SIF Round 4 Project Registration

Date of Submission

May 2025

Project Reference Number

10157199

Initial Project Details

Project Title

FORTRESS - Flexibility and Optimisation for Resilience in Energy Systems (SIF DISCOVERY R4)

Project Contact

fnp.pmo@sse.com

Challenge Area

Greater heat flexibility

Strategy Theme

Flexibility and market evolution

Lead Sector

Electricity Distribution

Other Related Sectors

Electricity Distribution

Project Start Date

01/05/2025

Project Duration (Months)

3

Lead Funding Licensee

SSEN - Scottish Hydro Electric Power Distribution Plc

Funding Licensee(s)

SSEN - Scottish Hydro Electric Power Distribution Plc

Funding Mechanism

SIF Discovery - Round 4

Collaborating Networks

Scottish and Southern Electricity Networks Distribution

Technology Areas

Commercial

Demand Response

Demand Side Management

Energy Storage and Demand Response

Resilience

Stakeholder Engagement

Project Summary

It is essential that Protected Sites (PSs), e.g. hospitals and military sites, have a resilient energy supply to meet critical requirements. Most protected sites currently use fossil-fuels for heat and backup solutions.

For Distribution Network Operators (DNOs), supporting protected sites' transition to electrified heating will require providing additional capacity whilst maintaining the requisite level of resilience, involving major infrastructure investment. Utilising a coordinated, flexible approach to heat demand offers the opportunity to offset some of these costs .

FORTRESS's hospitals use case demonstrates these diverse resilience needs,from critical-care to administrative buildings, analysing innovative heat flexibility strategies for DNOs.

Add Third Party Collaborator(s)

RICARDO-AEA LIMITED

Tayside NHS Board

Project Budget

£163,905.00

SIF Funding

£146,524.00

Project Approaches and Desired Outcomes

Animal testing

- ○ Yes
- ◉ No

Problem statement

FORTRESS (Flexibility and Optimisation for Resilience in Energy Systems) addresses Challenge 2.

Problem

UK's DESNZ Electricity Supply Emergency Code prioritises maintaining power for Protected Sites (PS), such as hospitals, airports, and water treatment facilities, during emergencies. These sites are already major energy users, with a large proportion of this demand currently hidden from DNOs through onsite fossil fuel generation. As PS move away from fossil fuels, their energy demands from the grid will only increase.

PSs' diverse resilience needs, from critical care to administrative buildings, necessitate innovative heat flexibility strategies. Current systems rely on carbon-intensive backup solutions; without co-ordinated decarbonisation planning between Protected Sites and electricity networks, the counterfactual is significant, uncoordinated investment in the electricity networks.

Due to their significant and varied heat demands, FORTRESS is using hospitals as a first case study as there is no clear solution to delivering decarbonisation for these sites. Replacing hospital heating appliances with electrified technology will require greater DNO capacity, and scaling this across 200 large hospitals in Great Britain highlights the size of the decarbonisation challenge.

FORTRESS will conduct extensive stakeholder engagement for our first case study site, NHS Tayside, and will gather site energy data and identify critical needs which must be considered within the context of resilience and flexibility.

Key Discovery outputs include an assessment of future changes which impacts the electricity network and Protected Sites, an understanding of the business case for PSs energy flexibility, a summary of key decarbonisation pathways based on real site data and an assessment of network impacts and benefits.

Innovation Challenge

FORTRESS will investigate reducing peak electricity demand from heat decarbonisation by identifying optimal flexibility solutions for large PSs, directly addressing Challenge 2.

FORTRESS solution will be applicable and accessible to diverse customers that operate PSs by collaborating with the NHS, using real data and creating user-centric designs to produce replicable recommendations.

Throughout FORTRESS, there will be upskilling of DNOs through a deeper understanding of PSs demands, particularly around resilience, and upskilling of NHS on electricity networks and their capabilities. During Discovery we will flag knowledge gaps and seek to fill them with new partners in Alpha where appropriate.

Potential users

FORTRESS will be useful for PSs, as well as DNOs and energy consumers; aiming for PSs' future demands to be included in DFES and fed into RESP.

Other Innovation funded work

Energy Rev funded by UKRI and Industrial Strategy.

Video Description

https://vimeo.com/ssen/review/1053763155/ffd66f0aed

Innovation justification

Core Innovation

By understanding potential operating modes, grid impacts, electrification scenarios and flexibility market options, PSs will be better able to plan their heat decarbonisation journey and its impact on the electrical network, whilst maintaining appropriate levels of resilience. In turn this will help DNOs formulate their long term investment planning. This project will assess the challenges, obstacles and potential solution mechanisms which may exist to allow PSs to understand their electrification pathways and build a clear investment case.

This project is innovative because it's a unique collaboration between a DNO and a PS, combining real site data and the user's insights to fill a knowledge gap in solutions to deliver increased electrical capacity and heat flexibility simultaneously.

How Project Builds on Previous Research

Whilst decarbonisation technologies exist, the commercial framework to invest in these solutions does not exist for large PSs. Compliance with sector specific standards such as the Health Technical Memoranda add complexity to the challenge.

Discovery will map the current landscape and demands for the NHS, assess the impacts on the network of various scenarios and understand the business case for energy flexibility within the confines of critical resilience needs. Alpha will build on Discovery to test innovative technologies and identify suitable commercial models, minimising the network upgrade costs and therefore consumers bills and going beyond incremental innovation.

FORTRESS builds on Blue Light and Heatropolis, amongst other SIF and NIA projects, outlined in Question 12.

Technology, Integration and Commercial Readiness

Electrified heating is well established from technology providers. The integration and commercial readiness to invest in these solutions will be progressed in this project phase. Please see appendix.

SIF Funding

FORTRESS sits firmly in the SIF aims of reducing the cost of the energy transition for consumers, through not only addressing the specific innovation challenge, but also having a range of stakeholders involved and bringing new and novel ideas. FORTRESS will reduce network reinforcement costs for the consumers , bymodelling the implications and potential scale of the network impact across a range of decarbonisation scenarios.

The current BAU process is not a suitable route due to the uncertainty of the decarbonisation pathway for Protected Sites. Due to the critical dependencies on Protected Sites, new models of flexibility are seen as inherently risky and have not been tackled, making FORTRESS innovative.

Counterfactual The counterfactual to is uncoordinated and reactive network investment, resulting in higher costs for consumers.

(FORTRESS_Q5_Innovation Appendix.pdf (opens in a new window) (/application/10157199/form/question/45874/forminput/128809/file/805525/download)

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Financial - cost savings per annum for users of network services

Environmental - carbon reduction – direct CO2 savings per annum

Revenues - creation of new revenue streams

Impacts and benefits description

Currently, there is insufficient understanding of the most suitable decarbonisation options for PSs. FORTRESS aims to improve stakeholders' capabilities to build scenarios with different technologies based on operational data, by producing more knowledge that can be used for future network planning. See Benefits below:

Networks:

-Improved decision-making through more accurate and updated information on the electrification challenges of large PSs, in particular for decarbonisation of heat. NHS England data (ERIC) shows that average acute hospital electricity consumption is 7.9GWh compared to 38GWh of gas - suggests significant future electrical demand increases where heat is electrified.

-Consideration of whole system solutions when considering critical customer needs (locational options, heat networks, cross-technology approaches to mitigate peak electrification scenarios).

-Potential reductions in network investment, due to enhanced network planning from direct coordination and engagement with PSs.

-Facilitating the energy transition of the sites from an inflexible demand user to a flexible demand, thereby reducing network constraints and increasing spare
capacity headroom.

Energy Consumers

-A more cost-effective approach than "over-engineering" the solution as per BAU reinforcement.

-Less socialisation of investment in new grid infrastructure to energy consumers through their energy bills. This aligns with Ofgem's policy of providing value formoney to energy bill payers.

Cost savings for PSs:

-Adopting innovative planning and operational procedures for PSs with electrified heat can reduce costs and CO2 compared to BAU.

-Understand the electricity market revenue streams, network planning mechanisms and whole system solutions for heat decarbonisation leading to anopportunity to create new flexibility revenue streams integrated into a site'sdecarbonisation plans.

-Reflect benefits of interruptible gas supplies to hospitals.

-Articulate the needs of PSs from electricity markets, to support their electrification investment planning.

-Greater DNO and PSs' coordination will lead to more streamlined site planning to enable decarbonisation plans to be achieved cost-effectively.

UK economy:

-Significant network flexibility unlocked in one sweep, making electrification more efficient (requiring less investment in grid upgrades), via the scalability of the approach for large sites. For example, there are over 200 significant large hospitals in England alone -- 100's MW+ nationally of potentially flexible load. Even short term flexibility intervals -- e.g. 5 mins - could be of significant benefit for DNOs and other network users.

-Long-term certainty of hospitals make it's flexibility more likely to be dispatched by a DSO compared to a typical industrial/commercial or domestic customer.

-An optimised, coordinated approach to ensure resilience for PSs.

Teams and resources

FORTRESS creates a new consortium made up of NHS, Ricardo and SSEN, building on previous relationships between SSEN and Ricardo as well as between Ricardo and NHS. This project creates a new relationship between NHS and SSEN, and introduces NHS Tayside to SIF Innovation.

SSEN owns and operates the distribution network across Central Southern England and the north of Scotland, responsible for ensuring and delivering safe and reliable power supply to over 3.9 million homes and businesses.

Role: Leading project management, providing SME input from their Connections, Engineering & DSO teams.

Skills: SSEN has well-established project management processes that have successfully delivered SIF projects, as well as NIC and NIA projects. SSEN also contributes SME expertise on DSO networks.

Ricardo is an energy consultancy with a long track record of involvement in Network Innovation programmes, (formerly NIC and now SIF). This includes projects with all UK DNOs, spanning asset management and performance, technology trials, design and implementation, digital solutions for optimisation, Cost Benefit Analysis, and consortium programme management.

Role: providing combined power, heat and energy system expertise to underst and,analyse, and synthesise the learnings from NHS operations, and consider how this can be adapted for future energy system needs, where electrification of heat will play an increasingly important role.

Skills: Heat Development Plans for large commercial sites and associated technical skills, Network Innovation project management and reporting, stakeholder engagement, and network analysis and modelling.

NHS Tayside is responsible for commissioning health care services for the residents in the geographical local government areas of Angus, Dundee and Perth and Kinross. NHS Tayside's governance includes 3 major hospitals and a number of community hospitals, including the University of Dundee's Medical School attached to the region's flagship institute, Ninewells Hospital in Dundee. It also includes over 60 GP surgeries and a variety of health centres staffed by thousands of employees of the health region.

Role: NHS Tayside will provide Ninewells site data and inform the project of critical needs and demands which need to be considered in the context of resilience and flexibility, to provide an initial case study for Protected Sites.

Skills: NHS Tayside will provide expertise from their Estates and Energy team, as well as from senior management, with responsibility for operational performance and energy portfolios.

For Discovery, there are no external resources, equipment, external parties, network users or consumers who are vital for its successful delivery.

Project Plans and Milestones

Project management and delivery

FORTRESS project management will be led by SSEN following their well-established processes that have successfully delivered SIF, NIC and NIA projects. Partners will employ project management processes, as documented in the PM Book.

Weekly coordination meetings and two in-person meetings will ensure clear communication, swift issue resolution, and stakeholder engagement. Deliverables and dependencies will be meticulously tracked using UKRI-provided tools (RiskRegister, Project Plan) and internal resources (Gantt Chart, Finance Tracker),enabling us to monitor progress and ensure timely, high-quality outcomes.

Work Packages

- WP1 Project Governance: establishes management framework, facilitating effective communication, risk management, and progress monitoring---underpinning all WPs.
- WP2 Energy and Resilience Requirements will evaluate current heat operations at large PSs, and understand the potential site decarbonisation pathways required, including and in particular, electrification of heat. It will translate these findings into potential consequences and considerations for DNOs, taking different technologies, processes and operational requirements into account, to ensure the projections are based on site-based evidence.
- WP3 Policy and Regulation will produce an overview of regulatory and policy considerations for Protected Sites with significant heat electrification and flexibility potential, including an initial cost-benefit analysis. Dependencies between WPs ensure a logical flow aligning with objectives and stakeholder expectations, and can be viewed in the PM Book.

Risk management

Outcomes for WP2 feed directly into WP3 activities. To mitigate potential knock-on risks, activities across WPs are staggered with margin for addressing blockers from a previous WP, together with practical mitigations to limit timeline risk.

Highest-impact risks at Discovery relate to availability of sufficient high-quality site data to inform findings and recommendations. It will also be critical to maintain the support and engagement of site stakeholders throughout the project, during preparation, analysis and with final deliverables.

These risks will be consistently monitored through weekly coordination meetings and mitigated via risk-specific approaches detailed in the risk register. Where risks cannot be fully mitigated, these can be escalated to SSEN management or the UKRI monitoring officer.

Supply interruptions

There will be no planned or unplanned supply interruptions for consumers and the project doesn't anticipate any specific policy and regulatory risks or challenges to deployment, derogations and requests for changes in regulation for Discovery phase.

Wider engagement

There will be stakeholder engagement with other Protected Sites to share learning, test it and gather feedback on requirements.

FORTRESS_DiscoveryR4_PMBook_FINAL.xlsx (opens in a new window) (/application/10157199/form/question/45878/forminput/128833/file/805550/download)

Key outputs and dissemination

The Discovery objective is to understand how to use flexibility technologies to reduce the peak of electrical demand from heat for Protected Sites that need to balance flexibility against resilience.

Key outputs

Discovery will produce nine outputs (including five outputs relating to project management/ UKRI engagements) as specified in the PM Book.

The key outputs enabling the objectives at Discovery are:

- Future Energy Models and Scenarios with assessment of network impact and benefits: A report analysing current data and critical needs and demands that are required to be considered within the context of resilience and flexibility for Hospitals, and understanding the implications and scale on the network. This could include a demonstration of peak demands at key times and impacts of different operation modes within the hospital estates as an example.
- Benefits assessment: An initial cost-benefit analysis to quantify and qualify cumulative net benefits of the proposed solution to SSEN and energy consumers, as well as the business case for PSs to invest in site energy flexibility. This assessment will be used to inform the Alpha application and will be further refined during Alpha.

Planned dissemination activities

We intend to disseminate key outputs and lessons learned through a multi-channel approach:

- Report publications: End-of-phase reports (deliverables 2.1, 2.2 and 3.1)reflecting on activities and technical findings at Discovery, along with lessons learned and other relevant materials, will be made freely available to all DNOs and interested parties via SSEN's website and industry platforms.
- Official channels: Amplification through UKRI, Innovate UK, and Ofgem official SIF communications to reach a wider audience.
- Media and events: Raising general awareness through press releases, participation in annual Energy Innovation Summit, and promotion via websites and social media platforms.
- Disseminate learnings to NHS Property and Energy (Resilience & Build)Working Group and NHST Climate Change and Sustainability Board.
- Project results will be shared in reports up to NHS Chief Executive Team and Performance and Resources Committee.

Preventing market monopolies

This project is designed to support competitive markets by knowledge sharing and free dissemination of our findings/outputs to encourage industry-wide adoption and innovation within PSs in Great Britain, including hospitals, prisons, and MoD estates.

Commercials

Intellectual Property Rights (IPR), procurement and contracting (not scored)

To ensure clarity is provided to the Project partners, UKRI and Ofgem regarding the intellectual property (IP) landscape, the Project is using an IP register to track the Background IP provided to the Project, the Foreground IP the Project generates, and the use and access rights to all this IP.

The main contract governing the Project (the Collaboration Agreement) will include detailed, mutually agreed terms governing IP that are in line with the SIF Governance Document. For the Discovery Phase, all the IPR arrangements will follow the default recommendations of Chapter 9 SIF Governance Document.

Investment Needs

Each of these examples provided previous context of components relevant to FORTRESS, in particular:
-Needs of critical users (emergency services).
-Impact of large-scale district heating in relation to grid planning.
-Consideration of connections for large non-domestic buildings.
-Heat flexibility from residential heating.

NIA/ NIC

Blue Light (£1,188,442)

Blue Light intends to streamline the connections process and enhance visibility of connection requirements for emergency services and the DNO, and support network planning and reinforcement. The self-serve solution will allow emergency services to input electrification plans and offer information, including headroom against connection capacity now and over time, and provide optimisation options to reduce costs and ensure resilience.

EQUINOX (£15,375,360)

The project will develop novel commercial arrangements and supporting technologies that unlock flexibility from residential low carbon heating, while meeting the needs of all consumers, including the fuel poor and vulnerable.

SIF

Inform (£138,731)

The proposed project is aimed at scoping a self-serve automated connections estimator for larger sites/non-domestic buildings, that can be accessed by those considering early-stage projects. Inform expects fewer projects will fail or be delayed if the connections costs and options are easily accessible at the beginning of the project.

Heatropolis (£177,193)

Decarbonising large-scale district heating systems will have profound implications for investment planning in the electricity networks. The challenge of distributing power to low-carbon heat networks is growing and BEIS estimates that by 2050 they will serve over 18% of the heat demand for buildings.

IFI

Home Based Flexible Demand Management (£150,302) The Technology Strategy Board (TSB) project is exploring how residential customers might be engaged in providing responsive demand and control the output of distributed generation on behalf of DNOs. The aim is to develop the scope for a technical solution, consumer proposition and business model which will allow for responsive demand to be utilised before the completion of the UK wide smart metering rollout, and without the involvement of investment from the electricity supplier.

Value for money

FORTRESS is an ambitious project bringing together a strong partnership to build a firm foundation for future phases.

Ricardo is a leading energy and environment consultancy with technical expertise and heritage in electricity networks and in Heat systems. This experience spans Network Innovation projects for UK DNOs (NIC, NIA and SIF) over the past 15years, engineering standards and technical documentation for industry bodies like the Energy Networks Association, delivery of feasibility studies and due diligence for site implementation, and regulatory themed, such as reviews of markets. From the Heat perspective, Ricardo has decades of experience working with local authorities, NHS organisations, and other large public sector bodies, on development of Heat Networks and Heat Decarbonisation Planning.

The team has carefully prepared a Discovery phase project plan, and resources used are necessary to fulfil the scope and to deliver a quality output. We are confident that the proposed benefits of the project significantly outweigh the initial costs of launching the project through Discovery and then developing it through later phases. The future application of the initial NHS case study to other PSs, means the work has a wide applicability and so will provide value for money.

Total project costs and SIF funding

Total Discovery costs: £163,905

- SSEN-D: £42,486
- NHS: £32,127
- Ricardo: £89,292

SIF Discovery funding requested: £146,524

- SSEN-D: £38,237
- NHS: £28,914
- Ricardo: £79,373 Discovery contributions: £17,381 (11%)

Contribution

- SSEN-D: £4,249
- NHS: £3,213
- Ricardo: £9,919 The balance of costs and SIF funding across the consortium is shown below and reflects effort required to deliver assigned work package content. There are no subcontractor costs associated with this application:
- SSEN-D: 26%
- NHS: 20%
- Ricardo: 54% BAU Adoption and Commercialisation

The proposed solution is designed to have potential applicability not only across other DNOs in Great Britain but also across the breadth of PSs, including military sites and food production. We aim to validate the solution with stakeholders and potential adopters in subsequent project phases, ensuring broad applicability and value.

An essential element of the commercialisation and BAU adoption process has been provided in Appendix 1 of Q5. The commercialisation plan and BAU adoption involves defining the roles and responsibilities of all stakeholders in the value chain. The end-goal of FORTRESS is to create and clarify potential commercial model/s which could provide the framework needed for sites to invest efficiently inheat flexibility within their premises, as the potential financial returns will be clearer.

The finances of all project partners are included in the milestones summary (/application/10157199/milestones-summary)

Supporting documents

File Upload

SIF Round 4 Project Registration 2025-05-02 3_40 - 73.7 KB

Documents uploaded where applicable?

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