and value to network companies.
· The ability of the market to deliver – are suitable technologies and skills available? Does the availability of these influence the scope of the project?

5. Closedown: Project reporting

Scope

This project is a 6 month feasibility study with the aim to improve knowledge of the technology's benefits, challenges and costs to determine whether a demonstration project is appropriate. As a study, it will provide insight into both cross-vector and cross-sector opportunities covering the electricity and gas networks, heat, and transportation. This project aims to investigate the feasibility of the use of hydrogen for vehicles and as fuel for combined heat and power. This task is designed to help understand the capability of the market to deliver a demonstration project like the one proposed. Specifically, this task will assess the level of maturity of the hydrogen market (to support building a view as to the deliverability of a trial project), and the likely future market for larger scale roll out / getting to business as usual.

Objective(s)

The primary aim of this project is to research the use of hydrogen electrolysers as a controllable load. In areas with large penetrations of renewable generation, controllable load will increase the capacity for further generation connections.

WPD has developed an outline proposal for a "Heat and Fleet" demonstration project which would explore the use of electrolysers to generate hydrogen from excess local renewable electricity. This concept could result in less curtailment of renewable resources, and provide a highly controllable demand allowing energy storage in the form of hydrogen gas. As a demonstrator, it would provide insight into both cross-vector and cross-sector opportunities covering the electricity and gas networks, heat, and transportation and as suggested by the project name, there are two potential end uses for hydrogen:
· Heating: Use in a fuel cell for heating a building, combined with electricity output.
· Transport: Use in hydrogen vehicles (either internal combustion or fuel cell).

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

A comprehensive review of hydrogen technology is presented. A case study of how the technology can bring benefits to WPD's networks is demonstrated and a relationship with manufacturers has been established. A viable pathway leading to a trial project is recommended where full details of capital and operating costs is documented. We would want the study to address the three key questions of maturity, feasibility and delivery of the technology.

Project Partners and External Funding

Delta-ee

Potential for New Learning

Other DNOs will also be able to gain a comprehensive understanding of the use of hydrogen after reviewing this project's reports and results. They can use the presented case study as an example to evaluate the benefits that could be brought to their networks by this technology. The knowledge from manufacturers could also be used by other DNOs if they wish to pursue trial projects.

Scale of Project

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Recent advances in electric vehicle and battery technology have led to a rapid uptake of BEVs especially for light vehicles. It is claimed that continued cost reduction and technology development will further increase the penetration of BEVs over the next few years. In the longer term, there may be increased challenges around electrification of transport for heavier vehicles and long range / high utilisation applications. There will also be increased requirements for electricity storage over longer periods. This project will assess whether using Hydrogen for transportation and heating will be more effective and cheaper than the former. The fundamental question this project will address is what role hydrogen play, and will also seek to understand how a demonstration project will look like.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

Areas that require additional capacity but do not allow the implementation of traditional solutions due to land availability, cost or other constraints will have the biggest benefit from technology implementation. This would typically represent a dense, urban environment. Therefore, areas where Western Power Distribution and GDNOs operate would be considered.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

£54,000

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)

N/A - research project

Please provide a calculation of the expected benefits the Solution

N/A - research project

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

The research is relevant to all DNOs

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

This research is relevant to all DNOs

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 outcomes from the research will be disseminated to other network licenses and a full report will be delivered at the end of the project.

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.

Research has shown that no electricity licensees have identified any projects which may cause duplications. The outputs of this project will be disseminated to all UK DNOs.

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

Hydrogen is an emerging technology that can significantly improve system reliability and load serving capability. Through a feasibility study, this project will provide insight into both cross-vector and cross-sector opportunities covering the electricity and gas networks, heat, and transportation.

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

WPD have experience of using hydrogen as a fuel in vehicles but not in the area of heat and power. The learning from this will be transferred to this project.

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

Other DNOs will also be able to gain a comprehensive understanding of the use of hydrogen after reviewing this project's reports and results. They can use the presented case study as an example to evaluate the benefits that could be brought to their networks by this technology. The knowledge from manufacturers could also be used by other DNOs if they wish to pursue trial projects.

This project has been approved by a senior member of staff

☑ Yes