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

Project Reference Number

NIA_SPEN_0069

Project Registration

Project Title

Heat - Discovery Continuation

Project Reference Number

NIA_SPEN_0069

Project Licensee(s)

SP Energy Networks Distribution

Project Start

February 2022

Project Duration

1 year and 11 months

Nominated Project Contact(s)

Watson Peat

Project Budget

£150,000.00

Summary

Heat - Discovery Continuation aims to explore the feasibility of network flexibility from large-scale and domestic TES to reduce peak demand on the transmission and distribution networks over multiple timescales, reducing the need for network reinforcement. We will also consider benefits to electricity generation by reducing the capacity required to meet peak demand and the gas system by helping to smooth the future demand for hydrogen.

This project is in place to safeguard the delivery and continuity of the associated SIF project.

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Credible pathways for decarbonising heat result in a large increase in electricity demand as gas and other fossil fuel fired boilers are replaced by heat pumps. One of the major challenges for the electricity system is the huge seasonal variation in the demand for heat with gas demand representing heat. In addition, there are extreme intra-day fluctuations in heat demand with rapid ramp rates.

Problem statements:

- Unmitigated increase in peak demand for electrified heat would overload the transmission and distribution networks, requiring major investment.
- Around 30% increase in generation capacity is needed for peak heat electrification, requiring major investment.
- To meet the unmitigated peak demand from low carbon renewable generation implies massive over-capacity in the generation and transmission systems for much of the year which will require to be met by investment.

This would lead to an increase in consumer bills.

Renewable generation is connected predominantly in the north of GB and heat load is predominantly in the south. The interconnectors in the transmission system are already constrained in their ability to export renewable electricity at times. Transmission connected renewable generators are being constrained off at a cost of ~ £450m per year to electricity customers and this is increasing. Renewable generation capacity is expected to quadruple to meet net zero, which could significantly increase constraints.

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Method(s)

A desktop feasibility study to investigate the feasibility of scale thermal energy storage in the UK as well as validating the economic benefits.

Scope

- Form TES Working Group
- Select heat network partner
- Develop a high level design for future demonstrations
- Support and accelerate the transition to SIF alpha

Objective(s)

Maximise the success of discovery by feeding in additional data gathering, formatting, reviewing and validation to inform the SIF outcomes

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

N/A awaiting tool.

No impact has been identified that would cause adversity to any consumer vulnerability group (based on the PSR definition)

Success Criteria

Maximise the success of discovery by feeding in additional data gathering, formatting, reviewing and validation to inform the SIF outcomes.

Project Partners and External Funding

- **The University of Edinburgh** will leverage their experience of transmission system modelling in the INTEGRATE project.
- **The University of Glasgow** will be a major contributor, bringing their extensive experience in geological thermal energy storage.
- **Ramboll** will bring their experience in the rapid development of the thermal pit storage technology in Denmark.
- **DELTA-EE** will primarily contribute learnings from their research into large-scale TES undertaken for BEIS and others.
- **Vattenfall** will contribute from their practical experience as one of Europe's largest producers and retailers of electricity and heat.
- **Erda Energy** will support by bringing expertise from their innovative solutions for low-carbon heating, cooling and geo-exchange technology.
- Active Building Centre Research Programme: Centre of excellence for buildings involved in developing new TES technologies.

- Connected Response: SME technology provider of smart controls for storage heating and hot water systems.
- Sunamp: A leading manufacturer of Phase Change Material thermal battery storage technology.
- E.ON Energy Solutions: Leading energy solution provider within the UK domestic sector.

This project is in place to safeguard the delivery and continuity of the associated SIF project.

Potential for New Learning

This project will provide learning on the feasibility and requirements of TES solutions in the UK.

Scale of Project

Heat - Discovery Continuation facilitates a small-scale feasibility study and CBA, which will inform both a small-scale and a large-scale demonstration.

Technology Readiness at Start

TRL3 Proof of Concept

Technology Readiness at End

TRL4 Bench Scale Research

Geographical Area

N/A

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

£150,000

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:

The number of heat networks is set to rapidly increase as part of the government's energy and environmental plans and legislation in line with the energy system transition. There is an opportunity to ensure that appropriate TES is incorporated with heat networks to assist with an efficient transition to low carbon heat and optimal development of the whole energy system.

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

Please provide a calculation of the expected benefits the Solution

This is a research-based project. Benefits will be quantified throughout the project.

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

We will demonstrate the value of TES to different parts of the energy system and propose how this can be released.

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

This is a research-based project. Roll out costs will be quantified throughout the 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

The learning generated will be in line with UK requirements, this means the TES solutions investigated will be highly applicable to licencees across the UK.

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.

There are very few documented examples of TES at the required scale in the United Kingdom. BEIS, Evidence Gathering: Thermal Energy Storage (TES) Technologies, 2016 commented 'For interseasonal heat storage, developments in the UK are far behind those advancements made in other northern and central European countries.'

An important academic research project in which a number of our partners are involved is the EPSRC INTEGRATE (Integrating seasoNal Thermal storagE with multiple enerGy souRces to decArbonise Thermal Energy, EP/T023112/1) project.

The HotScot project which has been awarded early stage funding by UKRI to develop plans to harness the geothermal energy contained within an abandoned, flooded coal mines in Scotland.

Innovation projects have been carried out on topic of heat however there are still many barriers to deployment to be addressed. In particular the use of domestic TES has not yet been fully explored. In addition to projects researching decarbonisation of heat, we will take relevant learnings from projects investigating the wider topic of demand flexibility.

Network Innovation Allowance (NIA) projects of particular relevance in investigating how peak demand reduction can be achieved through use of TES:

Small scale TES is addressed within NINES and ACCESS and we are building on this with our Re-Heat project in which we are trialling PCM thermal storage as a flexible asset alongside ASHPs on a wider scale.
4D heat found that storage heating could enable significant amount of presently constrained wind to be dispatched and we are investigating how flexibility from storage heaters can be utilised through our Flexible Tower project.

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 is the first project to explore and compare different large scale and domestic daily and interseasonal thermal energy storage solutions in the UK.

Relevant Foreground IPR

The specific Relevant Foreground IPR is unknown for this project phase due to it being a feasibility study. If the project is successful and progresses to futher phases where the identified optimal solution is being developed, Relevant Foreground IPR will be identified and reported.

Data Access Details

Access to this data must be requested by contacting SPInnovation@spenergynetworks.com Please provide the following information in your request:

- Affiliation, position and contact details of requesting party
- Relevant project and type of data required
- Reasons for requesting this data and evidence that this data will be used in the interest of the UK network electricity customers
- How data will be shared internally and externally by the requesting party

Any data request deemed unsuitable for sharing will be highlighted to the appropriate requesting party. After receiving the request we will provide the estimated date for completing the data provision based on other requests and our team workload at that time. All requested data remains the property of SP Energy Networks.

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

There is no allowance within the SP Transmission RIIO-2 business as usual funding that is appropriate to fund this innovation 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

The project has both technical and commercial risks including the identification of suitable test locations and developing a solution that is at least cost to the consumer. Due to the early TRL, the success of the project and associated financial benefits of the project cannot be determined at this stage therefore it can only be undertaken with the support of NIA. This NIA is in place to meet all user requirements of the SIF scope and to derisk the delivery.

This project has been approved by a senior member of staff

☐ Yes