SIF Round 3 Project Registration

Date of Submission

Mar 2024

Project Reference Number

10105895

Initial Project Details

Project Title

LDES NODE – Long Duration Energy Storage for Network Optimisation, Decarbonisation, and Efficiency

Project Contact

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Challenge Area

Novel technical, process and market approaches to deliver an equitable and secure net zero power system

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Distribution

Other Related Sectors

Electricity Distribution

Project Start Date

01/03/2024

Project Duration (Months)

3

Lead Funding Licensee

Electricity North West

Funding Licensee(s)

Electricity North West

Funding Mechanism

SIF Discovery - Round 3

Collaborating Networks

Electricity North West

Technology Areas

Storage

Project Summary

LDES NODE will develop a methodology to inform the optimal locations of Long Duration Energy Storage (LDES) technologies when deployed on electricity distribution network. With optimal deployment on the electricity distribution network, LDES technologies, can assist with alleviating local constraints and maximising the output of renewable generation as well as performing valuable stability and resilience grid services The LDES NODE methodology and corresponding mapping tool will provide regional stakeholders with data-driven insights into key locations for LDES installation, allowing co-ordination with broader net-zero energy plans.

Add Third Party Collaborator(s)

Environmental Resources Management (ERM)

Project Budget

£165,968.00

SIF Funding

£145,953.00

Project Approaches and Desired Outcomes

Problem statement

Long Duration Energy Storage (LDES) technologies will play a vital role in effectively managing peak electricity demand and stabilising the network, particularly as the deployment of renewable generation increases to enable the UK to meet energy system transition targets.

To maximise the benefits of LDES it is important that deployment occurs strategically across local electricity distribution networks, requiring a bottom-up analysis to understand optimal placement whilst minimising overall system costs. This necessitates an understanding of the intricacies LDES technologies, Local Area Energy Planning (LAEP) processes and the development of the electricity network.

LDES NODE's primary objective is the development of a comprehensive methodology and tool that identifies the optimal geographical locations for LDES installation. The tool will appropriately map the technologies, accounting for their specifications, network conditions, and geographical constraints.

The Discovery phase will focus on the ENWL network area, with a strategic vision to expand its coverage to encompass the whole of GB in subsequent phases.

The LDES NODE tool's potential user base is diverse, catering to the needs of DNOs, Local Authorities, and LDES technology developers. The advantages extend to each user group by addressing the following needs:

- DNOs will need an understanding of the potential effect of LDES on their network. To assess this, the LDES NODE tool will provide data on specific LDES technologies and installation locations that can be used in demand forecasting and load-balancing modelling.
- Local Authorities will benefit from integrating the tool in their Local Area Energy Plans (LAEPs). It will provide data-driven insights into key locations for LDES installation, aligning with broader net-zero energy plans. This strategic integration will enable Local Authorities to play a proactive role in sustainable energy transitions.
- LDES technology developers will gain insights into optimal locations for deployment. The tools' output will assist developers to identify and prioritise project locations, where economic, geographic, and practical factors are likely to be attractive and where the impact of the installation on the whole energy system is maximised.

In addition to addressing the primary aim of Innovation Challenge 2 – scope 3, LDES NODE aligns with the broader innovation goal of novel market and technical approaches to cost-effectively minimise renewable generation curtailment.

Video Description

https://www.youtube.com/watch?v=gi-4csonNPU&feature=youtu.be

Innovation justification

The core innovation that will be developed in LDES NODE is an analysis methodology and associated tool to map optimal LDES deployment across an electricity distribution network.

The tool will create a geospatial representation of the network to:

- determine optimal deployment locations for LDES,
- identify network areas with a need for LDES connection and the appropriate node at which to connect, and
- allocate the most appropriate technology and its required capacity to connect based on:
  - network node characteristics (e.g., generation headroom, connection cost, existing and planned renewable generation, etc.),
  - expected network benefit, and
  - lifetime costs of the storage technology.

There are no existing, directly equivalent products used across business-as-usual operation within DNOs and relevant stakeholders, such as LDES developers and manufacturers. This is because the backbone of the modelling, a techno-economic appraisal of LDES technologies, is in and of itself a novel piece of work. Although similar investigation has occurred at

transmission level, as part of the National Grid ESO NIA project, (Impact of Long-duration Energy Storage Systems on GB Transmission Planning) our analysis will be focused on identifying impacts and benefits of LDES at distribution level, comparing counterfactuals such as hydrogen and electrochemical storage with novel alternatives such as adiabatic compressed air energy storage (A-CAES).

The current technological readiness of the software tool is a formulated concept (TRL 2). Following Discovery Phase the tool will be a proof-of-concept (TRL 3), and successful completion of the Alpha and Beta phases would result in the tool informing an LDES demonstration project (TRL 7).

Whilst the UK already has multiple gigawatts of installed long-duration storage capacity, it is almost completely from pumped hydro, and novel technologies must be explored to meet local needs and constraints whilst progressing to Net Zero. The scope of LDES NODE is, through the development of an LDES mapping tool, to facilitate future deployment of LDES onto the distribution network.

Whilst the Discovery phase will produce a proof-of-concept tool with application to ENWL, the expectation is to progress development to produce a product usable across any GB distribution network.

Furthermore, the project will benefit from collaboration with an LDES technology developer to progress potential LDES solutions to the deployment stage. As a result of the innovative scope and multi-phase approach, SIF funding is the ideal mechanism through which to develop LDES NODE.

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

Environmental - carbon reduction – indirect CO2 savings per annum

Revenues - improved access to revenues for users of network services

New to market – products

New to market – processes

Impacts and benefits description

The LDES NODE Discovery phase will deliver a novel techno-economic analysis of LDES technologies at a distribution network level. The optimal siting of LDES on local networks is key to achieving Net Zero, and providing this analysis to regional stakeholders will promote their use in local area energy planning allow the unlocking of whole system benefits such as:

- alleviating distribution and grid network constraints thereby avoiding expensive, carbon intensive reinforcement,
- reducing CO2 emissions directly from a reduction in curtailment,
- reducing CO2 emissions indirectly by displacing carbon intensive generation,
- providing cost savings for users of network services including balancing and flexibility services.

Until now, the primary focus of investigation into LDES impacts and benefits has been undertaken at the transmission level and has shown that LDES integration can reduce system costs, deliver greater and cheaper storage capacity than shorter-duration solutions, and reduce renewable deployment risk. In the UK, it has been modelled that LDES can reduce the cost of system by £13bn - £24bn (3.1% - 5.1%) by 2030, from addressing seasonal storage needs and the displacement of a greater capacity of shorter-duration storage.

A preliminary cost-benefit analysis indicates pursuing LDES NODE has significant potential value to network operators. Annuitised reinforcement costs can range from £50,000/MVA to £300,000/MVA, and thus even the prevention of a single transformer upgrade of 10 MVA (a conservative estimate) would produce a project ROI of between 3.33 and 20.0.

Optimising LDES integration into the network, such as through co-location with renewable generation sources or reutilisation of land from stranded fossil fuel assets, can provide significant value to network operators by leveraging existing grid connections and assets. The prevention of a single generation connection would produce a project ROI of 3.33.

Many LDES technologies also have inherent benefits with further potential to lower system costs, such as relatively short lead times (compared to new generation connections), the lack of deployment restrictions and a modular architecture that can be scaled with evolving needs.

Teams and resources

The proposed team, with a pre-existing relationship and the combined experience and capability necessary for successful project delivery, is comprised of the following members for the Discovery phase:

ENWL (Lead network, project management) has a proven track record of delivering innovation projects on time and to budget. ENWL's role in LDES NODE will be to manage the delivery of the work packages, monitor project progress and provide subject matter expert technical input to ensure successful delivery of the outputs. ENWL will also track the finances and manage the relationship with the UKRI Monitoring Officer.

ERM (partner, project delivery) - ERM is the leading pure play sustainability consultancy focused on helping clients identify, manage, and take advantage of the innovation challenges and opportunities presented by the energy transition. The Sustainable Energy Solutions (SES) team in ERM has over 150 experts across 10 activity areas, working globally as part of the ERM Group to tackle the most pressing challenges for our clients.

Within SES there are dedicated teams housing experts in different activity areas, the most relevant of which are:

- The Energy Networks team, which has a wealth of experience in supporting networks' strategic forecasting through scenario-based modelling. This work often focuses on the impact of decarbonisation pathways on network infrastructure.
- The Smart Energy Systems team, whose main area of expertise is modelling future energy systems, focusing on the role that storage and flexibility will play in these systems.

These teams, along with others within SES, regularly provide expert analysis to the National Grid, several UK DNOs, UK government (particularly DESNZ), local authorities and energy project developers. This has included work for Statera Energy, where we conducted an analysis of a planned integrated renewable hydrogen system consisting of a wind farm, an electrolyser, and a hydrogen peaking generation plant to determine optimal sizing under a range of assumptions.

ERM has deep expertise in multiple other areas relevant to this project, such as the Capital Projects Delivery team, which specialises in delivering large sustainability projects and whose expertise could be leveraged in the alpha and beta phase of this project.

The Discovery phase of LDES NODE will be comprised of desktop-based research and tool building, and thus has minimal non-labour resource requirements. All the data to inform the LDES mapping tool will be provided by ENWL or obtained by ERM through the techno-economic analysis.

Project Plans and Milestones

Project management and delivery

The overall project will be managed by an experienced project manager, who will be accountable for project progress and success. They will be the key contact person, facilitating communication between the project partners. There will also be a designated project manager in the partner organisation to ensure that their contributions are delivered.

The project will be monitored according to a set of KPIs and established processes that cover aspects such as project delivery timeline, risk monitoring/mitigation, staff availability. We propose to hold regular virtual meetings between the project partners, during which project progress, timelines, risks, and next steps are discussed. The communication plan will be finalised during project mobilisation.

Project milestones are summarised in the Project Management Template. Key milestones include:

- an overview and outputs of the technoeconomic analysis
- the final outputs of running the proof-of-concept mapping tool and
- a final report on project outcomes.

The links between work packages are illustrated in the Gantt chart provided. WP1 will run alongside the other work packages. WP2 will carry out analysis that will be used when the mapping tool is created in WP3, which will then be used to create the outputs of WP4 using the data gathered in WP4.

We will maintain the risk register throughout the project, and new risks identified during the work will be raised with project partners, together with time-based mitigation actions where necessary. More generally, we bring a wealth of experience and complementary skills, which is at the core of the risk management strategy.

The risks identified with project delivery are the unavailability of data; the loss of key staff members, not being able to create a tool that reaches the project goals in time and errors in the outputs. Mitigation strategies for these risks have been identified and will be employed during the project.

We will work in a robust, transparent, and flexible manner, with a focus on timely delivery. We have ensured sufficient resource within the project team to provide timely delivery of the outlined tasks. We also have a large pool of resources to draw on as contingency should any members of the team become unavailable. There are no known risks in relation to policy and regulatory challenges known for this project, and the project will not affect consumer supply, and is not anticipated to involve consumers directly.

Key outputs and dissemination

By the end of the Discovery Phase, we will have created a proof-of-concept tool which uses economic analysis and a model of a region's relevant characteristics to identify optimal location for LDES deployment which could benefit the DNO. In particular, we will produce outputs which inform how LDES development could be progressed within ENWL and can be disseminated across interested stakeholders. We expect this to include visual materials to help with communication of the results, which will be specified after completion of the tool.

Alongside this, the project will also produce a report on the learnings from the tool creation, with recommendations for how the project can be built on by further work in this area.

ERM will be responsible for developing the specifications for the techno-economic analysis and the proof-of-concept mapping tool, as well as running the tool with real data to produce outputs.

ENWL will be responsible for reviewing and providing key technical network planning input as well as the overall management of the project. ENWL will be the lead partner for project management and the dissemination activities following the creation of the tool and its outputs.

Reports will be produced, capturing the learning and insights from the activities described above, and disseminated to audiences interested in network innovation through channels such as the Smarter Networks Portal, ENWL's website and network innovation

conferences.

We will operate with transparency and accountability and make our findings available in a timely manner to interested stakeholders. LDES NODE will help inform future decision-making on the optimal location for LDES in a way that is compatible with competitive markets. As we will disseminate project findings as part of the SIF funding process, the work will be open for other organisations to challenge or build upon, preventing an increase in competitive advantage for certain networks or technology providers.

Commercials

Intellectual Property Rights (IPR) (not scored)

Each Project Partner will comply with the default IPR arrangements as set out within Chapter 9 of the SIF Governance Document.

For the Discovery phase all selected Project Partners, whilst they have significant ability and the relevant expertise to deliver, are bringing minimal background IPR to the project.

ERM has background IPR in the form of:

- Existing energy storage models, including:
  - the Flexible Asset Model (FAM) – optimisation of on-site renewable generation, storage and DSR to minimise cost of energy / maximise revenues.
  - Integrated System Dispatch Model (ISDM) – hourly dispatch model to forecast future volatility in the power sector and the role of storage to reduce system costs.
- Load forecasting models:
  - Element Energy Load Growth Model – model to forecast future demand and generation at network assets under various decarbonisation pathway scenarios.

Any learning developed during the Discovery will also adhere to the default IPR arrangements. Section 9.7 outlines that "each party participant shall own all Foreground IPR that it independently creates as part of the project, or where IPR is created jointly then it shall be owned in shares that are in proportion to the work done in its creation". For the purpose of this project, "the proportion to work done in its creation" is defined by the days to be spent on the project. Prior to starting the Discovery phase, each project Partner will make a declaration of background IP to be included in the consortium agreement that will clearly define any background IP they bring to the project. If any specific IP issues arise during project delivery, they will be addressed by the project Steering Committee and, if necessary, raised with the monitoring officer.

In addition to complying with the default IPR arrangements, data generated during the project will be shared and made available through knowledge dissemination to allow other parties to benefit from the outputs.

Value for money

The total Discovery project costs are £165,968.

The total SIF funding request is £145,953, meaning an overall contribution of £20,015 or 12.06% from project partners.

Compulsory Contribution

All Project Partners will provide a minimum of 10% contribution in the form of a reduced day rate.

Balance of costs across Project Partners

The SIF funding request, contributions and balance of costs across partners are shown below:

ENWL – SIF request £26,520 (£29,466 including 10% contribution via reduced rates) which is 18.17% of project costs.

ERM - SIF request £119,433 (£136,502 including 12.5% contribution via reduced rates) which is 81.83% of project costs.

This project involves no subcontractor costs and will not be funded by any other innovation funding.

Providing Value for Money

Value for money will be added through the expertise held ERM on modelling storage technologies which we will leverage to efficiently develop the model and reduce costs and can use some basic methodologies developed in the creation of these other models to quickly progress initial development of the model.

Commercialisation and BAU Deployment

There are no plans to commercialise the model developed in the Discovery Phase of LDES NODE. Once developed, the functionality can be made available to all DNOs for use in forecasting and decision making.

Supporting documents

File Upload

LDES NODE SIF Discovery Show and Tell 2024 06 04 - v1.1.pdf - 629.5 KB
WP3 and WP4 Model Methodology and Outputs.pdf - 1.5 MB
WP2 Techno-economic Analysis.pdf - 3.1 MB
SIF Round 3 Project Registration 2024-03-27 3_47 - 61.8 KB

Documents uploaded where applicable?

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