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

Mar 2023

Project Reference Number

NIA2_NGET0035

Project Registration

Project Title

Green Heat for Local Communities (GHLC)

Project Reference Number

NIA2_NGET0035

Project Licensee(s)

National Grid Electricity Transmission

Project Start

April 2023

Project Duration

1 year and 7 months

Nominated Project Contact(s)

Siyu Gao

Project Budget

£213,000.00

Summary

With the need to decarbonise heat we need new and innovative ways of heat delivery that do not involve large infrastructure investment, high installation costs for consumers or high energy charges. The current solution is electrified heat via ASHPs[SA1] [GS2] (Air Sourced Heat Pumps). The CoP[SA3] [GS4] [GS5] (Coefficient of Performance) of an ASHP in the summer months can be as high as 4.5 but can drop below 2 when temperatures outside decrease to sub-zero. This reduction in efficiency would force the ASHPs to consume more electricity in order to meet the same demands. The increased electricity consumption is highly undesirable. This project would explore the feasibility of recovering waste heat from community adjacent cable head house(s) to maintain the CoP so that the energy bills could be lowered for consumers.

Nominated Contact Email Address(es)

box.NG.ETInnovation@nationalgrid.com

Problem Being Solved

With the need to decarbonise heat, we need to look at new and innovative ways of heat delivery that do not involve large infrastructure investment, high installation costs for consumer or high energy charges. The current solution is electrified heat via air sourced heat pumps (ASHPs). During the summertime, low grade warm air is used as a heat source which is upgraded to a higher temperature for heat distribution. The coefficient of performance (CoP) of an ASHP in the summer months can be as high as 4.5 but can drop to 2 or lower when temperatures outside decrease to below zero. This reduction in efficiency would force the ASHPs to consume more electric power in order to meet the same temperature demands. The increased electricity demand is highly undesirable as it increases the energy bills paid by the consumers, who are already facing the challenges imposed by the current cost of living crisis.

Method(s)

The proposed solution method is to investigate the feasibility of heat extraction of community adjacent transmission cable head house(s), and to incorporate such heat extraction as part of the district heating solution design. The air temperature at the cable head

house(s) is determined by the cable loading, which is usually at maximum during winter times, meaning that it is quite possible that there is enough heat to be recovered to keep the CoP of the ASHPs at high levels during winters and therefore keeping the electricity consumption at minimum.

The heat recovery system could be installed at the most appropriate location inside the head house(s) to allow most efficient heat extraction. Identification of such locations is part of the feasibility study. The recovered heat could then be fed into a district heat network to provide heating for both space and water used by consumers.

If successful, the proposed solution would be able to reduce the electricity demand by ASHPs in both summers and winters, therefore lowering the energy bills paid by consumers.

This project proposes to perform a feasibility study to define the parameters required to enable this solution to be commercially viable, e.g., optimised equipment placement configuration in the transmission cable head house, ventilation shaft flow rate, primary heat pump output capacity, temperatures at various location of the heat loop, pipework costs, indicative system installation costs, etc.

Data Quality Statement (DQS):

- The project will be delivered under the NIA framework in line with OFGEM, ENA and NGET internal policy. Data produced as part of this project will be subject to quality assurance to ensure that the information produced with each deliverable is accurate to the best of our knowledge and sources of information are appropriately documented. All deliverables and project outputs will be stored on our internal sharepoint platform ensuring access control, backup and version management. Deliverables will be shared with other network licensees through following channels:
  - Closedown reports on the Smarter Networks Portal.

Measurement Quality Statement (MQS):

- The methodology used in this project will be subject to supplier's own quality assurance regime. Quality assurance processes and the source of data, measurement processes and equipment as well as data processing will be clearly documented and verifiable. The measurements, designs and economic assessments will also be clearly documented in the relevant deliverables and final project report and will be made available for review.

In line with the ENA's ENIP document, the risk rating is scored 6 = Low.

TRL Steps = 2 (3 TRL steps)

Cost = 1 (<£500,000)

Suppliers = 1 (1 supplier)

Data Assumption = 2 (Assumptions known but will be defined within project)

Scope

The project is scoped into 2 phases.

- Phase 1: Feasibility study and scheme design
  - Project inception and commencement meeting
  - Site survey visit
  - Workshop 1: data collection & shortlist design options
  - Feasibility study report for the project
  - Workshop 2: design option confirmation
  - Royal Institute of British Architects (RIBA) Stage 3 design pack of the project
  - Phase 1 close out meeting
- Phase 2: Reference design for NGET specification integration
  - Phase 2 commencement meeting
  - Collated package of RIBA Stage 3 reference design including heat recovery performance specification, generic layout, and schematic drawings
  - Project close-out meeting

The key aspects of each phase are:

- Core feasibility study (Phase 1): Detailed analysis and feasibility study for the selected site in order to understand the heat recovery potential as well as how and to what extent the recovered heat can be integrated into a district heating solution that is commercially

viable.

- Wider application & preparation for roll-out (Phase 2): Building on the learnings from Phase 1, an integrated reference design would be developed for heat recovery with both improvement in cable cooling and heat recovery. This aims to incorporate the design into NGET's design library, such that they could be easily adopted by NGET as part of the standard specifications for future projects to reduce overall build costs and to accelerate deployment. [SA1] [GS2]

Objective(s)

The objective of this project is to assess the feasibility of recovering waste heat from community adjacent cable head house(s) for district heating solutions. The study would focus on a most suitable transmission cable head house owned by NGET that is adjacent to communities that need heat supply.

Consumer Vulnerability Impact Assessment (RIIO-2 Projects Only)

An assessment of distributional impacts (technical, financial and wellbeing related) for this project has been carried out using a bespoke assessment tool, which assesses the project as having a positive, negative or neutral effect on consumers in vulnerable situations. To help inform the assessment, this tool considers the categories of consumers identified in the Priority Services Register.

This project has been assessed as having an overall positive impact on consumers in vulnerable situations. The assessment has identified that this project will look to reduce the costs for households (energy bills). Other considerations including the projects impact on supply, immediate health and safety in the home have been made in carrying out this assessment.

Success Criteria

This project is deemed as successful if the objectives are achieved. In particular, the following outputs will be important when assessing the success of the project:

- Validation of the feasibility of heat recovery from community adjacent cable head house(s)
- Validation of the design of heat recovery utilisation and its integration into district heating
- Standardisation of hardware design for cable head house heat recovery

Project Partners and External Funding

Project partner: SGN Commercial Services Limited (unregulated). They will provide expert knowledge on ASHPs and essential data.

Potential for New Learning

The potential new learnings from this project are:

- Design requirements for the most effective and efficient heat recovery in a cable head house environment
- The best way to integrate recovered heat for district heating solutions
- Standardisation and future-proof requirements for such heat recovery designs

The learning will be disseminated through the publication of project progress and closedown reports on the ENA portal. Various workshops and dissemination events would also be planned.

Scale of Project

The scale of the project includes the followings.

- Data collection of the cable head house(s) and other relevant sites
- Design optioneering and candidate selection
- Detailed feasibility study and reporting
- Confirmation of design option
- Provision of RIBA Stage 3 design pack
- Detailed study of design standardisation
- Provision of the standardised design
- Project conclusion and way forward presentation

Technology Readiness at Start

Technology Readiness at End

TRL4 Bench Scale Research	TRL7 Inactive Commissioning

Geographical Area

The project will mainly be carried out on the premises of the supplier. NGET and SGN sites will be accessed for assessment and data collection purposes as the project requires.

Revenue Allowed for the RIIO Settlement

Not applicable.

Indicative Total NIA Project Expenditure

Total NIA expenditure: £191.7k

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:

To decarbonise heat, which is an important aspect of the energy system transition, it is important that the alternative heating solutions, e.g., ASHP, are effective and efficient at producing heat. This project aims to produce a heat recovery solution that could improve the CoP of ASHPs at all times, so that their energy consumption would be at minimum. If this project is successful, this solution could be rolled out nationally and the learnings from the project could contribute significantly into heat decarbonisation.

How the Project has potential to benefit consumer in vulnerable situations:

If the project turns out to be successful, networks could apply the proposed solution for their district heating designs and thus reduce the energy bills paid by the consumers since the proposed solution would be able to lower the electricity consumption by the ASHPs.

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)

Not applicable.

Please provide a calculation of the expected benefits the Solution

The benefits of this project are calculated based on a 637-home development by SGN. The assumption is that, with the proposed heat recovery solution, the CoP of the ASHPs could be maintained to an annual average of 3. The NPV benefits over the next 25 years is £958k.

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

NGET owns about 80 cable tunnels in England and Wales. If this project is successful and there is enough interest from the tunnel adjacent communities, it is possible that the solution developed in this project could be adopted for the local communities.

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

The costs of deploying this solution would depend on the cable loadings, since the higher the cable loading, the more waste heat could be recovered and vice visa. The local tunnel access, the distance from the cable head house(s) to the communities and the local demand for heat would also impact on the cost of deployment.

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 aims to assess the feasibility of recovering waste heat from cable head house(s) for local district heating. A successful project would produce a standardised hardware design and recommended integration solution. These outcomes should allow relevant licensees to evaluate whether they could adopt such a solution for their own assets.

Or, please describe what specific challenge identified in the Network Licensee's innovation strategy that is being addressed by the project (RIIO-1 only)

Not applicable.

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 is a project registered on the ENA portal, NIA2_NGET0003, which is exploring heat recovery. However, this project is investigating the feasibility of heat recovery from housed transformers, which is set in an entirely different context to cable head house. Moreover, in NIA2_NGET0003, the placement of the heat recovery unit has already been identified, while in this project, placement of the heat recovery equipment is an essential part of the feasibility study. Also, this proposal could have direct positive impacts on consumers' energy bills, which is not included in NIA2_NGET0003. A wider search on the ENA portal and the internet did not identify similar projects.

If applicable, justify why you are undertaking a Project similar to those being carried out by any other Network Licensees.

Not applicable.

Additional Governance And Document Upload

Please identify why the project is innovative and has not been tried before

Heat recovery has been done before for recovering waste heat from indoor transformers. Heat recovery from cable head house(s) has not been investigated before as it is more complicated and may require access to the cable tunnel shaft. To recover heat from a cable head house, it may be required to install non-standard hardware in the cable shaft, or the cable ventilation may need modification to accommodate the heat recovery equipment. This project would investigate how these needs could be standardised and this would be an important innovation of the project.

Relevant Foreground IPR

The foreground IPR will mainly be the results of the feasibility study, the RIBA Stage 3 design pack and the standardised design solution. The background IPR concerning the cable head house(s) and other relevant sites will be contributed by NGET and SGN.

Data Access Details

Data for this project and all other projects funded under the Network Innovation Allowance (NIA), Network Innovation Competition (NIC) or the new Strategic Innovation Fund (SIF) can be found or requested in a number of ways:

· A request for information via the Smarter Networks Portal at https://smarter.energynetworks.org, to contact select a project and click 'Contact Lead Network'. National Grid already publishes much of the data arising from our innovation projects here so you may wish to check this website before making an application.

- Via our Innovation website at https://www.nationalgrid.com/uk/electricity-transmission/innovation
- Via our managed mailbox box.NG.ETInnovation@nationalgrid.com

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

It is currently unknown whether it would be feasible to recover enough heat from cable head house(s) to make it a commercially viable solution. Even there is enough heat to be recovered at one location, there may not be a demand for the recovered heat. Due to these uncertainties, BaU is thus not the appropriate funding mechanism for 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

This project involves feasibility studies that are highly uncertain and are above the risk appetite of BaU. The project aligns fully with the NIA objectives as it has the potential to accelerate decarbonisation of heat. It also has the potential to offer direct benefits to consumers as if the project is successful, it could lower the electricity consumption by the ASHPs and thus lower the energy bills paid by consumers. It is innovative as heat recovery in cable head house has not been explored before. The learnings can be used by other network licensees to speed up their own heat decarbonisation solutions. Therefore, NIA is the appropriate funding mechanism for this project.

This project has been approved by a senior member of staff

☑ Yes