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 2024

Project Reference Number

NIA_SPEN_0102

Project Registration

Project Title

Re-Heat: Enabling Renewable Heat (ED-2)

Project Reference Number

NIA_SPEN_0102

Project Licensee(s)

SP Energy Networks Distribution

Project Start

May 2024

Project Duration

2 years and 3 months

Nominated Project Contact(s)

Michael Green

Project Budget

£1,985,213.00

Summary

Re-Heat will trial innovative techniques to mitigate the effects of increased demand from domestic electrical heating on the distribution network and increase utilisation of presently curtailed renewable generation.

Preceding Projects

NIA SPEN 0057 - Re-Heat: Enabling Renewable Heat

Third Party Collaborators

Energy Innovation Centre

Nominated Contact Email Address(es)

innovate@spenergynetworks.co.uk

Problem Being Solved

Space heating and hot water, predominantly from fossil fuels, accounts for 21% of UK carbon emissions. Decarbonising heat is essential to meet the ScottishGovernment's 2045 Net Zero target. Electrification of heat forms a major part of that ambition and the off-gas grid is a priority. We forecast up to 0.8 million heat pumps to be connected in Scotland by 2030 (Source: SSEN Distribution Future Energy Scenarios (DFES) 2020 and SP Distribution DFES 2020). Further, within the draft heat in building strategy published in February 2021 the Scottish Government have set an ambition to convert over 1 million domestic properties to low carbon heating by 2030 many of which will be heat pumps. Large scale electrification of heating will significantly increase peak demand on the electricity network. The present peak heat demand across GB can be four times that of 'normal' electricity usage. Major investment in electricity

networks will be required to facilitate this via network reinforcement and delivery of new flexible services. The ability to shift heat demand by using domestic thermal storage offers an option to assist the network through flexibility as an alternative to conventional reinforcement.

Additionally, network constraint payments to Transmission connected wind farms exceeds £100m per annum. Recent work by SSEN and the ESO in the 4D Heat project estimated that better matching heat demand to the constrained periods could result in savings of £24m per year by 2030.

Phase Change Material (PCM) heat batteries are a relatively novel technology which offer a low maintenance, long life alternative to hot water storage and electric batteries. The use of domestic PCM heat batteries to shift and manage peak load on the network and enable greater use of constrained wind could result in financial benefits to the customer through reduced reinforcement costs and reduced network constraint payments. However, integration of the technology with smart controls and network signalling has not been trialled on a large scale. This project will understand customer behaviour, and identify the most appropriate technical, commercial and regulatory architectures to be applied.

Smart meter load control switches are an option for control of heat load in emergency situations which would inconvenience customers. There is a need for an option which enables networks to be able to access flexibility whilst maintaining customer comfort. This option requires a sophisticated active network management approach.

Method(s)

We will undertake a large-scale technical trial of PCM storage in conjunction with smart control and heat pumps investigating the capability to:

1. Reduce peak demand on LV networks and therefore defer or avoid conventional reinforcement
2. Time-shift heat demand to better match available wind generation and therefore reduce constraint payments

We will develop the planning and analysis tools ‘DSO Toolkit’ to assess the impact of installation and operation of electric heating technologies on the electricity networks, and enable design solutions using thermal storage with smart control to be evaluated.

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Scope

The Scope of Re-Heat is outlined below:

S1 Develop network planning tools to:

1. Assess the impact on network demand profiles and diversity, particularly peak demand characteristics.
2. Help evaluate the most efficient design solution considering the technique being trialled under Re-Heat compared to conventional reinforcement and alternative smart solutions.

S2 Develop a Direct Load Control in home controller to be used in domestic properties with Air Source Heat Pump and PCM thermal storage devices.

S3 Develop an interface to allow the DNO to schedule and dispatch load control requirements.

S4 Demonstrate through installation and trial in ~150 properties successful operation of the smart controls and thermal storage solution in conjunction with heat pumps.

S5 Analyse and evaluate trial results and develop policy, regulatory and funding recommendations to enable the trialled Re-Heat method to be adopted at scale. The expected benefits will be revisited and recalculated based on the trial results.

S6 Calculate benefits of the Re-Heat approach compared to conventional reinforcement.

S7 Stakeholder engagement and dissemination to address stakeholder expectations and disseminate learning effectively to maximise further uptake of the solution.

Objective(s)

The high-level objective of Re-Heat is to facilitate the deployment of low carbon electrified heating by avoiding delays and costs created by the need for reinforcement :

1. Develop DSO tools for assessing the network impact of heat load and for evaluating alternative solutions including the method trialled under the project
2. Assess the effectiveness and reliability of PCM thermal storage as flexibility to the network and on customer acceptance, comfort and satisfaction through live trials.
3. Evaluate the technical and commercial models used in the trial to understand their effectiveness and costs/benefits of using the ReHeat method in comparison with conventional reinforcement.

Consumer Vulnerability Impact Assessment

This project was evaluated to have a net benefit to customers, through increased understanding of the impact of heat pumps on demand profiles, and improving networks' ability to manage this.

Success Criteria

The broad success criteria of the project will be to determine whether the use of PCM heat battery alongside a smart controller can be a cost effective and reliable alternative to conventional network reinforcement.

Project Partners and External Funding

We have partnered with SSEN to deliver Re-Heat. Other project Partners will be E.On, Derryherk and an academic partner.

The project leverages funding from several other sources which are outlined below:

E.On
Amount: £484,787
Type of Agreement: Agreement in principle from project partner to fund from ECO obligation

Participating Local Authority
Amount: £1,202,500
Type of Agreement: Participating local authorities are applying for HEEPS:ABS funding

ScottishGovernment LCITP
Amount: £1,427,000
Type of Agreement: Funding applied for through the ScottishGovernment’s Low Carbon Infrastructure Transition Programme

Potential for New Learning

Re-Heat will deliver significant new learning which will reduce the costs of network upgrades for both customers and network operators and accelerate the deployment of electrified heat.

Re-Heat will generate new learning in the following areas:

- Proven techniques as alternatives to conventional reinforcement that can support the wide scale deployment of electrified heat in areas of network constraint, refined and improved through trials,
- Solutions that work for customers. Customer engagement and research that will be undertaken around the technical and commercial approach trialled
- Recommendations for GB-wide implementation. Including policy implications, regulatory requirements, and funding considerations

Scale of Project

The project will involve a trial of ~150 household located in areas which are off the gas grid.

This will be broken down as follows:

- East Ayrshire Council ~50 properties (SPEN)
- East Dunbartonshire Council ~ 50 Properties (SPEN)
- Highland Council ~50 properties (SSEN)

Each property will be provided with a thermal storage unit and smart control device to support the heat pump use.

Technology Readiness at Start

TRL6 Large Scale

Technology Readiness at End

TRL8 Active Commissioning

Geographical Area

The project trial will take place across three local authority regions in Scotland; East Ayrshire Council, East Dunbartonshire Council and Highland Council.

Revenue Allowed for the RIIO Settlement

None

Indicative Total NIA Project Expenditure

The project total expenditure will be £4,936,000. The amount funded through NIA will be £1,983,213. The estimated NIA contributions from funding licensees will be:

SP Energy Networks - £1,218,213
SSEN - £767,000

Project Eligibility Assessment Part 1

Requirement 1

Facilitate the energy system transition and/or benefit consumers in vulnerable situations

Please answer **at least one** of the following:

How the Project has the potential to facilitate the energy system transition:

The project will improve the understanding of the impact of Heat Pumps on the network, and will facilitate increased installation and propagation of the equipment.

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

N/A

Please provide a calculation and/or description of the expected benefits of the solution

Two typical rural clusters of households within SPD region were selected for case studies. The two clusters consisted of 160 properties in total. The benefits achieved through using the Re-Heat method have been calculated based on the average of these two typical rural clusters.

Our analysis estimated that there are around 600 similar clusters in SPD area.

The benefit compared to conventional reinforcement was calculated as £145k approximately per cluster.

Base Case (Conventional reinforcement) – £203k
Re-Heat Method – £55k

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

The method trialled by Re-Heat could be replicable across all other parts of GB where there are off gas areas as electrification of heat will be a priority. The percentage per DNO will vary.

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

Our analysis estimated that there are around 600 clusters in SPD area. We extrapolated our case study results across the SPD region using this number and then pro-rata across GB.

Using this approach we have estimated that roll out of the Re-Heat method across GB would total £429m.

Requirement 3 / 1

Involve Research, Development or Demonstration

Projects 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

Involve Research, Development or Demonstration - Please select all that apply

☑ 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 learnings from Re-Heat will help enable a cost-effective means to help networks support the decarbonisation of heat in off-gas areas. Learnings from the DSO toolkit will be relevant for network analysis and design teams.

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. Networks must explicitly mention similar projects that they have considered and how these differ.

Please demonstrate below that no unnecessary duplication will occur as a result of the Project.

Re-Heat is the first project to investigate the extent to which the use of thermal storage and smart controls can benefit the network. There is a large-scale electrification of heat demonstration project being delivered by BEIS which will install 750 heat pumps across GB. We will maintain regular contact with the other projects which are investigating electrification of heat so that findings can be shared.

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

Re-Heat seeks to introduce an innovative smart control and thermal storage which have not been trialled previously. Thermal storage unit costs are presently expensive for customers to install and there is not a commercial mechanism available for the customer to

obtain a return on investment. The work to be undertaken in Re-Heat will consider whether thermal storage may offer a return on investment for when network benefits are taken into consideration.

Relevant Foreground IPR

This Section is not to be completed until we receive IPR guidelines from Ofgem

Data Access Details

The SP Energy Networks Data Sharing policy can be found here.

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

There are aspects of Re-Heat which will require an amount of development work. These include the development of planning and operation tools and development of smart in-home controllers. Such activities will develop the TRL of technologies to a level where they can be included within a commercial proposal. Without innovation funding the business could not commit to these activities due to the associated risks and uncertainties.

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

As an innovation project Re-Heat holds a number of uncertainties and risks which would not have been possible in our BaU activities. The most prominent risks include lack of customer willingness to participate, failure of the trial to deliver as expected and interface issues between smart controllers. Delivery of Re-Heat will enable the project partners to closely monitor the project risks make early identification of new risks and apply appropriate mitigation where relevant.

This project has been approved by a senior member of staff

☑ Yes