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Network Innovation Competition Screening Submission Pro forma

Notes on completion

Before completing this form, please refer to the relevant Network Innovation Competition (NIC) Governance Document(s).[1]
Please use default font (Verdana size 10) in your submission and retain 1.5 line spacing.
We will only accept the text visible in the text entry areas.
The text entry areas are predetermined and should not be changed.
The full-completed submission should not exceed 19 pages in total.

Ofgem will publish all the information contained within this Screening Submission.

Is the application for the Gas or Electricity NIC? If a Cross-Industry Project, please state 'Cross-Industry'.
Electricity NIC
Funding Licensee
SP Distribution plc
Project Partners including other Licensees
Delta-EE; Energy Systems Catapult; E.ON Energy Solutions Ltd; PassivSystems Ltd; Smarter Grid Solutions; Supergen; East Ayrshire Council; National Grid ESO; UK Power Networks; Western Power Distribution; Northern Powergrid; SSEN
Project Title
Re-Heat: Enabling **Re**newable **Heat**

[1] https://www.ofgem.gov.uk/publications-and-updates/version-30-network-innovation-competition-governance-documents All capitalised terms used in this document have the meaning given to them in the respective NIC Governance Document.

OFG1161

Project Summary
Re-Heat is the first project to address how electricity networks can facilitate the large-scale decarbonisation of heat. This requires innovations in demand reduction, system flexibility and energy storage to help manage the greatly increased demands on the electricity system. The primary focus is off-gas grid heat as this carbon intensive sector is a priority for action for UK government and devolved governments. Uniquely, Re-Heat will demonstrate how to: • Reduce or defer extensive network upgrades arising from increased peak demand from electrified heat. • Better match electric heating to renewable generation; reducing network constraint payments and increasing the use of low carbon electricity. It will be the first project to demonstrate in a large-scale trial with electric heating systems the ability to shift and smooth peak demand by interfacing networks constraint requirements to in-home control systems. Building on the products of ENA Open Networks, Re-Heat will: • Demonstrate and evaluate different approaches for management of electric heating; reducing peak demand and reducing constraints on renewable generation. • Trial and evaluate commercial arrangements, focussing on the customer perspective. • Develop tools for DNOs and wider stakeholders to make better informed, quicker decisions on the best options to facilitate the uptake of electrification of heat.

Estimated Start Date		**Estimated End Date**	
January 2021		December 2024	
Total Project Cost	£15.5m	**NIC Funding requested**	£8.5m
Technology Readiness Level (TRL) at start and end of project			6 - 8

What is the Problem that the Project seeks to address?

Space heating and hot water, predominantly from fossil fuels, account for 21% of UK carbon emissions. Decarbonising heat is essential to meet the government's 2050 Net Zero target. Electrification forms a major part of that strategy. Off-gas grid is a priority; approximately 2 million GB properties need to transition to low carbon electricity by 2030.

- The winter peak heat demand can be five times that of electricity. Large scale electrification of heating will significantly increase peak demand on the electricity network. Major investment in electricity networks will be required.
- Renewable generation is being curtailed at a cost to customers of over £100m per year because generation exceeds transmission network capacity at times. This issue will worsen with increased renewable penetration. Coordinating electrified heat demand with renewable generation could significantly reduce these costs.

Heat demand characteristics are complex due to the variation in geography, housing types and occupancy patterns as well as the different means of heat provision. A large-scale trial is required to answer the following questions, which are of strategic importance:

1. How can we evaluate the impact of the electrification of heat down to a granular local level and share this information with stakeholders in the planning process?
2. What alternatives to conventional reinforcement can help address the increased demand that electrification of heat presents to electricity networks?
3. How effective are the different solutions across geographies, housing types, and customer demographic groups?
4. How can we adjust the demand profile of electrified heat to better match available renewable generation thereby reducing constraint payments and increasing the utilisation of low carbon electricity?
5. How can this be done in a way that is acceptable to customers, enabling them to benefit from cost efficiencies, without a reduction in service levels or comfort?
6. How should alternatives to network reinforcement be funded, for example if they involve investment in customer premises?

The project will demonstrate how cost optimal solutions can be put in place to enable the transition to renewable heat.

What Method(s) will be used and why? Ie, what is being demonstrated or developed? Please describe in terms of the NIC eligibility criteria. (page 1/3)

Re-Heat brings an experienced delivery team together with the network partners required to make the project a success and ensure that its learnings can be adopted across GB electricity networks. The project will consist of four workstreams:

1. Trialling solutions to support deployment of electric heating.

This is the central workstream and will undertake a large-scale trial of network solutions to facilitate the transition to electric heating with particular focus on off-gas grid:

- We will leverage the complementary funding that is being invested in the electrification of heat to facilitate a large-scale trial across geographies, housing types, and customer demographic groups.
- The technical solutions to be trialled comprise network control systems, home energy optimisation systems, domestic thermal storage, and the interface/communications between these systems.
- The commercial solutions to be trialled will range from Time of Use tariffs to more sophisticated service plans that are capable of influencing or controlling energy use.

The objectives of this work package are:

- To build understanding of the network impacts of the electrification of heat across geographies, housing types and customer demographic groups etc.
- To evaluate the effectiveness of the technical and commercial solutions trialled as alternatives to conventional network reinforcement to enable the large-scale deployment of electric heating.
- Analysis of customer behaviour and feedback to evaluate customer acceptance of different propositions.

2. Development of a whole system toolkit to support electrification of heat

Local authorities and devolved governments/administrations throughout GB need to develop plans for the decarbonisation of heat. Due to the complex nature of heat demand characteristics, the electrification of heat will impact on networks in local areas in different ways. Stakeholders need understand the capacity of local networks to support electric heating and the alternative solutions that are available where network issues arise.

This workstream will develop a methodology and tools for assessing the impacts of electrification of heat. This will help stakeholders and DNOs identify the most cost-optimal

What Method(s) will be used and why? (page 2/3)

route to renewable heat. For example, smart heating management and smart grid controls to facilitate electrification of heat as a cost-effective alternative to network reinforcement.

The objectives of this work package are:

- Develop tools that assess how different heating requirements impact network demand, particularly peak demand. Identifying where demand growth triggers the need for network reinforcement and estimating the costs of conventional reinforcement compared with alternative interventions.
- Build on the learning from existing platforms such as the SPEN Network Analysis and Visualisation (NAVi) system, and the Northern Powergrid Self Service design application to deliver network data to third parties in a coherent form to aid their decision making.
- Inform the deployment of alternative interventions in Workstream 1. In turn, learning from trials will be used to refine the toolkit.

The learning from this workstream will be shared with network licensees to help in developing common approaches that assist stakeholder deployment of electrification of heat at scale.

3. Technical, commercial, and regulatory architectures

This workstream will build on the learning outcomes from the large-scale trial to develop recommendations for these 3 interlinked architectures needed for the delivery of electrified heating at scale. Through:

- Evaluating the technical and commercial models used in the trial to understand their effectiveness and costs/benefits for each of the actors in the electrical heating supply chain with recommendations for GB-wide, at-scale implementation.
- Analysis of the trialled and alternative energy supply market arrangements to develop recommendations on how best to implement the highest net value enabling technical and commercial architectures for electrical heat solutions.
- Recommendations for policy and regulatory modifications where required to support efficient investment in, and deployment of, the most promising trialled heat supply technical and commercial arrangements.
- Development and recommendations for network and third-party funding models for non-conventional interventions such as domestic thermal storage.

What Method(s) will be used and why? (3/3)

4. Stakeholder Engagement and Knowledge Dissemination

We use a 9-step approach to stakeholder engagement that will be further explained in the full submission. We will carry out comprehensive stakeholder engagement and knowledge dissemination throughout the duration of the project. This will ensure the project progresses with stakeholder input from the outset and meets their expectations to deliver real benefits for customers. We will communicate our intended approach, as well as outcomes and relevant learning from the trial to a wide range of stakeholders identified via stakeholder mapping exercises (including DNOs, local authorities, devolved governments/administrations, heat technology providers and installers, energy retailers, and consumer groups etc.), ensuring the project has wide impact – including sharing the Whole System Toolkit with other network operators. Regular project updates, including delivery of key milestones, will also be communicated to stakeholders ensuring they are informed of project progress and have opportunities to engage further with us throughout.

Funding Commentary (page 1/2) *Licensee must provide a commentary on the accuracy of its funding estimate. If the Project has phases, the Licensee must identify the approximate cost of each phase. If the NIC is being used as match funding, please state the other sources of funding.*

We have developed a budget in conjunction with our project partners from an initial task breakdown and using our previous project experience. The overall project Budget will be £15.5m of which £8.5m is requested through NIC. We believe that this total is accurate to within 15%. Project cost will be refined and provided in detail in the full proposal.

The project is broken into 4 workstreams and the funding requested through NIC for each of these is outlined below:

Work stream 1 – Trial Deployment - £5.9m

Work Stream 2 – Whole System Toolkit -£0.9m

Work Stream 3 – Technical, commercial, regulatory and architectures - £0.7m

Work Stream 4 – Stakeholder Engagement and Knowledge Dissemination -£1.0m

Funding Commentary (page 2/2)

Project partners will contribute at least 10% with details of contributions provided within the full submission. Project costs are continually scrutinised and challenged within the project team in order to ensure best value for money is achieved and identify efficiencies. We will demonstrate at FSP that project costs are benchmarked and that the project is delivering best value for money.

The project intends to leverage £6.1m of complementary funding for the supply and installation of heating equipment including heat pumps, retrofit insulation and thermal storage. Much of this funding will arise from existing initiatives or be part of existing projects including: ECO funding; Renewable Heat Incentive (RHI) or its replacement; Warm Homes Fund; HEEPS:ABS, HEEPS:WHS, and SEEP in Scotland; Arbed funding for retrofit insulation in Wales.

We will provide further details in the FSP.

Which specific requirements does the Project fulfill?		
Mark YES in the appropriate box(es)	**Electricity**	**Gas**
A specific piece of new (ie unproven in GB) equipment (including control and/or communications systems and/or software)	**Yes**	
A specific novel arrangement or application of existing electricity/gas transmission and/or distribution equipment (including control and communications systems software)	**Yes**	
A specific novel operational practice directly related to the operation of the electricity/gas transmission and/or distribution systems	**Yes**	
A specific novel commercial arrangement	**Yes**	

How does the Project accelerate the development of a low carbon energy sector and have the potential to deliver net financial benefits to existing and/or future customers in the relevant sector? (page 1/2)

1. Accelerate development of low carbon energy sector

Re-Heat will accelerate the deployment of low carbon energy in two ways: firstly, enabling more rapid deployment of low carbon heating, and secondly, increasing usage of renewable generation. More specifically the project will deliver new learnings and methods that will contribute to:

- Accelerate the transition of heat to low carbon electricity by mitigating network capacity issues, initially in off-gas grid areas, and generate learning that is also relevant to the on-gas grid transition.
- Utilise increased levels of variable renewable generation and reduce volumes of renewable energy curtailment due to network constraints.
- Reducing or deferring network reinforcement, potentially both at transmission and distribution level – thereby avoid the direct and indirect carbon emissions associated with network reinforcement.

Accelerates the low carbon energy sector (page 2/2)

2. Potential to deliver net financial benefits to existing and/or future customers

The transition of heat to low carbon electricity is a challenge that impacts on the whole electricity system. Significant funding will be required. One of the unique features of this project is that it considers the whole system - renewable generation; transmission network; distribution network; energy retail/service provision. The financial costs and benefits attributable to each part of the system in delivering solutions for electrified heating are being assessed. This will enable cost optimal solutions to be identified and investment methodologies to be proposed. For example, there is expert opinion that domestic thermal storage and home energy optimisation systems will form part of the whole system cost-optimal solution. By identifying where in the whole system, the benefits accrue from these interventions we will make recommendations on appropriate funding models that could facilitate these lowest overall cost solutions.

The electrification of heat will require significant funding and this holistic approach to price discovery will find solutions at the lowest whole-system cost to customers.

Specifically, in relation to network benefits this will result in:

- Mitigation of conventional network reinforcement costs which could potentially run into hundreds of £millions across GB, thereby benefiting all network customers.
- Reducing constraint payments to renewable generators that currently exceed £100m per year and are paid by network customers.
- Financially benefitting customers for providing flexibility from electric heating, thereby increasing the strength of the value proposition for electric heating, incentivising this part of the transition to Net Zero.

The techniques demonstrated in the project will improve system reliability and security of supply by avoiding potential overloading of the network. Better network availability will bring financial and social benefits to customers in rural/semi-rural areas as they become wholly reliant on electricity for heat and transport, more so than in large towns and cities with other modes of heat and transport.

How will the Project deliver value for money for electricity and/or gas customers?
The potential financial benefits arising from the project will outweigh project costs. The learnings from this project can improve GB DNOs network planning and operational practices by introducing smart, controllable solutions. This can reduce network investments provide better utilisation of assets, which results in lower network charges paid by customers. We believe the methods developed within this project, if proven successful, would enable the large-scale roll-out of electrified heat, which is applicable within each GB licence area. Only around half of the overall cost of the project is being requested from NIC funding. Much of the remaining funding required to install heating systems in domestic premises will be leveraged from complementary funding that is being invested in the electrification of heat. Partners will also make a significant financial contribution to the project. In developing the Whole System Toolkit which is a key deliverable from the project we will leverage previous innovation investment that has resulted in successful platforms such as the SPEN Network Analysis and Visualisation (NAVi) system. The background IP and in-depth knowledge of this rests with SPEN and therefore further development to meet the needs of this project can be undertaken on an extremely cost-efficient basis. Where appropriate we will carry out competitive procurement for both equipment supply and installation services. **Delivering value for all customers** Better management of the domestic heating load has the potential to benefit customers by reducing their overall electricity bills. However, networks face the challenge of ensuring that no customers are left behind as a result of the energy system transition. The project focuses on off-gas grid areas – where the incidence of fuel poverty is significantly higher than on-gas grid areas. In England customers using electricity as their main fuel for heating have double the likelihood of being in fuel poverty than those using gas. In Scotland fuel poverty rates are also higher in off-gas areas. This project therefore, has the potential to demonstrate how those customers at risk of fuel poverty can be included in the energy system transition.

How will the Project generate knowledge that can be shared amongst all relevant Network Licensees?
National Grid ESO, UK Power Networks, Western Power Distribution, Northern Power Grid, and Scottish & Southern Electricity Networks are project partners. They will be able to contribute to the development of the Whole System Toolkit which is a key project deliverable, ensuring that it is relevant to all licensees. Re-Heat will be the first project to undertake a large-scale trial of the effect that electrification of heat will have on the network and, in particular, the effect that peak demand during cold winter temperatures can have on maximum demand. Understanding this peak condition and the extent to which the new mitigation measures trialled can lower maximum demand as an alternative to network reinforcement is critical knowledge to SPEN and other DNOs. Learning on the extent to which heat demand (with and without thermal storage) can be turned up in periods of constrained wind generation to mitigate constraint payments will be of particular value to the ESO. In addition, understanding how to better match heat demand to available renewable generation has the potential to bring major benefits to customers through electricity prices, as well as increasing the use of low carbon electricity on the journey to Net Zero. An important deliverable will be recommendations on standardising the commercial approach for direct and indirect engagement with customers including agreed options for technical architecture and commercial arrangements for constraint and price signalling. All network licensees will be engaged in agreeing these. The primary learnings from the project will be: • The extent to which peak electrified heat demand can be managed using different solutions. • Customer benefits, acceptance and behaviour when using different solutions. • Technical and commercial architectures for DNOs to enable the electrification of heat. Close engagement with other DNOs and wider stakeholders throughout the project will ensure that learnings will be captured and disseminated.

Answering Yes or No, does the Project conform to the default Intellectual Property Rights (IPR) arrangements set out in the NIC Governance Document? *If answer is NO, the Licensee must demonstrate how learning will be disseminated to other relevant Licensees and how value for money will be ensured. The Licensee must also outline the proposed alternative arrangements and justify why the arrangements are more suitable than the default IPR arrangements.*
Yes – Any deviations, if identified, during the proposal development will be highlighted in the full submission.

How does the project demonstrate it is innovative (ie not business as usual) and has an unproven business case, that the innovation risk warrants a limited Development or Demonstration Project to demonstrate its effectiveness?

What knowledge is new?

This project will generate knowledge to show how networks can facilitate the transition to low carbon heat in a way that optimises cost.

Major challenges for the decarbonisation of heat are the scale of peak demand in winter (up to 5-times peak electrical demand) and the rapid swings in demand. These are currently accommodated by storage in the gas network and other fossil fuel storage such as heating oil. Re-Heat will generate new knowledge on the extent to which peak electrified heating load and load swings can be mitigated.

The NINES project in Shetland demonstrated that electric storage heaters in conjunction with a smart control system can reduce peak demand. However, it is likely that air source heat pumps rather storage heaters will become the predominant heating solution in off-gas grid areas. FREEDOM tested hybrid heat pumps which don't need to use electricity at peak times. This inherent flexibility isn't available with pure heat pumps.

Re-Heat will test how effectively heat pump maximum demand can be smoothed using different commercial and control philosophies including the addition of domestic thermal storage. Re-Heat will therefore create new knowledge that will have a significant bearing on the UK's heat decarbonisation strategy and impact on consumers.

ESO has never tested the viability of turning up electric heating demand to reduce wind constraints. ESO is currently developing the concept through the 4D Heat NIA project. Re-Heat will implement a large-scale trial to test this approach.

Why is business case unproven and why is a demonstration project warranted?

The business case for managing heating demand to reduce network upgrade costs and constraint payments is not yet understood. Domestic heat flexibility barely exists in our markets, if at all. There are risks around the effectiveness of the technical and commercial concepts, and customer willingness to accept these solutions in real life situations. A trial to develop this understanding is urgently required.

How were Project Partners, external resources/funding identified, and what are their respective roles in the Project? Please evidence how Partners were identified and selected, including the process and rationale that has been followed. *The Licensee should provide details of any Project Partners who will be actively involved in the Project and are prepared to devote time, resources and/or funding to the Project. If the Licensee has not identified any specific Project Partners, it should provide details of the type of Project Partners it wishes to attract to the Project.*
The ENA launched its most recent call for third party ideas for the NIC in September 2019 to identify innovative solutions to the biggest challenges we face across the transmission and distribution networks. A review of submissions and an interview process, undertaken by licensee representatives, shortlisted the proposal from Energy System Catapult/E.ON which received broad support from the licensees. This is evidenced by the number of licensees partnering on the project. Additionally, SPEN issued an Innovation Challenge focussed on decarbonisation of heat and through that shortlisted the Delta-EE/Smarter Grid Solutions /PassivSystems consortium. By bringing these two proposals and teams together we believe we have capable partners with the relevant knowledge and capability to deliver the project. E.ON Energy Solutions Ltd (distinct from the E.ON energy retail business) are our primary delivery partner. E.ON have worked successfully with several local authorities across GB to install heat pumps. They have recently been successfully awarded one of the BEIS contracts for the large-scale trial of heat pumps. E.ON previous experience and customer base provides confidence in their ability to recruit the large quantity of customers required across geographically diverse trial areas. E.ON have undertaken to develop a home energy management system as part of their contribution in kind to the project. E.ON are also offering ECO funding for eligible householders that will part fund certain measures. The other partners above fulfil technical/commercial/project management roles that will be detailed in the full submission. The Supergen Programme will provide academic support. An energy retail partner is required in the project. Following a call for expressions of interest we are currently undertaking a selection process for this partner to include in the FSP. We are engaging with national/local government to establish trial areas in off gas areas. East Ayrshire Council are our first local authority partner.

Would the Project require any derogations or exemptions to current regulatory arrangements? *If YES, please provide details of the required changes.*
It is not anticipated that the project will require any derogations or exemptions. Should any be required, they will be identified during FSP.

How will the Project activities impact customers? *The Licensee should outline any planned interaction with customers or customers' premises as part of the Project, and any other direct customer impact (eg amended charging arrangements, supply interruptions).*

Customer interactions

The project will require the recruitment of customers from a mix of privately owned and socially rented homes. E.ON will lead the design and delivery of an end-to-end customer journey, which will be split into clear phases, within which there will be multiple customer interactions (physical & digital). An initial view is shown below;

- RECRUITMENT - Multi-channel marketing plan to target areas to engage customers and generate expressions of interest in the scheme.
- SUITABILITY ASSESSMENT- Over the phone assessment questionnaire.
- SURVEY - 2 elements; technical system requirements captured; detailed discussions with customers about the products available, benefits and scheme commitments.
- QUOTE / SIGN UP - Customers are presented with a quotation including detailed scope of works and decide to proceed (sign up) or not.
- INSTALLATION - Suite of products installed within customer's homes – thermal efficiency improvements delivered first, followed by heating system and associated products.
- AFTERCARE - Customers contacted routinely to provide advice on efficient system usage, tariffs and address any other concerns/queries.
- NETWORK CONTROL - Customer provides flexibility to the network, adapting their energy consumption behaviours and system usage to accommodate and make us of associated financial benefits.
- RESEARCH - Customer contacted to capture their opinions of key project objectives i.e. impact of providing flexibility to the network.
- DECOMISSIONING – Project specific monitoring equipment removed. Final handover of products to customer (under standard warranty).

Charging arrangements may be different, to explore commercial offers that will benefit customers and incentivise uptake of offers. This could include dynamic time of use tariffs, existing E7 / E10 tariffs, Heat as a Service and Aggregator scheme payments. We will ensure that no customers are financially disadvantaged as a result of changing their tariff for the trial.

This question is for Cross-Industry Projects only. What funding is being requested from each NIC? Please include justification for the funding split.
Not Applicable

Are there any further details the Licensee considers would support its submission?
Re-Heat enables an essential step on the energy system transition and the project is aligned with work presently being undertaken through several of the workstreams on the ENA's Open Networks project. SPEN are ideally placed to leverage learning from CHARGE and Optimise Prime on flexible connections and behind the meter optimisation as applied to the EV charging challenge. SPEN have taken a leading role in enabling renewable generation through ANM schemes including our flagship Dumfries & Galloway scheme. We will apply this learning to the challenges of heat demand management and constrained wind under Re-Heat. Re-Heat supports our strategic partnership with the Scottish Government and SSEN to accelerate net zero in Scotland through delivery of LCT technology. Officials of the Scottish Government have indicated a desire to decarbonise the off-gas grid domestic heating sector completely by 2030, primarily using air source heat pumps. This represents 220,000 homes in the SPEN area and 220,000 homes in the SSEN area, and will result in a significant network reinforcement challenge. Re-Heat will develop the tools to help us address this challenge. SPEN is working to understand, develop and enable LCT heating through several projects which will support Re-Heat. These include our partnership with CALA Homes in which we are engaging in a number of LCT topics including hybrid heat pumps. This is one of several projects which support customers and enable us to gain knowledge from practical deployment of LCTs across our licence areas. We are also investigating the impact heat can have on the network through our NIA project SAFE-HD. SPEN recently experienced the impact of a gas network outage which occurred in and around Falkirk during the start of December 2019. The outage occurred on a cold winter day and emergency electric heaters were supplied to residents. We observed a large increase in demand as customers used these heaters, with areas of the network suffering overloading. This event attracted national attention highlighting the potential for even limited electrification of heat load to cause network issues without the tools to manage it appropriately. It further emphasises the need for learning on how to best manage future increase in demand created through electrification of heat.

Contact Information (Cross-Industry Projects can provide two contacts)

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