SIF Alpha Round 3 Project Registration

Date of Submission

Mar 2025

Project Reference Number

10145740

Initial Project Details

Project Title

Geogrid

Project Contact

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Challenge Area

Unlocking energy system flexibility to accelerate electrification of heat

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Distribution

Project Start Date

01/01/2025

Project Duration (Months)

6

Lead Funding Licensee

NPg - Northern Powergrid (Northeast) Limited

Funding Licensee(s)

Northern Powergrid

NPg - Northern Powergrid (Northeast) Limited

NPg - Northern Powergrid (Yorkshire) Plc

Funding Mechanism

SIF Alpha - Round 3

Collaborating Networks

Northern Powergrid

Technology Areas

Heat Pumps

Modelling

Energy Storage

Project Summary

The GeoGrid project explores the use of Geothermal Long Duration Energy Storage (LDES) to store renewable electricity as heat with Leeds University as a trial site. LDES offers a cost-effective, scalable solution that will reduce constraint on the electricity networks. By storing off-peak electricity and discharging it during peak demand periods, LDES can lower curtailment costs, reduce network congestion, and enhance grid resilience. GeoGrid will assess the commercial potential of geothermal energy storage for both the trial site and nationally across GB to provide insights regarding its wider deployment, benefiting consumers with low-cost heat while supporting decarbonization and energy security.

Add Third Party Collaborator(s)

University of Leeds

Leeds City Council

E.ON

star refrigeration ltd

LCP Delta

Project Budget

£481,227.00

SIF Funding

£432,935.00

Project Approaches and Desired Outcomes

Animal testing (not scored)

- ○ Yes
- ⊙ No

Problem statement

This project will demonstrate how the increased demands on the grid from heating decarbonisation can be mitigated by use of geothermal heat provision and long-term energy storage. This approach will provide the benefits of cross-vector energy system operation, resulting in lower carbon and cost heat, whilst reducing the impact on the electricity networks, and thus fundamentally lowering the cost of heat decarbonisation to consumers.

Problem: Heat decarbonisation through electrification will impose a significant increase in power demand, potentially requiring extensive upgrades to the electricity networks to meet peak winter heating loads. The seasonality of the loads also poses inter-seasonal storage challenges with the current inability to store excess summer electricity to meet winter peaks. The significant increase in intermittent renewable electricity sources will also result in greater underutilisation of wind energy and significantly increased costs on congestion management due to excess generation and / or transmission and distribution constraints.

Specific SIF Innovation Challenge: This project primarily targets the Innovation Challenge 2: Greater heat flexibility by using geothermal energy generation and storage coupled with heat pumps and heat networks to address the dual challenges of significant increases in electricity demand due to heat electrification and significant power network congestion and curtailments due to network constraints. This project presents an integrated solution aligned with UK heat policy enabling the electrification and decarbonisation of heat, increasing the amount of flexibility and energy storage in the energy system, and enabling lower carbon sources of heat to be developed for heat networks. With a Government target of around 20% of UK heating to be met by district heating in 2050, there is a significant market opportunity.

The project addresses the following specific problems:

Problem 1: the growing burden and associated pinch points on the power networks due to increased electrification of heat. Innovation solution: to reduce the burden at pinch points through place-based geothermal energy storage and high-efficiency heat provision, resulting in lower peak demands than alternative electric heating solutions and increased demand diversity.

Problem 2: grid capacity constraints and associated curtailment costs for excess renewable energy generation. Innovation solution: to use off-peak seasonal renewable electricity provisions to recharge geothermal reservoirs as an energy battery for use in the winter months.

Problem 3: enabling low carbon heat networks. Innovation solution: Opening up a much larger range of low carbon heat sources through exploiting high efficiency heat pumps coupled to geothermal storage.

To address the problems identified, the project focuses on:

Whole system integration -- integrate underground thermal storage into existing energy grids with significant renewable generation.
Accelerating heating decarbonisation through high-efficiency heat provision and aiming to minimise electricity network reinforcement and/or freeing up capacity.
Unlocking energy system flexibility and optimisation to accelerate electrification of heat through deployment of large scale inter-seasonal geothermal energy storage.
From feasibility study to Alpha: University of Leeds has completed an innovative, on-campus, living lab of drilled geothermal wells and monitoring boreholes in July 2024, designed to investigate the potential for geothermal energy heat and storage to play a role in the heat decarbonisation, with associated building energy use studies and data. The University has committed to using this infrastructure as a trial site for the innovative concepts set out in this proposal.

Users:

Electricity: Conventional decarbonisation, congestion and curtailment management all add to the costs paid by electricity

consumers. Geothermal energy generation and storage defers network reinforcements, reduces curtailment of renewable generation, and offers the highest level of inter-seasonal flexibility.
Heat sector: More sustainable and economical large scale energy storage solutions and seasonal heating and cooling sources for heat decarbonisation.

Innovation justification

The GeoGrid project will deliver a novel analysis for optimisation of an in-place geothermal energy heat and energy storage that supports cross-sector decarbonisation by facilitating, managing, and integrating heat and flexibility services.

Innovations

GeoGrid will provide evidence to enable the electricity and heat sectors to implement geothermal energy storage as a heat decarbonization solution with significant flexibility benefits. It will evaluate how flexible heat generation and storage using geothermal wells can accelerate heat decarbonisation whilst minimising the impact on electricity distribution networks and providing a long duration energy storage solution to optimise the electricity system. Geothermal energy is an established heating supply option and has already delivered environmental, economic and technical benefits in some European countries with similar geology to the UK, such as the Netherlands, Germany, and Belgium. However, only a small fraction of geothermal heat resources are used in the UK, covering approximately 0.3% of the heat demand. The existing operational sites include load balancing between heating and cooling, but geothermal energy has not been considered as an energy system asset.

This project will assess the potential for geothermal solutions to become an important tool in managing network constraints alongside providing long duration energy storage for inter-seasonal balancing. This will include stacking of a wide range of system services and associated revenue streams to ensure viable business case. Analysis by LCP Delta for DESNZ shows that deploying 20 GW of LDES could save the UK £24 billion by 2050, reducing reliance on costly natural gas. NESO estimates that 11.5 to 15.3 GW of LDES will be needed by 2050 to meet net-zero targets. Thermal long duration storage provided by geothermal could be a very cost-effective method of achieving some of this demand.

Our novel developments are:

For the first time, advanced simulation modelling and predictive control will permit geothermal production sites and local heat demands to be coordinated to manage excess renewable generation on the electricity system through recharging. This will facilitate alleviation of network constraints through diversity from geothermal storage and improved heat pump efficiency with higher ground temperatures.
Through development of a novel optimisation model, the flexible demand of the campus, partly derived from the ground source heat pump operation and the recharge of geothermal reservoir will be aggregated to provide flexibility to the power grid, by participating in system services market and local flexibility markets.
Learning from preceding projects

This project builds on extensive knowledge gained from the University of Leeds' Geothermal Living Lab. Extensive analysis has been conducted on the thermal design and planning including committed development activities for a geothermal energy system to provide heating and cooling on campus. This presents a low-risk trial opportunity with senior stakeholder buy-in. Existing work has also included extensive engagement with other stakeholders including Leeds City Council and DESNZ.

Among the published projects registered on the Smarter Networks Portal, GeoGrid stands out as a timely and crucial initiative for heat decarbonisation. Existing SIF funded projects (Heat Balance and Watt Heat) and schemes such as the Gateshead District Energy Scheme have explored system flexibility and stacking revenue streams, but not considering the duration and capacity of a geothermal storage system and its societal benefits.

Changes in TRL, IRL, CRL Currently, the Technology Readiness Level (TRL) of geothermal production is high (TRL 7-8), with lower Integration Readiness Level (IRL3) and Commercial Readiness Level (CRL 3). By the end of the alpha phase, it is expected that both the IRL and CRL will increase to 5.

Impact and benefits (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 CO_2 savings per annum

Others that are not SIF specific

Impacts and benefits description

Geothermal heat provision and LDES presents a promising solution for delivering substantial benefits to electricity consumers, while offering incidental advantages to vulnerable groups and the broader energy system. This project will demonstrate how geothermal LDES can alleviate network congestion, reduce consumer costs, and improve the UK's energy system resilience and flexibility, thereby supporting the UK's decarbonisation. The associated CBA spreadsheet submitted demonstrates the cost benefit of the core scheme.

Current Position (Baseline)

The UK's electricity network faces challenges of increasing heat electrification and the integration of intermittent renewable energy sources. These lead to higher peak demand, especially during winter, and contribute to network congestion. National Grid has forecasted that by 2026, constraint payments to curtail renewable energy could reach £2 billion annually.[1] Additionally, network reinforcement to manage peak demand such as new transmission links is costly and disruptive. Consumers currently bear the financial burden of these inefficiencies through higher energy bills. Vulnerable groups, particularly those in fuel poverty, are disproportionately impacted.

Metrics to measure the current baseline including annual curtailment costs, peak electricity demand during winter, and total costs of network reinforcement will be tracked throughout the project to assess the impact of the LDES solution.

Benefit to consumers

This project directly benefits consumers by reducing the curtailment of renewable energy, a cost ultimately placed on bills. LDES enables storage of excess renewable electricity as heat during off-peak periods, which can then be discharged (via efficient heat pumps) during periods of high demand. This reduces the need for costly network upgrades and mitigates curtailment, thereby driving down costs for consumers.

Benefits will be realised through identification of cost-effective ways to store renewable energy and avoid curtailment. The integration of LDES into business-as-usual will further reduce the need for peaking generation, leading to long-term savings for consumers. The system therefore benefits directly connected customers (the University and heat network consumers), alongside broader UK consumers via a better optimised system.

Wider System Benefits

Geothermal heat provision and LDES offers broader benefits to the entire energy system, including both electricity and gas sectors. By reducing peak electricity demand, it lowers the reliance on gas-fired generation during winter, thereby contributing reduced carbon emissions and enhancing the UK's energy security. The ability to store renewable energy for use during peak periods reduces the need for expensive peaking generation and imports of fossil fuels, further benefiting consumers. For heat network providers, integrating LDES improves the economic viability of heat networks by enabling the use of curtailed renewable energy and opening up a source of income generation through participation in system services market and local flexibility markets.

Supporting Decarbonisation and Energy Security

This project supports the UK's decarbonisation goals by exploiting geothermal as a high efficiency source of heat, whilst maximising the use of renewable energy and minimising curtailment. Currently, mismatches between renewable energy generation and demand often result in curtailment leading to higher system costs. LDES allows excess renewable energy to be stored as heat for later use, offering inter-seasonal storage that ensures peak winter demand is met without relying on costly fossil fuel generation.

By reducing the need for electricity network reinforcements, LDES also provides long-term financial savings and enhances the UK's energy security. It minimises reliance on global fossil fuel markets, protecting consumers from price volatility and supply disruptions. Carbon benefits are further realised through reductions in CO_2 emissions associated with curtailed renewable energy and reduced fossil fuel generation.

There is a significant gap in technologies which can affordably provide long duration (weeks -- months) energy storage, and geothermal could be an important solution to fill the gap.

Teams and resources

Who will be involved with the delivery of the project during the Alpha phase? Are there any changes in team or resource requirements from your previous SIF Discovery Phase, or innovation project funded through other routes?
The project team comprises a diverse set of partners and expertise for the project, and include Northern Powergrid (NPg), University of Leeds (UoL), LPC Delta (LPC), Leeds City Council (LCC), Star Renewables (Star), and EON. Many of these partners have worked together before, with LCP Delta coordinating the project and having long standing relationships with EON, NPG and Star.

Individuals include:

NPg: Bart De Leeuw (BD), Steve Newall (SN), Conor Edwards (CE), Liz Sidebotham (LS);

UoL: Emma Bramham (EB), Fleur Loveridge (FL), Simon Rees (SR), David Barns (DB), Arka Dyuti Sarkar (ADS), James Van Alstine (JVA), Kang Li (KL), Tong Zhang (TZ);

LCP: Andrew Turton (AT), Katharine Blacklaws (KB), Edward Smith (ES);

LCC: Thomas Cowen (TC); Martin Elliot (ME);

Star: David Pearson (DP), Nicky Cowan (NC);

EON: Antony Meanwell (AM)

Roles, skills and experience:

NPg: knowledge, expertise and data on the distribution network, providing analysis and data on the network connection and operation, and how this can be optimised. NPG will support the understanding of increased electrification projections, current and future constraints and identification of areas for future prototype replication.

UoL: bring research expertise, and the campus will act as the prototype installation for the alpha phase project, with UoL providing all data, costings and reports associated with the new campus geothermal living lab, campus energy use, projections of future electrification needs for heating and cooling and plans and associated costs for increased electricity provision to campus. The team comprises: Emma Bramham (UoL project lead) subsurface/geothermal geoscience expertise, supervise PDRA1 researcher; Fleur Loveridge - geoenergy engineering expertise and advisory to PDRA1; Simon Rees - building energy systems expertise and advisory to PDRA2; James Van Alstine - environmental policy expertise; Kang Li - smart energy systems expertise and advisory to PDRA2; Tong Zhang - simulation and optimisation of integrated energy systems expertise; David Barns - energy and planning policy and politics expertise; Arka Dyuti Sarkar -- geothermal reservoir modelling expertise

LCP Delta: leading energy transition research and consultancy, with extensive network experience. LCP Delta are currently leading a number of network innovation projects including NPG's Community DSO (£14million trial), and have worked with all of the UK electricity and gas networks. LCP Delta brings deep market and commercialisation knowledge, and electricity market modelling expertise.

Star: A leading UK innovator in large scale heat pumps, with leading international expertise in district heating heat pumps having developed one of the first HP DH schemes in Drammen, Norway, with a 14MW system.

EON: international utility in the energy supply, flexibility, and district heating sectors. E.On provide industry expertise in operating DH schemes, and the supporting service and business models including participation in the flexibility markets. E.On will support on the commercialisation and cost benefit elements of the project.

LCC: UoL and LCC have engaged extensively on the development of district heating and potential for expansion of the University scheme. LCC will be a key stakeholder for engagement to explore how the concept can be deployed more widely in the Leeds City area, and develop broader trial opportunities for Beta stage.

The project partners have been selected based on a number of criteria:

Ability to deliver a reliable and low risk project. LCP Delta will be providing overall coordination and management.

Technical expertise. All partners are deep experts in their specific technical areas. In particular, UoL bring leading geothermal expertise and capabilities.
Commercial expertise. Developing a replicable and deliverable concept is important and EOn, Star, and LCP Delta are major market players and advisors.
Existing relationships. All of the partners have existing working relationships with one or more of the partners.

Project Plans and Milestones

Project management and delivery

WP1: Project and Stakeholder Management

LCP Delta will manage timelines, oversee work packages and deliverables, ensuring effective coordination between partners. Stakeholder engagement will ensure widespread support and alignment with market needs. Key tasks include regular project meetings, risk management, and outreach to grid operators, heat sector stakeholders, and policymakers to ensure broad support.

Milestones: Project kick-off, two stakeholder workshops, and project finalisation on deliverables.
Deliverables: Two workshop findings summaries, mid-project summary report, finalised risk register.

WP2: Geothermal Source Analysis
UoL will develop a model for sustainable management of the on-campus geothermal reservoir. This will focus on capacity, recharge potential, and sustainability of geothermal sources. Geothermal well operation and storage cycles will be analysed to assess integration into the energy grid, including environmental and geological factors affecting performance. Identification of grid congestion points and geothermal energy potential across key Leeds city sites and in the wider UK to assess future translation potential.

Milestones: Initial geothermal assessment, final data analysis report.
Deliverables: Analysis of geothermal well performance, seasonal storage capacity, and environmental impact.

WP3: System Optimisation
UoL, assisted by NPg, Star Renewables, EON and LCP Delta will model integration of geothermal energy with the local electricity grid to reduce renewable electricity curtailment and alleviate network congestion. This will involve developing an optimisation model to evaluate aggregated flexibility from geothermal sites and local end users, built on geothermal data from WP2. Outputs, including energy user operation, shiftable demand within market frameworks and long-term energy storage capacity, will be used to update flexibility availability and electricity network headroom, informing the cost-benefit analysis in WP4.

Milestones: Initial electricity market model, final optimisation report.
Deliverables: Models for integrating geothermal energy into the grid, scenarios for reducing curtailment and improving grid flexibility.

WP4: Cost Benefit Analysis, Commercialisation, and Market Potential
LCP Delta, assisted by UoL, EON and NPg will quantify financial and environmental benefits of geothermal storage through a cost-benefit analysis. This will include cost savings from deferring network reinforcements and reduced curtailment. A commercialisation roadmap will outline steps to scale geothermal storage, exploring market potential and regulatory requirements.

Milestones: First iteration of commercialisation strategy roadmap, business case validation, finalised commercialisation roadmap.
Deliverables: Interim market and cost benefit assessment report and market study commercialisation strategy report.

WP5: Summary Report and Dissemination
NPg will lead the creation and dissemination of the final project report, summarising findings and key recommendations for policymakers and industry stakeholders. UoL and NPg will host workshops and webinars to share insights and promote geothermal energy storage adoption.

Milestones: Final dissemination workshop.
Deliverables: Final report, policy recommendations, and consumer-facing materials.

Links and Dependencies Between Work Packages

WP2 informs WP3 by providing data for system integration.
WP3 informs WP2 by providing data on key grid congestion zones
WP4 relies on outputs from WP2 and WP3 for financial and environmental assessments.

WP5 consolidates findings for dissemination.
Delays in WP2 will affect WP3's modelling, impacting WP4's analysis and overall recommendations. Regular communication will avoid bottlenecks.
Risk Management Strategy

Monthly Risk Reviews: A live risk register will be reviewed monthly to monitor risks.
Mitigation Plans: Contingency plans will address delays in data collection and technical challenges in geothermal integration.
Regulatory Risks: Early engagement with regulators will help identify potential barriers. Requests for regulatory updates, such as derogations, will be submitted to facilitate project progress.
Supply Interruptions

The project does not expect supply interruptions during the Alpha phase and aims to avoid them in future phases. Geothermal integration will not disrupt consumer energy access.

Key outputs and dissemination

Key outputs from the Alpha phase will include a fully validated assessment of geothermal heat provision and LDES potential, focusing on integration into the electricity grid and its capacity to reduce the need for network reinforcement, offset the need for increased electrification of heat, and provide low-cost heat to the University of Leeds campus. We will develop optimised models for geothermal energy heat provision and storage and provide a cost-benefit analysis that quantifies the financial and environmental benefits for both electricity and heat networks. Additionally, we will assess the wider commercial viability and market potential of LDES, offering insights into how it can utilised in different locations and scaled up nationally to contribute to GBs decarbonization.

Dissemination Plan

We will use multiple channels to provide wide dissemination of key outputs and lessons learned::

Industry Workshops and Webinars: LCP Delta will lead the organisation and delivery of workshops with key stakeholders including grid operators, heat network providers, and policymakers to share findings and gather feedback. A public show-and-tell webinar will be held at the end of the project to present findings.
Project Reports: will be include contributions by all project partners and will be published on NPg website. Reports will focus on different key areas covered across the WPs including technical analysis, cost-benefit evaluations and recommendations. We will actively share these with relevant industry bodies, such as the NESO, DESNZ and other DNOs using our internal contacts.
Academic Publications and Conferences: The University of Leeds will lead the academic dissemination by publishing papers in peer-reviewed journals and presenting findings at energy and geothermal conferences, ensuring scientific rigor and peer engagement.
Online Platforms: Key outputs, including reports, will be publicly promoted through digital platforms like LinkedIn and industry forums. All project partners will contribute to promoting project outputs through their relevant organisation channels. LCP Delta will ensure all outputs are in an accessible format to enable broad dissemination to the widest possible audience.
Competitive Market Development

The project will ensure that the development of competitive markets is actively promoted, not undermined. Geothermal heat provision and LDES is designed to complement existing energy systems, rather than replace them, providing additional flexibility and particularly inter-seasonal storage capacity that can be integrated with multiple generation technologies and heat networks. A differentiated approach to Value of Lost Load (VoLL) will guide the deployment of LDES to regions where flexibility is most societally beneficial, such as areas with higher customer impact during outages, thereby enhancing reliability and promoting societal value. All project outputs, including system model results and cost-benefit analyses, will be shared openly to encourage engagement, innovation, and competition in the geothermal and energy storage sectors. By providing transparent data and insights, we will enable new market entrants to participate, further fostering a scalable, competitive, and dynamic energy market.

Commercials

Intellectual property rights, procurement and contracting (not scored)

Each partner will sign a bilateral collaboration agreement with NPg which will outline the IPR terms.

In accordance with Section 9 of the SIF Governance Document, this means that for all agreements, before the project starts, all background IP will be documented, agreed and signed. All foreground IP will be developed after signing an agreement for each technology, and it has been agreed that foreground IPRs developed by individual partners will be owned themselves, while foreground IPRs jointly created will be owned jointly with the associated partners.

As in any innovation project of this type, there is some uncertainty over the exact type and source of IPR generated. IPR will remain a regular agenda item, and any issues arising during the project will be openly discussed and raised with UKRI where relevant.

The IPR log will be updated during the project so that all forms of IPR are clearly identified and logged.

Commercialisation, route to market and business as usual

Geothermal heat provision and LDES has the potential to become a key solution in the UK's energy landscape, providing inter-seasonal energy storage that reduces network congestion, provides low-cost, low-carbon heating, enhances grid flexibility, and supports decarbonisation. Our commercialisation plan focuses on demonstrating the viability of geothermal LDES at scale, identifying key market entry points, and outlining steps for business-as-usual deployment.

Route to Market

This will be driven by Geothermal LDES' ability to address immediate and long-term energy system challenges. The primary target market includes heat network providers, distribution network operators (DNOs) and sites with a large enough heat profile including university campuses, hospitals, housing developments and industrial sites looking for long-duration, low-cost heat storage solutions.

DNOs: By storing excess electricity during periods of low demand and discharging it during peak times, geothermal LDES helps avoid expensive grid upgrades and reduces curtailment costs. LDES is therefore an attractive alternative for the DNO, as it provides inter-seasonal flexibility in place of costly reinforcements. We will engage with DNOs to identify sites in their area that are suitable for integrating geothermal LDES and thereby provide scalability of the concept.

Heat Networks: Geothermal heat and LDES offers an attractive option for heat networks looking to decarbonise. Through exploiting high-efficiency geothermal heat provision and maximizing the use of low-cost, off-peak energy and storing it as heat, the technology offers significant operational savings. This includes delivery of low-cost heating during the winter peak, ensuring that heat networks can operate efficiently while reducing reliance on fossil fuels. We will outline cost savings to existing and new heat network developments using economic models to support business cases.

Business-as-usual Deployment

The long-term vision is to integrate geothermal LDES into GB's energy system as a standard solution for large-scale energy supply and long-duration energy storage. We intend to apply for Beta at the completion of the Alpha phase, through which we will focus on:

Standardisation and replication: the Beta phase will use alpha outputs to develop a geothermal trial-site solution within the Leeds area. The location will be selected in collaboration with Leeds City Council to support city climate targets and designed to be replicable across the wider UK. The learning from this exercise will be included in the final report to provide a replicable, modular approach to geothermal LDES development which will reduce future deployment costs. Additionally, learnings will facilitate easier adoption in different geographic regions of GB.

Policy and regulation: collaboration with policymakers and regulators will be crucial to ensuring that geothermal LDES is supported by appropriate incentives and regulatory frameworks, enabling widespread deployment. We will outline policy reforms that encourage investments in renewable storage solutions, such as LDES.

Commercial partnerships: To scale the solution, we will pursue partnerships with renewable energy developers, engineering firms, heat network developers, local authorities and aggregators, ensuring that geothermal LDES becomes an integral part of GBs decarbonisation strategy.

Commercial Readiness and Investment Requirements

We have already completed an advanced technical feasibility for the Leeds University site. The Alpha phase will focus on proving system integration and cost-benefit analysis. To scale the technology commercially, additional investments will be required in several areas:

Site-by-site refinement: Whilst geothermal energy is proven, each site will require specific assessments. We will provide a decision tree to aid assessment of the needs for different sites to support implementation of appropriate geothermal technology options.

Private and public investment: To achieve commercial scalability, we will seek private investment from energy sector stakeholders and public funding through innovation grants and regulatory support. This dual approach will ensure the financial backing needed for rapid commercial expansion.

Policy, standards and regulations (not scored)

The project will ensure necessary standards and regulations are met and it is not expected for these to act as barriers to successful delivery. The project will employ the UoL geothermal energy system. The drilling work was completed in summer 2024 in accordance with necessary regulatory requirements including:

-Environment Agency license to investigate a groundwater source

-Yorkshire Water temporary approval for discharging water to sewerage system during testing phase

-Coal Authority permit to enter or disturb Coal Authority interests

During lifetime operation of the geothermal system , a water abstraction license for schemes abstracting over 20m3/day from the Environment Agency will obtained. This must be renewed every 12 years. The University of Leeds will be responsible for upkeep of the license for ongoing operation.

The geothermal system will comply the electricity system codes for integrating LDES, including Balancing and Settlement Code (BSC), Connection Use of System Code (CUSC), Distribution Use of System Agreement (DCUSA), Grid Code and Distribution Code.

Value for money

This project provides a unique opportunity to explore the interactions between flexible low carbon heating, long duration / inter-seasonal energy storage, and the electricity system. Solving these issues is central to the energy transition but there are very limited opportunities to explore this through innovation due to the need for large scale heat infrastructure and risks of developing a trial, coordination of a number of partners and skills, and availability of natural resources.

This project is unique and presents exceptional value for money because:

It builds on existing extensive research and investment by the University of Leeds into geothermal heating and the funding enables additional focus on the electricity system interaction.
The University has senior buy-in to its heat decarbonisation strategy and this project will benefit from the University's asset investment and expertise.
There is broader buy-in to the concept across Leeds enabling scaling of the solution in the short term, and the University has developed a broader network of interested parties demonstrating the broader replicability and UK market potential.
Overall the University's direct project costs are estimated to be £239,527 with £215,574 of funding sought. However, the University has so far contributed £1.2 million to the geothermal scheme at the centre of this project, alongside £0.5 million of research academic costs which all support this project. The indirect project costs are therefore significantly higher, demonstrating the value to money for this project.

LCP Delta will be coordinating and managing the project and bring extensive knowledge of the innovation space in networks, particularly with Northern Powergrid, and have leading expertise in flexibility and electricity system modelling. LCP Delta were involved in SPEN's Heat Balance project and can bring the learnings from this. LCP Delta have provided over 10% reduction in commercial rates to demonstrate investment in this project in line with the funding requirements.

Project partner Star Renewable Energy are leading experts in large scale heat pumps for district heating and bring extensive industrial innovation expertise. Likewise project partner E.ON are major players in the district heating space and bring inhouse flexibility trading capabilities. Low carbon flexible heat networks present a major opportunity in the UK and internationally and both Star and E.ON see a considerable benefit in developing the market further though innovation and will contribute expertise and knowledge considerably in excess of their funding.

The overall project costs are £483,477 with a funding request of £432,935 and represents excellent value for money with the SIF funding leveraging significant additional project funding. By building on this additional investment made by the University and project partners, future customers will benefit through reduced electricity system costs, and more cost-effective low carbon heating for up to 20% of UK heat customers on heat networks.

More broadly there are a range of indirect benefits from this project which support consumers including supporting a more resilient and reliable electricity system, and enabling a faster energy transition allowing increased uptake of other low carbon technologies. So the value provided by the project and expected benefits is much broader. These values are difficult to capture in the direct CBA, but will be explored at alpha and beta (assuming successful) stages.

Associated Innovation Projects

- ○ Yes (Please remember to upload all required documentation)
- ◉ No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

WP4-Interim Report-May 2025.pdf - 1.1 MB
WP2_and_3-MidPoint_Progress_Report.pdf - 4.5 MB
SIF Alpha Round 3 Project Registration 2025-04-14 8_19 - 80.5 KB
SIF Alpha Round 3 Project Registration 2025-03-13 3_30 - 80.4 KB
SIF030_SIFProgramme_Project Management Book Template 001.pdf - 31.2 KB
SIF063_SIFProgramme_Associated Network Innovation Projects (ANIP) Form_ 001_live.docx - 520.9 KB
ANIP - Project evidence combined.pdf - 6.5 MB

Documents uploaded where applicable?

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