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

Aug 2018

Project Reference Number

NIA_UKPN0041

Project Registration

Project Title

Dual Fuel Transport

Project Reference Number

NIA_UKPN0041

Project Licensee(s)

UK Power Networks

Project Start

September 2018

Project Duration

1 year and 5 months

Nominated Project Contact(s)

Carol Choi and Cadent Innovation Team

Project Budget

£165,382.00

Summary

The UK government has pledged to reduce emissions by 80% (from 1990 levels) no later than 2050. As a result of this, drastic changes will be required across all sectors. This is currently most apparent in the electricity sector, as many of the early solutions to decarbonisation have been based on a transition to electricity consumption in applications which traditionally relied on the direct combustion of fossil fuels (e.g. electric vehicles for transport).

Decarbonisation of heat and transport looks to move a large amount of energy between existing sources and vectors to other ones (including new sources). The three Problems that this project looks to address include:

1. The capacity of gas and electricity distribution networks is not fully utilised or optimised.

2. There is a lack of available alternative powertrain technologies in low emission vehicles across all transport segments leading to dependence on electric vehicles (EVs) which could result in costly reinforcement of electricity infrastructure.

3. There is not an established diverse range of technologies in the competitive market that can provide flexibility to both gas and electricity distribution networks.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Problem Being Solved

The UK government has pledged to reduce emissions by 80% (from 1990 levels) no later than 2050. As a result of this, drastic changes will be required across all sectors. This is currently most apparent in the electricity sector, as many of the early solutions to decarbonisation have been based on a transition to electricity consumption in applications which traditionally relied on the direct combustion of fossil fuels (e.g. electric vehicles for transport).

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Method(s)

The increase in electrification has led to interest in a new gas-electricity transport hub (the hub) concept to leverage the potential synergies available between the gas and electricity sectors when providing fuel for both hydrogen and plug-in electric vehicles. The Method is a research project to investigate the ability to convert between different networks to create considerable synergies, making use of under-utilised capacity on either network and helping to avoid over-loading one network at times of high demand. Furthermore, there are benefits of the flexibility inherent in a system of this type which could be sold on to transmission network operators and/or directly to generators.

The project will explore the technology of the key hub components and the business models around them to develop a viable configuration that will deliver customers with clean energy at minimum cost. The hub may consist of the following:

· Storage (e.g. hydrogen storage, battery)

· Fuel conversion units (e.g. electrolyser, fuel cell, steam reforming)

· Infrastructure for the appropriate low emission vehicles (e.g. powertrains in all transport segments including rail, EV charge point, hydrogen station)

Scope

The project will be carried out in 3 phases.

Phase 1:
- Interviews with key stakeholders to understand user requirements for both short-term feasibility insights and longer term interests in the business cases should there be a widespread replication of the hub
- Technology and market review of potential hub components, relevant vehicle types and the hub revenue stacks including sale of fuel and flexibility services in the UK

Phase 2:
- Economic and technical simulations and environmental impact assessment of potential hub configurations
- Financial model to project costs and revenues for preferred hub design(s)

Phase 3:
- Assessment of locations suitable for the hub within the funding licensee areas based on the above
- A detailed viable design and business case of the hub for all relevant stakeholders.

Objective(s)

This study aims to develop a viable design (including suitable technologies and business models) for a hub that could:

- optimise the utilisation of gas and electricity network capacities to avoid costly infrastructure upgrade

- be a cost effective option to facilitate the decarbonisation of transport and gas networks

- understand the opportunity to provide flexibility solutions to constrained networks

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

n/a

Success Criteria

The following outcomes which will be considered when assessing the delivery of a successful project:

1). A market report to understand the market opportunities including the current status and future projections for the vehicle types and hub components

2). Techno-economic model results of different hub designs with network impact assessments and business case evaluations

3). Assessment of potential benefits of a viable hub to all stakeholders

Project Partners and External Funding

This is a joint project between UK Power Networks and Cadent Gas Limited (Cadent). UK Power Networks will be leading the project and Element Energy (EE) will provide the consultancy services outlined in Scope. The cost of consultancy services will be shared 50/50 between UK Power Networks and Cadent. There is no external funding.

Potential for New Learning

This project will propose viable designs for a gas-electricity transport hub connected to both the gas distribution networks (GDNs) and electricity distribution network operators (DNOs). There will be new learning on the appropriate technology suitable for such an interface hub; the revenue streams for the hub and the kind of network services the hub can provide to minimise the impact of decarbonisation.

Scale of Project

This project is a desktop research study. It will investigate technology feasibility and market projections in GB; reducing this could potentially miss some applicable solutions that could be rolled out in GB. Phone and in-person interviews will also be carried out to understand stakeholder requirements.

Technology Readiness at Start

TRL2 Invention and Research

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

This is a desktop research project. The location assessment of preferred hub designs will focus on the geographical area where the funding gas and electricity network licensees overlap.

Revenue Allowed for the RIIO Settlement

No expenditure was allowed for this work within the RIIO-ED1 settlement.

Indicative Total NIA Project Expenditure

The consultancy costs for this project are split equally between UK Power Networks and Cadent, with each network recovering their internal costs. As UK Power Networks are leading the project their costs are higher. It is expected that the NIA expenditure will be £165,382 (£95,957 for UK Power Networks and £69,425 for Cadent) of which 90% will be reclaimed.

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 whole systems approach to deliver benefits for the electricity and gas networks and the transport sector. If proven viable, the hub could help defer or avoid network reinforcement cost which would otherwise be socialised to customers. A viable hub could also help facilitate the decarbonisation of transport and gas networks resulting in significant carbon benefits.

Please provide a calculation of the expected benefits the Solution

N/A as this is a research project.

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

The outputs of the project are applicable across GB subject to locational and network specific requirements.

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

It is expected that the costs for rolling out similar studies across other DNO groups would be comparable to UK Power Networks, although additional costs would be potentially be incurred to create network specific assessment. This project covers one of six DNO groups, therefore the expected costs across GB would be approximately £1m.

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

If it is shown that a hub is feasible then a follow-up demonstration project could be proposed to prove the learning. The project will also inform future GDN and DNO flexibility strategies.

The outputs of this project are relevant to the wider circle of stakeholders in the energy and transport sectors whose requirements will be captured in delivering 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.

There are a range of projects underway looking at hydrogen technologies and cross-vector compatibility. This project seeks to build on some of those learnings and to develop a viable use case for the gas and electricity networks. Specifically, we've looked at the following projects:

- H21 series of projects led by Northern Gas Networks produced detailed feasibility study of converting the gas networks to hydrogen but there was minimum work on the electricity networks.

- Both the Aberdeen Hydrogen Feasibility Study (2012_02) led by Scottish and Southern Energy Power Distribution and Hydrogen Heat and Fleet Viability Assessment (NIA_WPD_032) led by Western Power Distribution look at the logistical viability and network impact of refuelling hydrogen vehicles. PowerFlow aims to also study the optimisation and flexibility markets across both gas and electricity networks.

- Another project underway is Green City Vision (NIA_WWU_051) led by Wales and West Utilities which aims to inform an holistic and optimised energy solution for a city. PowerFlow is taking a step further to develop a specific viable use case (i.e. a transport hub).

We have spoken to stakeholders of the projects mentioned above to ensure no duplication and we will continue to leverage learnings from each other where applicable.

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 explores alternative powertrains in all transport segments including rail. Moreover, recent projects have mainly focused on enabling EVs or hydrogen vehicles separately but there could be synergy between them that can facilitate decarbonisation while optimising the utilisation of electricity and gas network assets.

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 no definitive study or testing to prove viable technologies and business models to support a gas-electricity transport hub. There are significant operational and financial risks to the networks and the hub operator in procuring such a hub without the feasibility study. It is unclear within the existing regulatory framework who would be a suitable owner / operator for the hub, increasing the risk for licensee investment.

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

This is a feasibility study to address some of the technical and commercial risks of the development of a gas-electricity transport hub. There is currently no proven business case of such a hub so these risks are unknown to both the DNOs and GDNs.

This project has been approved by a senior member of staff

☑ Yes