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 2023

Project Reference Number

NIA_NGN_391

Project Registration

Project Title

Low to no power heat alternatives

Project Reference Number

NIA_NGN_391

Project Licensee(s)

Northern Gas Networks

Project Start

May 2023

Project Duration

2 years and 1 month

Nominated Project Contact(s)

sdacre@northerngas.co.uk

Project Budget

£179,400.00

Summary

Loss of electricity, gas, or both occur across the UK due to a variety of reasons, ranging from natural causes, human error, and system overloads. Most outages do not last very long (ending in seconds to minutes), however, there are instances where network outages can last for extended periods of time (days to weeks). Though inconvenient for all consumers, the severity of impact can differ from each household, particularly where vulnerable individuals or persons requiring support from healthcare equipment are affected. During extended outages, local communities look to alleviate the impact by providing independent systems to provide heat or electricity output.

Third Party Collaborators

LIND Limited

Energy Innovation Centre

Nominated Contact Email Address(es)

innovation@northerngas.co.uk

Problem Being Solved

Energy network outages (loss of electricity, gas, or both) occur across the UK due to a variety of reasons, ranging from natural causes, human error, and system overloads. Most outages do not last very long (ending in seconds to minutes), however, there are instances where network outages can last for extended periods of time (days to weeks). Though inconvenient for all consumers, the severity of impact can differ from each household, particularly where vulnerable individuals or persons requiring support from healthcare equipment are affected.

During extended outages, local communities look to alleviate the impact by providing independent systems to provide heat or

electricity output. However, often these items or solutions are either short-lived and/or single use resulting in a strain to communities to efficiently distribute at the required frequency or at an acceptable cost level. Additionally, no technology covers the provision of both heat and electricity output, requiring multiple technologies to be deployed.

Method(s)

This project looks to modify the existing LIND Ltd technology (an installed energy storage system) to produce a solution that will alleviate the negative impacts associated with the loss of both the heat and electrical demand by the impacted households/ consumer. The end solution will comprise of a standalone unit that can be easily deployed and continually supported, beyond a single discharge capacity, in instances where outages last for a significant period (greater than a day). This solution can then be collected for reuse in future incidents and outages.

The project is split into three stages to take the proposed modified technology from TRL 3 to 6: Stage 1 (Design Study and Feasibility) – comprises of several investigations to refine the requirements of the LIND system to develop a solution that meets the technical needs while being as cost-effective as possible.

Stage 2a (Proof of concept and Prototype testing) – produce a full-scale prototype for the temporary solution and demonstrate its capability.

Stage 2b (Certification) – comprehensive testing and documentation of safeguards, both technical and nontechnical, in each environment by using established evaluation criteria.

Scope

Feasibility Study – production of a series of reports to assess need, impact, cost, and carbon footprint of proposed technology based on the modification of existing LIND Ltd technologies. These reports will provide information to the steering committee in their go/ no go decision.

Prototype Delivery – In house modifications to be developed and installed. Simulated operating and system efficiencies to be conducted. Proposal and production figures to be derived for steering committee to assess.

Objective(s)

· Stage 1

§ Market study – determine the need and requirements of the identified clients and the subsequent demand

§ Technical feasibility – the modifications required to provide the deliverables identified in the needs/ requirements of the market study. Innovations and associated impact to the technology will be assessed. Safety and risk issues identified with appropriate elimination/ mitigation assurances adopted.

§ Operational feasibility – support networks (such as the unit deployment, electrolyte refill, and personnel level) to be assessed based on the market study and the technical feasibility outputs.

§ Economic feasibility – will determine an initial upfront and ongoing cost for technology at the end of the project. Areas of cost optimisation to be identified and worked toward as part of stage 2 for hypothetical developments.

§ Carbon audit – impact to produce, support, and run will be determined for the system's carbon footprint assessment and compared to alternative technologies available

· Stage 2

§ Preliminary schematics – with the identified requirements from the Stage 1 Technical Feasibility and Operational feasibility showing the bill of materials and assembly process required for both the temporary and semi-permanent solutions.

§ Diaphragm reservoir – reservoir mechanical separation for drainage and replenishment of used and new electrolyte respectively.

§ Stack and electrolyte production – electrochemical stacks and electrolyte required for 1 prototype system will be produced and changed between the two system solutions

§ Temporary Solution system – the required wet works with inputted diaphragm technology produced and tested.

§ Life cycle assessments – inhouse cycle efficiencies tested on the temporary solution to the estimated usage pattern identified from the Stage 1 market study

§ Certification Acquirement – identification and conduct of appropriate certifications to be deployed into field

§ Report – a finalised report will be produced identifying risks possible for field deployment and updated figures incorporating real data to the estimates from the feasibility reports

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

The project is seeking to develop equipment that supports vulnerable customers during power and/or gas outages by means of continuous provision of energy to deliver common key needs of household (food storage/ prep, light, heat, etc.). This will be especially important to vulnerable consumers who are dependent on electrical equipment or heat, particularly in lengthy outages.

Success Criteria

The solution will:

- Provide power for medically vulnerable (as per Priority Services Register definition)
- Provide heat in a gas/power outage
- Be deployable at short notice
- Have a simple set-up/ installation process
- Be safe for domestic use
- Be electrically safe
- Require minimal additional support
- Not damage the area it is installed at

Project Partners and External Funding

This project will be delivered by LIND Limited and facilitated by the EIC. LIND Ltd's mission is to reduce the carbon emissions from people's homes while giving the power of energy consumption back under their control. By utilising redox flow battery technology with our own proprietary electrolyte, the LIND Ltd energy storage system can provide both heat and electrical energy supply from low-tariff or renewable energy generating sources.

Other parties involved are SSEN and UKPN who are equal funding partners to NGN (Lead Partner).

Potential for New Learning

§ Diaphragm reservoir mechanism for drainage and replenishment of discharge and charged electrolyte respectively.

§ Electrolyte carrier vehicle/ delivery mechanism

§ Assembly method of LIND systems

§ Alternative solution for providing temporary heating for customers with interrupted energy supply.

Scale of Project

This project will look to involve stakeholders and consumers from three networks' licence areas (NGN, SSEN, UKPN), including a market research study to compile data on vulnerable customers' heat and electricity demand, outage frequency and duration.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL6 Large Scale

Geographical Area

NGN, SSEN, and UKPN licence areas.

Revenue Allowed for the RIIO Settlement

N/A

Indicative Total NIA Project Expenditure

An indication of the Total NIA Expenditure that the Funding Licensee expects to reclaim for the whole of the Project (RIIO2).

Total NGN External Costs: £51,333.33

Total NGN Internal Costs: £5,133.33

Total Overall NGN Project Costs: £56,466.66

Total SSEN External Costs: £51,333.33

Total SSEN Internal Costs: £5,133.33

Total Overall SSEN Project Costs: £56,466.66

Total UKPN External Costs: £51,333.33

Total UKPN Internal Costs: £15,133.33

Total Overall UKPN Project Costs: £66,466.66

Total External Project Costs: £154,000

Total Internal Licensee Project Costs: £25,400

Total Overall Project Costs: £179,400

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:

The project is seeking to develop equipment that supports vulnerable customers during power and/or gas outages by means of continuous provision of energy to deliver common key needs of household (food storage/ prep, light, heat, etc.). This will be especially important to vulnerable consumers who are dependent on electrical equipment or heat, particularly in lengthy outages. The technology will enable consumers in vulnerable situations to have the impact of power/gas outages minimised by providing them with a temporary heat and power source.

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

Please provide a calculation of the expected benefits the Solution

This is for Development or Demonstration Projects, not required for Research Projects. It should be (Base Cost – Method Cost, Against Agreed Baseline) and include a description of the recipients of the benefits.

· Financial

o Technology with a long-life cycle (15+ years under normal conditions) offering lower LCOE

o Reduction of support mechanism costs

· Customers

o Supports vulnerable customers during outages

o Continues provision of energy to deliver common key needs of household (food storage/ prep, light, heat, etc.)

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

Once developed, this system will be able to be manufactured and rolled out across GB. It will be most effective in areas where

power/gas outages are more common and residents are especially vulnerable, but will be able to be utilised by any networks, utilities, or community groups.

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

A unit cost of c.£8,000 is being targeted for this solution following completion of this project.

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

This project will develop and prototype new technology capable of better supporting customers during supply outages, something which currently isn't possible for network licensees. The technology will enable consumers in vulnerable situations to have the impact of power/gas outages minimised by providing them with a temporary heat and power source

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

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.

Whilst there are other activities ongoing to ensure that vulnerable residents are supported in the event of gas/power outages, this innovative use of electrolytes will enable both heat and power to be provided from a single re-usable device. Once depleted, the

electrolyte can be recharged and re-deployed when required.

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

The existing LIND Ltd. solution is based on redox flow battery technology, where the energy storage system exists as two keys but separate component: the stack (power capability) and electrolyte (energy density).

Currently, the existing system can be charged in a household when there is either a lower tariff or renewable energy generators that produce power at an excess; this power can then use to provide both heat and electricity demands at a stable and lower cost.

To meet the needs of a relief system, a standalone system can be designed where no connection to a household's electricity is needed. These standalone units could be delivered to the impacted household(s) and loaded with charged electrolyte to provide a source of independent, continuous electricity and heat to the requirement of the user for an extended period (continuous usage for several days). In instances where the relief is required for significantly longer periods, these can be supported by the replenishment of charged electrolyte (through pumping out old and in new) for continuous supply.

The key value point within the system is that no component is consumable and can be stored and deployed when needed.

Relevant Foreground IPR

All IPR stays with GDN's and as such no change to exiting market arrangements, the project focussing on no regrets changes and the use of exiting processes / frameworks where possible in order to ensure that financial impacts on customers are kept to a minimum

Data Access Details

For more information, please see https://www.northerngasnetworks.co.uk/wp-content/uploads/2018/03/Innovation-Data-Sharing-Policy.pdf

Please identify why the Network Licensees will not fund the project as apart of it's business and usual activities

This project is innovative and new, using electrolytes as both a heat and power source for the benefit of our customers in vulnerable circumstances and other consumers who may require additional support during gas and/or power outages.

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 can only be undertaken with the support of NIA as it is a novel concept which needs further development which is not factored into current business as usual allowances. This cannot be completed as part of NGN's BAU activities as there is still an element of risk involved as it has never been done before. Using NIA will open the project outputs up to be shared with other GDNs and DNOs.

This project has been approved by a senior member of staff

☑ Yes