

Ofgem Strategic Innovation Fund Discovery End of Phase Report Template

Completion Information

In accordance with the [SIF Governance Document](#), the End of Phase Report (EOPR) is designed to facilitate learning and knowledge dissemination and demonstrate that a project satisfies the SIF Eligibility Criteria.

The continuation of your project into the next phase dictates whether or not an End of Phase Report is required, and when it needs to be provided.

- If you are not applying to the next phase, your EOPR must be submitted **within one month of project completion** to your Internal Monitoring Officer (IMO) by email or link to a file sharing site and must be published on the [Smarter Networks Portal](#).
- If you are applying to the next phase, but are unsuccessful, you are required to retrospectively complete and submit your EOPR **within one month of receiving your unsuccessful notification** to your IMO and upload it to the [Smarter Networks Portal](#).
- If you are applying to the next phase and are successful, you are not required to submit an EOPR at this stage.

All projects, regardless of whether applying to the next phase must present findings at a public Show and Tell webinar arranged by Innovate UK. A copy of the Show and Tell presentation must be submitted to the [SIF mailbox two days prior](#) to your allocated Show and Tell slot. Any other publishable project outputs must also be provided to your IMO and published on the [Smarter Networks Portal](#) **within one month of project completion**.

The EOPR template is broken into 7 sections that all require completion. The responses can be up to **400 words** long per section and should only provide information that focuses on the key elements of the project, in a manner that is easily reviewed and accessible to a range of stakeholders. You may include diagrams, hyperlinks and appendices to support this document.

The EOPR template has been designed to correlate with the application questions as much as possible, to help support easy completion for those who are not successful.

Project Number 10105895	Project Title LDES NODE
Date Mar – May 2024	Author and Contact Details ENWL InnovationTeam@enwl.co.uk

Section 1 -	Discovery Phase – Project Summary
Please provide a summary of the key findings from your Discovery Phase Project. Describe the innovative aspects of the work including any new findings or techniques. Please provide a short factual summary of the most significant outcomes of your work.	
You should describe: <ul style="list-style-type: none"> • how your Project has met the aims of the relevant SIF Innovation Challenge • how your perception of the problem and opportunity has evolved • why the problem relates to energy network functions, and the potential role of energy networks to realise future opportunities • the innovative, novel and risky aspects of the work, including any new findings or 	

techniques.

To maximise the benefits of Long Duration Energy Storage (LDES) it is important that deployment occurs strategically across local electricity distribution networks. LDES NODE Discovery developed a comprehensive methodology and tool to inform the optimal geographical location for LDES technologies when deployed on electricity distribution networks.

The project addresses SIF Innovation Challenge 2: “Novel technical, process and market approaches to deliver an equitable and secure net zero power system” The project met this challenge by increasing knowledge and creating innovative techniques for mapping LDES for optimal deployment on the electricity distribution network, and optimising the opportunity for LDES technologies to assist with alleviating local constraints and maximising the output of renewable generation as well as performing valuable stability and resilience grid services.

The project’s modelling outputs can play a vital role in “effectively managing peak demand and stability through increased flexibility including over longer time periods” (SIF Innovation challenge 2, Scope 3) particularly as the deployment of renewable generation increases to enable the UK to meet energy system transition targets. LDES NODE also aligns with the broader innovation goal of novel market and technical approaches to cost-effectively minimise renewable generation curtailment.

The project conducted a bottom-up analysis of the ENWL network to understand optimal placement whilst minimising overall system costs, building in detailed understanding of the intricacies LDES technologies, Local Area Energy Planning (LAEP) processes and the development of the electricity network.

The LDES NODE tool achieved its aim to appropriately map the technologies, accounting for their specifications, network conditions, and geographical constraints in the ENWL region.

Our understanding of the problem and opportunity has evolved giving key learnings and achievements summarised here:

- levelised cost of storage techniques can be used to compare LDES technologies: LDES can offer some services more effectively than Li-ion batteries
- developed a new framework to use LDES data with a model of DNO network: a methodology to identify where LDES can meet network needs.
- collated data for analysis and, using the model, produced locational LDES recommendations
- created outputs in a range of formats to make them accessible to a range of users, regardless of prior knowledge of LDES.
- visual outputs show how results relate to local authorities: Examined use cases with direct benefit to the local community e.g. district heating and learnings and data that can be directly embedded in Local Area Energy Planning (LAEP) processes.

Please summarise who your prioritised users are and their specific needs relating to your project. Please include how you have translated these into your project design and requirements.

You may want to describe:

- how you have defined and justified your scope boundaries
- what would need to happen to make the user journey as a whole work as well as possible (in particular, you are able to talk about other services that are part of the same journey, and the opportunities and challenges involved in making changes to those services)
- how you have tested your own assumptions against the needs of your users
- how the approach you have taken will minimise the burden on your future users and avoid duplication of effort through user journeys
- how you have considered the wider interactions of your outputs with the energy sector and other sectors. Please include a description of the product's user journey, processes, or wider services

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.

Discovery phase focussed on the ENWL network area, with a strategic vision to inform future development in expanding its coverage to encompass the whole of GB.

Section 3 -	Discovery Phase – Impacts and Benefits
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Describe your expected net benefits to consumers and justify any changes in proposed impacts since the Application stage. Please provide details of any changes that have been made to the Project and why these were necessary.

You may want to describe:

- if the project should be pursued outside the SIF, and if so, why is it cost effective to pursue and how you plan to take it forward?
- how the Project has progressed towards the benefits outlined in your Discovery application

- an indication on quantitative measurements for associated benefits. These could be related to the:
 - end consumer
 - economic benefits resulting from the project to your users and any other parts of the supply chain, broader industry, and the UK economy, such as productivity increases and import substitution
 - impact on government priorities and any associated benefits
 - environmental impacts, either positive or negative
 - any expected regional or wider energy supply resilience benefits
 - impact on consumers of the whole energy system (both individuals, and collectively), including those with any vulnerabilities or experiencing fuel poverty

The LDES NODE Discovery phase developed and demonstrated 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 LDES NODE 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.

Previously, 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 indicated pursuing LDES NODE has significant potential value to network operators. Annual 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.

Further network benefits including flexible services are discussed in section 6 below.

Section 4 -	Discovery Phase – Risks, issues, and constraints
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Please provide a copy of the final updated project risk register outlining the risks and issues you are currently aware of, including a likelihood and impact estimate, and mitigating actions.

If an application for Alpha **has not** been submitted for this Project, what constraints (if any), such as technical, political, policy, commercial, managerial etc., have you encountered during your project that have hindered your ability to progress this project further?

You may want to describe:

- any actual or potential constraints in regulation, legislation, commercial contracts, or legacy technology that affect the innovation you are developing
- any barriers for innovations to be delivered into business as usual which could be relevant to future projects
- how you will create an innovation that meets user needs while working within these constraints
- if you have identified constraints that can be removed over the short or long term, how have you overcome them and what is your plan for mitigating future risks? (if there is an intention to carry on with some or all aspects of your project via a different route)

The project Risk and Issues register logged mitigating actions taken to manage risks and issues identified during the Discovery phase.

Risks managed and mitigated during discovery phase include:

- required data not available in time for completion of project milestones
- modelling cannot achieve meaningful outputs in Discovery project timeframe
- loss of key staff members
- errors in outputs, assumptions and / or methodology

The LDES NODE team see the project as highly successful in achieving the aims set out for Discovery phase. We have achieved the desired learning outputs from Discovery phase. Progressing to a further phase with SIF funding is not considered to deliver sufficient benefits at the current time and an application for Alpha phase has not been submitted.

Section 5 -	Discovery Phase - Working in the open
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How have you worked openly during the Discovery phase and engaged stakeholders in a transparent and constructive manner? What have you learnt from the approach you have taken?

You might want to describe:

- ways in which you have talked publicly about the project
- how you have invited challenge and external input of your approach to the project
- how have you shared learning, to avoid duplication of work by others and accelerate industry progress on related initiatives
- how your team has been working openly and have started building relationships

<p>with organisations and teams responsible for other parts of the user journey. These could include infrastructure/data owners, regulators, policy makers, investors, and others</p> <ul style="list-style-type: none"> • any learnings from engaging with stakeholders that would be relevant for future projects • a description of any data or insights that you have produced/published from the project, and where they may be found or requested (other than documents to be hosted on the Smarter Network Portal)
<p>All reports on the work completed are publicly available on the Smarter Networks Portal and the Electricity North West website.</p> <p>This demonstrates the progress made during Discovery phase and provides learnings for stakeholders interested in this area. If further information is needed, stakeholders can contact the Electricity North West team directly.</p> <p>There has been a high level of collaboration and cooperation between the partners throughout the project. In line with other Electricity North West projects, the team used a secure online workspace to share project documents promoting an open culture and ensuring that everyone had access to the latest relevant information.</p> <p>Additionally, regular project update meetings were held to discuss development of the individual project outputs and update on progress.</p> <p>The project team will continue to take opportunities to disseminate the learning from LDES NODE at events such as the Energy Innovation Summit</p>

<p>Section 6 - Discovery Phase – Costs and value for money</p> <p>Please give a description of how funds were spent with reference to the original forecasted budget, explaining any significant variations and any additional contributions made over and above that which was set out in the Project Direction. Explain how the project has delivered value for money to consumers.</p> <p>Please complete the table below with the final project expenditure. Please indicate any figures that are yet to be confirmed as final (we will request confirmation of final amounts 6 weeks after the project has ended).</p>
<p>Project funds were spend in line with the original forecast budget.</p> <p>No variations or additional contributions were required over and above those set out in the Project Direction.</p> <p>The project delivered value for money to consumers by:</p> <ul style="list-style-type: none"> • performing a techno-economic analysis of a wide array of LDES technologies as well as hydrogen and short duration battery storage technologies. Using this

analysis to identify the conditions under which different LDES technologies can offer a benefit to the area which is being targeted by modelling

- developing the proof-of-concept model of the ENWL region and implementing the methodology for determining how LDES technologies should be distributed according to the needs of the system and areas and the benefits of the technologies.
- collecting the data required to run the model and using it in the model to create a map of how LDES technologies could be optimally deployed across the ENW region. Following this create materials to help disseminate the understanding gained from this analysis.

As a result of our learning from LDES NODE Discovery, the project has delivered valuable understanding of the wide reaching network benefits such as:

- network operators can better understand locations/technical options that are more likely for LDES to connect. LDES (as other storage types) are also expected to co-locate with renewable generation. Understanding location of LDES and co-located schemes helps DNOs to:
 - optimise network investment to release capacity only where and when needed to facilitate renewable penetration
 - understand the extent of additional renewable generation that can be facilitated with long-duration storage compared to no storage
- from a whole system planning perspective, LDES NODE focuses also on electrolyzers/hydrogen storage. Understanding the locations/likelihood to connect allows DNOs take into account whole system inputs in network planning
- a new offering to integrate this work with LAEP action plans in proactive engagement with local authorities to reduce network investment required to facilitate LAEPs, but also help local authorities who act as coordinators to reduce the whole system costs
- understand potential for longer-term flexibility services to defer expensive conventional reinforcement. This is important for DNOs that apply a "flexibility first" approach meaning deployment of flexible services in all cases that it's economic to do so.

Project partner name	SIF funding requested	Total actual project spend	Total project contribution made (incl. contributions in kind)
Electricity North West	£26,520	£29,466	£2,946
Environmental Resources Management Ltd	£119,433	£136,502	£17,069

If applicable, please describe how you have met the requirements of any project specific conditions set out in the Project Direction.

There was one project specific condition for LDES NODE in the Discovery phase: Prior to completion of the Discovery Phase the Funding Party must present, to the Monitoring Officer, how the findings can be integrated into the Local Area Energy Plans to help enhance planning at a local level.

During the Discovery phase the project team addressed the project specific conditions by considered LDES technologies and use cases that would be of particular interest to Local Authorities, such as looking at district heating as an LDES technology. This informed the design the LDES NODE tool outputs, and specification of a range of different presentations of the material with different levels of technical detail, so LAEP practitioners can use the format which best fits their needs. The design of the visual output included local authority boundaries on the map and presented the data in such a way to help local authorities focus on the results that are of most interest to them.

The outcomes from addressing the conditions are:

- the outputs include use cases with direct benefit to the local community such as district heating and can inform Local Authorities as to where LDES assets may be deployed for planning purposes.
- the project team produced and shared outputs including high level summary information, more detailed technical breakdowns, a map of results and guidance documents explaining the content of the outputs.
- the visual output can be explored over the ENWL area with clear boundaries showing the Local Authority areas.