SIF Discovery Round 2 Project Registration

Date of Submission

May 2023

Project Reference Number

10061386

Project Registration

Project Title

SHIELD - Smart Heat and Intelligent Energy in Low-Income Districts

Project Reference Number

10061386

Project Licensee(s)

UK Power Networks

Project Start

Apr 2023

Project Duration

3 Months

Nominated Project Contact(s)

innovation@ukpowernetworks.co.uk

Project Budget

£91,237.00

Funding Mechanism

SIF Discovery - Round 2

SIF Funding

£82,163.00

Strategy Theme

Net zero and the energy system transition

Challenge Area

Supporting a just energy transition

Lead Sector

Electricity Distribution

Other Related Sectors

Funding Licensees

Lead Funding Licensee

UKPN - Eastern Power Networks Plc

Collaborating Networks

UK Power Networks

Technology Areas

Distributed Generation, Energy Storage, Heat Pumps, Poverty

Equality, Diversity And InclusionSurvey

Yes

Project Summary

SHIELD addresses Challenge 1: Supporting a just energy transition. Covid-19 pandemic and the 'cost of living crises has exacerbated consumer vulnerability recently, with implications for driving a fair net zero transition. This requires decarbonisation approaches that embed a range of consumer needs at the core of new product and service development. SHIELD replaces existing heating solutions with innovative low carbon heating solutions in conjunction with novel energy generation and storage technologies that will balance demand and supply so that heat becomes affordable and scalable. In addition, SHIELD better identifies and understands vulnerable and low-income households needs to enable better adoption of low carbon technologies for heat and energy generation.

SHIELD requires strong network innovation as it brings multiple parties together to collaborate to embed new technologies, systems, and business models. The deployment of LCTs and onsite generation impacts the network and their assets and often requires work to be completed by the DNOs which can be costly and/or time consuming. SHIELD develops an innovative business model that enables affordable scalability given stakeholder capacity constraints. Existing stakeholder capacity constraints, addressed by this model, that hinder scalability include: i) funds for initial capital costs (ii) time and energy (iii) risk appetite (iv) trust in third party solutions (v) network capacity investment timelines.

This project includes a wide range of project partners to support the successful delivery of discovery phase:

- UK Power Networks: Owns and maintains the electricity network, from substations to cables and overhead lines that are required for the installation of low carbon technologies
- Essex County Council: Have a duty of care and understanding of their residents needs
- Power Circle Projects Limited: They are a social enterprise dedicated to supporting social housing providers, private house owners, communities
- Citizens Advice Essex: Expertise and engagement with vulnerable customers on their needs relating to energy and heat
- Eastlight Community Homes Limited: Experience working with communities to create affordable homes and great neighbourhoods
- UK Community Works: Experience supporting activities that help to build stronger, more cohesive local communities
- Thermify Holdings Limited: Technology Provider for distributed data centres
- Kensa Contracting Ltd: Technology Provider for ground source heat pump systems

Key innovation users are:

- Households and consumers, initial focus on social tenants requiring affordable solutions to decarbonising their homes;
- Registered Social Landlords who need innovative affordable solutions to decarbonising their stock
- Communities that need access to solutions that address the need for affordable decarbonisation of their residents.

Project Description

The current approach to decarbonising heat and energy in consumers' homes is costly and not inclusive of vulnerable and low-income households. New approaches and business models for installing low carbon technologies (LCTs) such as photovoltaic (PV), wind generation, storage, and electric vehicles (EV) charging, in conjunction with low carbon heating solutions can make the decarbonisation of heat and energy affordable and therefore accessible to vulnerable consumers.

This project aims to design, develop, and test new cross-industry and community business models and mechanisms that integrate several innovative LCTs to find a viable pathway for vulnerable customers to affordably decarbonise their heating and energy. This project will test the following approach:
(a) Provisioning Smart Local Energy Management Systems (SLES) in local community areas with aggregation and management support provided at county level enabling smart energy management for the most efficient usage of all innovations and enabling affordable EV charging;(b) Optimising onsite electricity generation sourced from rooftop PV and new rooftop wind energy technology with electric heating by matching the heat demand and load profile to the generation;(c) Using the heat produced from Thermify's Distributed Data Centres, installed in vulnerable customers in residential homes or flats will provide low-cost heating ;(d) Optimising heat provision using a scalable social Energy Services company (ESCo) model & electric storage;(e) Protective measures for vulnerable customers to ensure security of supply e.g., energy alerts, backup power; and(f) Testing new methods for identifying suitable vulnerable customers for the above technologies and appropriate engagement plans

SHIELD will be at the forefront of the energy transition for vulnerable customers. Whilst work has already begun to develop solutions for vulnerable customers to decarbonise their heating and energy, this is often done in silo of other complimentary technologies and the business models used are rarely sustainable or scalable. SHIELD will apply whole system and cross-vector thinking with innovative business models to converge existing technologies with innovative heat and energy generation technologies that balance their generation to design truly customer focused propositions. This is currently too risky for consumers and technology providers as many

of the solutions have not been tested at scale. For network companies, this project will be highly valuable as they will better understand the impact that multiple LCT households will have on the network and the possible solutions that will ensure network companies are not barriers to the uptake of LCTs for vulnerable customers.

Nominated Contact Email Address(es)

innovation@ukpowernetworks.co.uk

Project Description And Benefits

Applicants Location (not scored)

UK Power Networks Limited

Newington House, 237 Southwark Bridge Road, London, SE1 6NP

Project Short Description (not scored)

SHIELD aims to test and deploy new approaches and business models for installing low carbon technologies (LCTs) such as photovoltaic (PV), other renewable generation, storage, and electric vehicles (EVs) in conjunction with low carbon heating solutions to make the decarbonisation of heat and energy affordable and accessible to vulnerable consumers.

Video description

https://www.youtube.com/watch?v=naV9FHoptgk&list=PLrMOhOrmeR6ldr-EVoT8ABGhTCxgyBKqs&index=6

Innovation justification

Decarbonisation is costly with upfront capital, and not everyone is an owner of the property where they live. SHIELD is designed to support and initiate decarbonisation of mobility and heat for vulnerable customers, who are usually less likely to have access, and are more likely to be digitally excluded which complicates their transition.

SHIELD will apply new whole system thinking to converge existing technologies with innovative heat and energy generation technologies that balance their generation so that, heat becomes affordable, inclusive, scalable, and sustainable. Innovative business models and mechanisms as well as strong cross-industry collaboration will need to be designed to enable vulnerable customers to take up these solutions. This is currently complex, un-tested and risky for consumers at scale. Two examples of potential new technologies SHIELD will deploy to decarbonise heat and reduce energy costs are:

- **Distributed Data Centre** - Thermify, will provide safe and secure distributed data centres in homes to generate heat at low cost, since heat is a by-product and data services are the primary source of revenue. SHIELD will demonstrate the efficiency from applying Thermify's solution in individual houses and the integration of Thermify with heat pump systems in blocks of flats.
- **Rooftop wind** -- Rooftop wind energy has been avoided because of noise and vibration concerns, however new wind technologies have been identified which address these concerns. Energy from wind generation is well matched to electric heat load, so can effectively reduce energy costs.

Related projects that we will apply learnings from: CommuniHeat - this NIA project established a cost-effective way to deliver rural low carbon heat, through a community-led planned approach. Unlike CommuniHeat, SHIELD is focused on designing propositions for vulnerable consumers specifically and will be responsible for testing and installation these solutions directly with consumers in collaboration with industry and the community.

The main counterfactual for delivering net zero heat is ground or air source heat pump provision. In isolation, such provision can be expected both to add to householder bills and to add to electricity network pressures when replacing a non-electric heating solution.

SHIELD cannot be funded elsewhere within the price control or considered as part of business-as-usual activities given the complexity and risk in approach, integration of technologies and business model. Therefore, the SIF provides the right approach, funding, and ecosystem for the project to develop in an agile way.

Benefits Part 1

Environmental - carbon reduction – indirect CO2 savings per annum against a business-as-usual counterfactual
Financial - cost savings per annum for users of network services
Financial - cost savings per annum on energy bills for consumers
Financial - future reductions in the cost of operating the network
New to market – products, processes, and services
Revenues - creation of new revenue streams
Revenues - improved access to revenues for users of network services

Benefits Part 2

Cost savings per annum on energy bills for consumers

Metrics: Projected £/year energy bills for households: with and without SHIELD

Outputs and assumptions: SHIELD will provide end consumers with lower energy bills due to reduced energy consumption against households with low carbon heating solutions without any other complimentary technology. Electricity consumption of data centres is paid by Thermify.(a) Heating. Indicative Saving per home: £752 or 56%. Calculation: Indicative annual cost for heat and hot water with SHIELD: £600. Without SHIELD: In a gas area: average gas consumption 13124 (Ofgem average gas consumption for SE England) x 10.3p (gas price) = £1352. Saving: £752 or 56%.(b) PV and Battery. Indicative saving: £439 or 37% Calculation: from data from a current social landlord study

Carbon reduction

Metrics: Tonnes CO2e saved per annum with and without SHIELD

Outputs and assumptions: Savings at household level via onsite clean energy generation and savings at network level by battery storage enabling household demand to shift to when there is less grid carbon intensity.
Indicative quantitative measurement:(a) PV and battery: 1.74 CO2e tonnes/year saved per home (Based on a social landlord project). CO2e tonnes/year saved per home calculated by multiplying saving in energy consumption multiplied by the emissions factor of the energy used.(b) Thermify distributed data centre 75% reduction in emissions compared with centralised data centre. Thermify's solution does not require cooling equipment lowering the electricity consumption of the data centre. CO2e tonnes/year saved per home calculated by multiplying saving in energy consumption multiplied by the emissions factor of the energy used.

Improved access to revenues for users of network services

Metrics: £/year revenue to the project

Outputs and assumptions: - The social ESCo model allows for users to benefit from grid services revenues These are revenues from system operators paid to grid services providers and which, under the social ESCo model, provides benefit for users. Indicative quantitative measurement. £257 per home per year comprising £145 per home per year from grid services and £112 from enhanced income from export.

New to market

Metrics. £/year revenue per home. This is revenue to Thermify for heating and hot water.
Outputs and assumptions: New distributed data centre services will be deployed.

Non-financial benefits:

SHIELD will enable vulnerable and low-income households to adopt LCTs.
Metrics: Number of consumers that form part of the SHIELD trials.

Timeline to achieve all target outputs: Following deployment in Alpha/Beta.

Project Plans And Milestones

Project Plan and Milestones

WP1 project management (Essex County Council), - £13,518

*Description: WP1 has been included to ensure the timely delivery of the project within the requirements of the funder and adhering to all relevant regulations and processes.
*Success Criteria: efficient engagements and timely delivery of work packages.

WP2 site selection (Power Circle Projects Ltd, UKPN, Citizens Advice Essex, and Eastlight Community) - £14,943

*Description: this WP intends to shortlist potential properties via the provision of housing stock data, comparison of housing stock locations, identification compatible housing and scrutiny of grid capacity.
*Success Criteria: shortlist of SHIELD-ready homes

WP3 stakeholder engagement (UK Community Works) - £18,151

*Description: WP covers engagement and communication strategy, plus associated media (including trial engagement event
*Success Criteria: To design and trial an effective stakeholder engagement methodology.

WP4 Develop technical specifications (SLES, distributed data centre, GSHP and rooftop wind, Power Circle Ltd) - £19,803

*Description: To provide outline technical specifications of SLES, distributed data centres, ground source heat pumps and rooftop wind.
*Success Criteria: draft SLES and technologies integration specifications.

WP5 Outline energy and financial modelling (PCP with technology partners) - £10,383

*Description: Outline quantified assessment of proposed system(s) which may include reasons for specific technology options not being practicable or not being confirmable at this stage.
*Success Criteria: Providing a summary report from populated energy and financial models.

WP6 Alpha and Beta preparation (Power Circle Projects Ltd) - £5,365

*Description: Work package dedicated to the recollection of feedback among partners, reporting on discovery phase and preparation for Alpha phase.
*Success Criteria: Summary reports and adapted next steps.

The main risks or constraints for Discovery and delivery of SHIELD are:

- Delivery partner withdrawal
- Inability to identify a suitable site or sites to trial SHIELD solutions
- Inability to successfully create draft specifications for the SLES and relevant technologies
- Data not available for energy and financial modelling
- Energy and financial modelling do not generate anticipated value for the consumer or partners
- Consumers not engaged or willing to be part of the project
- Technology partners do not have the resources to develop, deliver and deploy services and products

These risks are to be mitigated by robust project management and governance. At this Discovery Phase our risk management strategy is to ensure that new and ongoing risks are continually identified, analysed, and prioritised, that an owner is assigned and that risks are assessed, managed, and monitored.

Regulatory Barriers (not scored)

A regulatory review has been conducted by Power Circle Projects (PCP) indicating that the model proposed for provision of energy services to households is consistent with regulatory requirements and does not require a derogation.

Several regulatory barriers nevertheless may hinder delivery to some degree either at Beta Phase or at scale up into business as

usual. These include:

- Current Ofgem regulatory requirements mean that for balancing mechanism revenues to be generated, the householder would need to agree to their electricity supply contract being with a licensed supply partner of the grid services aggregator. This is due to be removed as a constraint by 2024/25 and does not apply to Firm Frequency Response revenue.
- For blocks of flats where in excess of 50 kWp solar PV is to be installed, in Scotland (at scale up) this would require planning consent, unlike in England (this is not affected Beta stage). The Scottish Government has however indicated that it will soon bring forward proposals for the Scottish system to be at least in line with the English system in relation to these Permitted Development Rights

The above barriers are not central to the project and are not medium- or long-term barriers. The project will not require a derogation or exemption from any project-related regulatory requirements. We plan to utilise evidence from the project to influence future Ofgem and National Grid approaches to grid services provision to seek continued understanding and facilitation of provision of grid services. This will come from residential flexible energy assets to increase benefit both to system operators and to households, including in particular low-income households, from such provision.

Consideration will need to be given for future longer-term implementation of distributed data centres. In the future policy may change and restrict the scope of data that could be held in distributed data centres located within customer's homes due to the cyber risks involved.

Commercials

Route To Market

- The project will work with all the relevant stakeholders throughout the project lifecycle through design and testing to ensure solutions are based on real situations and achieve business as usual adoption at the quickest opportunity. We will work with (i) social landlords (ii) low-income private homeowners and tenants: PCP and others develop accessible ESCo-based financed solutions (iii) and DNOs: project partners collaborate with UKPN to disseminate findings to other system operators
- SHIELD seeks to advance and does not undermine the development of competitive markets as the offerings developed through SHIELD create additional offerings in the market and will be available to all eligible market participants.
- All project partners will be responsible for the implementation of the innovation since SHIELD depends on their skills, experience, and industry responsibilities to deploy.
- The primary customer segment for our innovation are residential consumers who are potential users of LCTs. They can be identified at three levels:
  - Locally: ECC and PCP are engaging with twenty local Parish Councils in Essex to develop SLES. SHIELD will be relevant to all these, in particular those with low-income communities.
  - Nationally: PCP engages with stakeholders across the UK and through the Procurement for Housing SHED (Social Housing Emerging Disrupters) Framework, any public body or charity can contract with PCP without a further procurement process.
  - At scale: total housing stock in the UK is 27.7m of which 4.8m is social housing. Many low-income homes are social but many more are privately rented and owner-occupied.
- The customer value proposition and associated business case. (i) Low income householders: significant reduction in energy bills against what they would otherwise be (ii) social and private landlords: lower tenant bills impact positively on social landlords, more affordable heating resulting in less damp, improved tenant health and better maintained housing, , contribution to meeting energy efficiency and climate-related regulatory requirements without constrained capital programs (iii) data centre users: flexible provision of data services with low emissions and high positive social impact to contribute to meeting customer CSR objectives (iv) system operators: higher number of integrated and flexible low carbon technologies will reduce impact on the network and improve resilience.
- Once proven effective, new services and/or incentives for customers would be funded through BAU allowances or project finance from the stakeholders implementing the solutions and the costs ultimately passed onto the customers themselves via the innovative business models.

Intellectual property rights (not scored)

The IPR arrangements for this project will be in line with the terms set in the SIF Governance Document Chapter 9 and the project participants agree to comply with the default IPR conditions

Costs and value for money

The total project costs are £91,237. UK Power Networks will contribute 11% of the total costs £9,074. The total SIF funding request is therefore £82,163

UK Power Networks:

- Costs: £9,075
- SIF Funding: £1 (11% of total project costs)

Essex County Council

- Costs: £3,498.00
- SIF Funding £3,498.00 (4% of total project costs)

Power Circle Projects Ltd

- Costs: £32,100.00
- SIF Funding £32,100.00 (40% of total project costs)

Citizens Advice Essex

- Costs: £5,400.00
- SIF Funding £5,400.00 (7% of total project costs)

Eastlight Community Homes Limited

- Costs: £8,870
- SIF Funding: £8,870(11% of total project costs)

UK Community Works

- Costs: £15,274
- SIF Funding £15,274 (19% of total project costs)

Kensa Contracting Ltd

- Costs: £9,376
- SIF Funding £9,376 (10% of total project costs)

Thermify Holdings Limited

- Costs: £8,400
- SIF Funding £8,400 (11% of total project costs)

The costs detailed above do not include any sub-contractor costs.

SHIELD Discovery Phase represents value for money due to the breadth of technologies and application opportunities, it explores the opportunities for their replication and the potential scale of impact they will have on the core mission of the project, to provide a just transition for vulnerable customers. This proposal made a conscious decision to not use sub-contractors specifically to ensure value for money. Having technology specialists as partners rather than sub-contractors brings their expertise to the project in a more cost-effective manner than if they were charging commercial rates to the project (typically commercial day rates would be in the region of £500-600 + VAT, in many cases double the day rates being incurred by those same organisations in the role as partner). Operationally, whilst requiring a higher degree of management this partnership relationship lends itself more strongly to true collaboration. Consultancy arrangements tend to be ones of call and response, with the customer defining the question and the consultant answering it. The partnership relationship allows for more flexibility in reframing the question based on incremental learning within the project, which is fundamental to the kind of exploratory, innovative activity required at this Discovery Phase.

If successful at Discovery Phase and assuming that SHIELD achieves success at Alpha and Beta stages and taking into figures quantifiable at the time of writing the proposed methodology will result in savings of around £1,500 per household treated.

Document Upload

Documents Uploaded Where Applicable

Yes

Documents:

SIF Discovery Round 2 Project Registration 2023-05-30 10_28

SIF Round 2 Discovery - SHIELD End of Phase (for upload).pdf

SIF Round 2 Discovery - SHIELD Show and Tell (for upload).pdf

This project has been approved by a senior member of staff

☑ Yes