SIF Alpha Round 3 Project Registration

Date of Submission

Oct 2024

Project Reference Number

SIF_SGN0022

Initial Project Details

Project Title

HyScale LOHC Phase 2b (Alpha)

Project Contact

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Challenge Area

Enabling power-to-gas (P2G) to provide system flexibility and energy network optimisation

Strategy Theme

Optimised assets and practices

Lead Sector

Gas Distribution

Other Related Sectors

Gas Distribution

Project Start Date

01/10/2024

Project Duration (Months)

6

Lead Funding Licensee

SGN - Southern England (inc South London)

Funding Licensee(s)

SGN - Southern England (inc South London)

Funding Mechanism

SIF Alpha - Round 3

Collaborating Networks

Cadent

Northern Gas Networks

Wales & West Utilities

National Gas Transmission PLC

Technology Areas

Gas Distribution Networks

Project Summary

The HyScale Liquid Organic Hydrogen Carrier (LOHC) project aims todemonstrate how an LOHC system can be used for capturing, storing andreleasing hydrogen into a gas network, to manage long-duration storagerequirements. The use of LOHCs connected to an electrolyser and a hydrogengas network, will enable it to run flexibly and take advantage of low electricityprices. This will reduce the cost of producing hydrogen for consumers,accelerating the uptake of hydrogen for industrial offtakers, power generation anddomestic heating. LOHC systems may play an important role in providing storageflexibility where geological storage is not available.

Add Preceding Project(s)

NIA2_SGN0024 - HyScale LOHC Phase 2 Project

Project Budget

£451,849.00

SIF Funding

£451,849.00

Project Approaches and Desired Outcomes

Animal testing (not scored)

- [ ] Yes
- [x] No

Problem statement

The rapid build out of intermittent renewable electricity sources, like onshore wind,has made it difficult to balance supply with demand. This issue will be further compounded as the proportion of renewables in our energy system increases.
A potential solution to address this is the storage of energy in the form ofhydrogen. Hydrogen can be converted back to electricity when required and transported through a repurposed gas network to provide heat to industrial, commercial and domestic consumers helping to balance inter-seasonal energy demands. However, there are some regions of GB where the options for geological hydrogen storage are limited and therefore, alternative forms of long duration hydrogen storage will be required.
Liquid Organic Hydrogen Carriers (LOHCs) are one of the potential solutions for long duration storage where geological options are limited. The aim of theHyScale project is to explore how LOHCs can be connected to a gas network to manage inter-seasonal storage.
To this extent, previous NIA-funded phases of the HyScale project have analysed the technical and economic feasibility of utilising the LOHC benzyl toluene (BT) asa means of hydrogen storage and undertaken the high-level design of ademonstration scale system capable of storing/releasing 20 kg H2/day.
The recently completed conceptual design NIA project demonstrated that a LOHCsystem connected to a hydrogen generating electrolyser or Autothermal Reformer(ATR) and a hydrogen gas network has the capability to not only store hydrogen and release it when required, but also to reduce the levelised cost of hydrogen(LCOH).
This reduction is realised as a consequence of two factors:
Energy arbitrage -- being able to take advantage of lower cost energy when production capacity exceeds demand during low energy price periods, and subsequently releasing energy during periods of high demand when prices areincreased.
Lower capital expenditure (CAPEX) costs -- LOHC storage facilities on the gas network would prevent the requirement for hydrogen production capacity to be sized to meet peak demand, thus reducing the size and CAPEX of electrolysersor ATRs required for hydrogen production.
The NIA design project identified that LOHC storage will benefit the two key users of this technology:
Hydrogen producers, who can reduce their system CAPEX costs.
UK Gas Distribution Networks (GDNs), who can balance intermittency in hydrogen production and demand by making use of LOHC storage in areas withno salt caverns.
The UK rate payer will also be a direct beneficiary of LOHC technology as a resultof lower LCOH and therefore reduced energy costs.
The design study identified that the project should evolve towards the physical demonstration of an LOHC storage system in combination with hydrogen production and a suitable offtaker by undertaking the following activities:
An assessment of shortlisted sites for the demonstration phase, with final interfaces and ancillary systems required for full operations defined. The relevant planning and consenting regulations should be identified and assessed.
Addressing further technical and operational questions, such as the LOHCcycling stability and degradation pathways upon exposure to air versus inert atmosphere, and an assessment of the optimal electrolyser technology to couple to the LOHC system.
Additionally, the economic balancing model that was developed in the previous phase should be used to provide insight into the optimal sizing of electrolyser/LOHC and ATR/LOHC systems considering whole system capital expenditure (CAPEX) and operational expenditure (OPEX), to produce a detailed cost benefit assessment of the technology.
Undertaking a comprehensive evaluation of the system flexibility and commercial advantages derived by using LOHCs in this proposed hydrogen storage project clearly provides strong alignment to the aims of this primary Innovation Challengeand focus area.

Innovation justification

The UK has set an ambitious 2030 target of 10GW of low-carbon hydrogenproduction. Electrolysers can potentially offer system flexibility and the ability to"vector shift", i.e., use low-cost electricity to produce green hydrogen, which can be stored over time for use in industrial or domestic heat decarbonisation. Long duration hydrogen storage is a key enabler.
The HyScale design project has for the first time demonstrated that deploying LOHC storage systems in conjunction with

hydrogen generation and a hydrogen gas network could facilitate power-to-gas system flexibility and energy network optimisation. Such integration of LOHC storage systems with industrial and/or domestic heat demand via a gas network will represent a world first.
This proposed project will lead to improved understanding of the business model and technical design required for this innovative method of long duration hydrogen storage. The project is therefore very well aligned to the aims of Innovation Challenge 4.
Integration of LOHC technology with hydrogen production would allow the electrolyser to run flexibly taking advantage of (a) low electricity prices and (b)long duration demand shift. This would decrease the LCOH of the combined system while demonstrating the capture, storage, and release of hydrogen inLOHCs proving its commercial viability.
The previously funded design study demonstrated significant reductions in LCOHto the UK rate payer:
9% at 1,000 homes scale.
17% at 100,000 homes scale.
The design study also demonstrated that LOHC large scale hydrogen storage is economically competitive with geological storage, whilst providing operational and geographical flexibility in areas where salt caverns are unavailable e.g. in Scotlandand South-East England.
While the economic case in the design study for LOHCs was promising and provided justification for the development of a demonstration project, several
knowledge gaps exist. The following activities are proposed to address these:
CBA of an optimal balance of LOHC storage and electrolysers operating under a strategy to vector shift power-to-gas.
Technology analysis of different electrolysers for coupling with LOHC plants including efficiency, performance, safety and techno-economic aspects.
The creation of a research roadmap focusing on topics specific to energy network use cases including optimising reactors for hydrogenation/dehydrogenation, developing an understanding of LOHC cyclestability and aging, and optimal operating and storage conditions.
Evaluations of proposed sites for LOHC integration including interface andancillary systems for the full operation of the demonstration project. Site optionsinclude SGN's H100, NGN's NERV, Cadent's London area site, distilleries and Ineos' Grangemouth site.
Design of a Beta Phase including project plan, final costing and the demonstration project operating plan.
The design study received funding via NIA. Tackling this challenge without SIF funding will be difficult as the technology, its use case and commercial model are unestablished. The Alpha Phase will model the flexible operation of an electrolyser operating under energy price arbitrage and establish the CBA for LOHC storage.
The Beta Phase funding required for a LOHC project would exceed the size of an NIA demonstration project and would not be covered by business-as-usual activities. The project will allow informed decisions to be made about the magnitude of cost savings possible in a future hydrogen gas network at the100,000 homes scale, currently estimated in the tens of £millions. This will align with the 2030 UK target of 10GW of low-carbon hydrogen production.
LOHC is an emerging technology (TRL7). HyScale aims to increase the integrated and commercial readiness of LOHC systems. In Alpha, current IRL3 will increase to IRL4 through the technical evaluation of LOHC and electrolyser system integration. Current CRL2 will stay constant while developing the demonstrationplant operational plan. Beta aims to achieve TRL8, IRL6 and CRL3 - 4.

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 – indirect CO2 savings per annum

Revenues - improved access to revenues for users of network services

New to market – products

New to market – processes

New to market - services

Impacts and benefits description

The most significant direct benefit of HyScale LOHC is in reducing therequirement for hydrogen production systems to be sized to meet peak demand periods. Coupled with LOHC storage, optimum hydrogen production can be achieved to meet variable demand and supply scenarios. This reduces the CAPEX of the overall system, resulting in a lower LCOH and lower energy costs for consumers.
Financial - future reductions in the cost of operating the network (21%CAPEX savings vs counterfactual of no storage)
An optimal balance of LOHC storage and ATR capacity at the 100,000 homes scale could result in CAPEX savings of 21% (ca. £15 - 25m).
LOHC allows for the provision of hydrogen storage at localised network points, providing resilience to hydrogen gas networks and supporting wider decarbonisation objectives. Our studies have shown that large scale LOHC storage competes with geological storage in a broad range of scenarios and is economically competitive. LOHCs can overcome some of the operational and geographical limitations of geological storage:
salt caverns are unavailable in Scotland and South-East England.
depleted oil and gas reservoirs and aquifers have withdrawal rate limitations,this restriction does not apply to LOHC systems.
Financial - cost savings per annum on energy bills for consumers (9% lowerLCOH)
An optimal balance of LOHC storage and electrolyser capacity maximises the cost benefits of electricity price arbitrage, decreasing the LCOH to the consumer by9%. These considerations are set out in the attached high-level CBA.
Additional savings could be achieved using constrained/curtailed low-cost electricity, and by integrating LOHC with electrolysers, achieving reductions inCAPEX (reducing redundancy) and OPEX (increased system efficiency).
Financial - cost savings per annum for users of network services and Revenues - improved access to revenues for users of network services
LOHC storage enables electrolysers to flexibly respond to system needs based on hourly renewable generation, resulting in lower energy supply costs (by avoiding operation during peak demand hours) and emissions intensity.
This delivers better alignment with renewable generation which helps reduce curtailment and alleviate network constraints. Thus, renewable electricity generators can increase revenues by continuing to supply renewable energy intothe grid at times of low demand and high renewables generation.
Environmental - carbon reduction -- indirect CO*2* savings per annum
Flexible electrolyser operation helps reduce:
emissions intensity of the overall energy system via reduced renewable energy curtailment.
need for redispatch or reliance on fossil generation as the hydrogen released from LOHC will have no CO2 emissions.
The above financial and environmental benefits will be quantified in the AlphaPhase CBA.
New to market -- products, processes and services
HyScale is defining a new hydrogen storage value chain and commercial business model for long duration energy storage. This will be beneficial to energy network operators, hydrogen and renewable power producers and energy consumers.
A key feature of LOHC storage is that there is no self-discharge of hydrogen overtime. This results in the option of multi-month storage without losses. This may be advantageous in areas of constrained wind and limited capacity for blending where hydrogen can be slowly released over time.
HyScale may lead to the creation of LOHC plant owners/operators across the UK,new market offerings, funding mechanisms and support services for the long-term development and growth of hydrogen storage.
Other - safety
LOHC storage provides a safer alternative to high pressure or liquified hydrogen storage solutions which present hazards due to the nature of physical storage.LOHCs store and transport hydrogen at ambient temperatures and pressure. They also remove the requirement for the handling of molecular hydrogen by chemically bonding hydrogen to a stable organic carrier.

Teams and resources

All partners previously involved in the HyScale LOHC project have played an invaluable role, providing knowledge and insights, and shaping recommendations.They will continue to be involved in the proposed Alpha Phase alongside additional partners who will offer vital contributions.
SGN:
the owner and operator of the gas distribution network in Scotland and the south of England. SGN was the lead sponsor of the previous HyScale projects and will continue their leadership and governance for the Alpha Phase. SGN fully supports the development of the emerging LOHC sector in the UK. They are developing world-leading, innovative hydrogen demonstration projects such asH100 Fife and LTS Futures. In this project, SGN will facilitate an evaluation of proposed sites for LOHC integration.
Blue Abundance:
a UK company dedicated to developing a bulk LOHC hydrogen storage and supply solution, who aim to own and operate LOHC

systems in the UK. Blue Abundance led the delivery of HyScale Phase 1 and the subsequent design study (Phase 2) successfully, providing the longer-term vision and overall project management. In Alpha Phase they will lead the Beta Phase design and provide overall project management. It is intended that Blue Abundance will operate the HyScale LOHC demonstration project post commissioning.

ERM:

a specialist consulting company engaged to provide the CBA and planning authority assessment. Having developed an extensive hydrogen carrier techno-economic model in HyScale Phase 1, the balancing model for LOHC use in gas networks, and determined the feasibility of scale up of LOHC inter-seasonal storage in the Phase 2 study, ERM is well placed to carry out activities in Alpha Phase. ERM's expertise in the hydrogen sector is exceptional and benefits the rigor of processes applied to the overall project.

Framatome:

an international leader in nuclear energy and the LOHC system integrator. In previous Phases, Framatome identified unique reactor designs and delivered the high-level engineering design of the demonstration plant. In Alpha, Framatome will evaluate the system integration of LOHC systems with electrolysers and the proposed demonstration project sites. Framatome has a proven track record and long-running experience with hydrogen technologies,such as water electrolysis and LOHC storage.

Framatome has constructed, delivered and operated LOHC systems in the past, e.g., the 'Smart Grid Solar' project in Arzberg (Germany) and in cooperation with the HydrogenSouth Africa Institute (University of the Western Cape)

. Framatome is majority owned by the EDF Group and intends to invest in its LOHC technology to developlong duration hydrogen storage solutions for UK energy networks.

Helmholtz Institute Erlangen-Nuremberg for Renewable Energy (HI ERN)

,part of

Forschungszentrum Jülich (FZJ)

: The Chemical Hydrogen Storage research department at HI ERN is known as the world's epicenter for LOHC research. The department's research into the development of di-benzyl toluene(DBT), BT and electrocatalysts has led to the spin offs and commercial activities o fFramatome and Hydrogenious LOHC Technologies. In Phase 2, FZJ designed the core reactor and the testing and experimentation plan of the demonstration plant.During Alpha, FZJ will develop the research roadmap for future advances in LOHC technology and longer-term research into next generation LOHC reactors.

Cadent, Northern Gas Networks (NGN) and Wales and West Utilities (WWU):

UK GDNs joining Alpha as supporting networks. NGN and Cadent will facilitatesite evaluation of NERV and a proposed east London site.

National Gas Transmission (NGT):

NGT will provide insight into their HydrogenStrategy and the role the national transmission system must play in a Net Zerofuture. This will be vital as the implementation strategy and business case forHyScale are developed.

Cadent, NGT and WWU were previous sponsors of the HyScale feasibility study.

Project Plans and Milestones

Project management and delivery

Seven work packages (WP) are proposed for Alpha Phase with clear ownership and accountabilities set out in the accompanying Gantt chart and project management template:
WP1: Project management (Blue Abundance) Overall management of the project ensuring completion of all work packages and deliverables on schedule and within budget.
WP2: CBA (ERM) Evaluate the economic benefit of using LOHC storage with electrolysers generating hydrogen under electricity price arbitrage, against electrolysers without storage.
WP3: Technical evaluation and research roadmap (Framatome and FZJ) Investigate technical and research topics specific to LOHC long duration hydrogen storage for energy network use cases.
WP4: Site evaluations (Framatome) Assess UK demonstration project site aspects including evaluation of H100, NERV or Cadent's London sites plus additional sites in SGN's territory. Define site interfaces and ancillary systems required for full operations of the LOHC demonstration plant.
WP5: Planning Authority Assessment (ERM) Review and update the Phase 2 Roadmap to Consent, identifying material changes to latest engineering design, technologies on site and possible additional locations for the demonstrator plant.Depending on the final selection of a suitable site, ERM may approach the planning authority and provide additional pre-application engagement services.
WP6: Technology and commercial readiness watch (ERM) Extend the work undertaken during Phase 2 to continue monitoring technical and commercial developments for alternative storage technologies and hydrogen gas network models.
WP7: Design the SIF Beta Phase (Blue Abundance) Develop the Beta project plan, including commitment from Beta Phase partners, their scope and site selection. Produce final costing, budget and cash flows for the demonstration project. This will include all requirements for SIF Beta funding application.
Blue Abundance will lead project management, using standard best practice methods and tools. Two, weekly project meetings will be held. The first among project suppliers to track work package progress. The second among all project participants to review and gain inputs on work packages, track deliverables and project milestones. More detailed analysis of project progress will be undertaken on an ad-hoc basis, or during weekly 1-2-1 meetings between Blue Abundance and SGN's project manager. Monthly status reporting will serve as a governance schedule aligned with project timelines.
All Blue Abundance project outputs will be available on HyScale SharepointOnline, with detailed Gantt charts and deliverable/milestone information accessible to all project partners, facilitating easier collaboration.
The partners are aware of the methodologies followed from previous HyScale projects. The project team has the skills, prior knowledge, and stakeholder relationships to deliver the project quickly, efficiently, and to quality.
Interdependencies between work packages are:
WP3 research evaluation of split reactors will feed into WP2, its economic benefit evaluation.
WP4 inputs on demonstration plant site evaluations will feed into WP5 updates to the Roadmap to Consent.
WP7 occurs toward the end of the project and requires inputs from all otherwork packages before its completion.
Risks and mitigation strategies are set out in the risk register. We will update therisk register, track and manage risks during project meetings. Key risks in theAlpha Phase are:
If we cannot identify a suitable site, we may not be able to deploy a LOHC demonstration project.
Introduction of major changes to hydrogen regulatory frameworks may make commercialisation of hydrogen storage unviable.
Lack of wider social acceptance of hydrogen might make certain end use cases unviable.
Two key project milestones are:
M1 (Month three): completion of WP2-1 (Modelling LOHC Storage Scenarios),WP3 (Interim), WP4-1 (Project sites review) and WP6: First Report
M2 (Month six): Alpha phase final report

Key outputs and dissemination

The Alpha Phase objectives are:
CBA of LOHC storage plants connected to electrolysers operating at an optimal balance as a combined system under a strategy to vector shift power to gas (hydrogen).
Technology analysis of different electrolysers for coupling with a LOHC plant including evaluation of efficiency, performance, safety and techno-economic aspects.
Creation of a research roadmap focusing on topics specific to energy network use cases including optimising reactors for

hydrogenation/dehydrogenation, developing an understanding of LOHC cycle stability and aging and optimal operating and storage conditions.
Site evaluations including interface and ancillary systems required for the full operation of the demonstration project.
Design of the Beta Phase including project plan, final costing and development of the operating plan for the demonstration project.
The proposed outputs by Work Package are:
WP1: Project management (Blue Abundance)
Completed Risk Register for Beta application.
Alpha Phase Final Report.
WP2: Cost benefit assessment (ERM) Evaluation of the economic benefit of using LOHC storage systems with electrolysers generating hydrogen under electricity price arbitrage, against systems using electrolysers alone without storage.
Completed Cost Benefit Template.
WP2 report with modelling of LOHC storage system scenarios with estimated potential savings on LCOH. Review of the economic benefits of split reactor configurations.
WP3: Technical evaluation and research roadmap (Framatome and FZJ) WP3Report containing:
Analysis of different electrolyser technologies for coupling with a LOHC plant.
Assessment of electrolyser technology with best integration potential for coupling with LOHC.
Research roadmap of the technical topics pertaining to the energy network use cases.
WP4: Site evaluations (Framatome) WP4 Report containing:
Site evaluation of the H100, NERV and Cadent's London sites plus additional sites in SGN's territory.
Confirmation from site teams
Defined site interfaces and ancillary systems required for the full operations ofthe LOHC demonstration plant.
WP5: Planning Authority Assessment (ERM) WP5 Report, will contain:
an addendum update to the original consenting report.
A pre-application submission pack may also be included depending on the final site selection.
WP6: Technology and commercial readiness watch (ERM) WP6 report, monitoring technical and commercial developments across:
Hydrogen storage in geological formations such as salt caverns, depleted oil and gas reservoirs.
Hydrogen storage in ammonia.
Alternative LOHC carriers such as DBT and toluene for both hydrogen storage and in the import and export supply chain.
UK-wide hydrogen transmission systems (e.g. Future Grid, Project Union).
UK hydrogen production projects and CO2 sequestration plans.
The import and export of hydrogen in international supply chains, covering compressed, liquid, or liquid carriers of hydrogen.
WP7: Design the SIF Beta Phase (Blue Abundance) A WP7 report, with:
The Beta Phase project plan, including commitment from Beta Phase partners, their scope and site selection.
Final costing, budget, cash flows for the demonstration project.
This will include completion of all requirements for application for SIF Beta funding.
Final reports and other required details of the HyScale LOHC Alpha project will be uploaded to the Smarter Networks Portal. The HyScale consortium will host anMS Teams event to disseminate the learnings and key outputs of the project to a wider audience including UK DESNZ and all UK energy system licensees. Thiswill be in line with earlier HyScale dissemination meetings. The timelines of the project align with the All-Energy Conference due to be held in Glasgow during May2025. The conference will include sessions dedicated to hydrogen and energystorage making it an ideal opportunity to disseminate the project outputs to key industry stakeholders. Additionally, there are channels within SGN to share the findings with the wider business such as Lunch and Learns and various committees where presentations could be given.

Commercials

Intellectual property rights, procurement and contracting (not scored)

The project parties agree to adopt the default IPR arrangements for this project asset out in Section 9 of the SIF Governance Framework. All parties have adopted the default IPR arrangements for earlier HyScale projects under NIA, which have similar IPR arrangements to SIF. Hence all HyScale Consortium members are familiar with these default IPR arrangements.
The partners recognise that knowledge transfer is one of the key aims of the Strategic Innovation Fund, and that the benefits of this project will be maximised by the ability of other licensees to be able to learn from the project in order to reduce costs for consumers. The partners do not anticipate that the Alpha Phasewill result in the creation of IPR.
Subcontracting: FZJ is a research arm of the German federal government. Given this nature, solely for contractual purposes they will be a subcontractor toFramatome. However, they function as a core member of the HyScale LOHC consortium in practice and spirit. This is the same arrangement that was followed in the HyScale LOHC Phase 2 project, and we propose to continue this for the SIF Alpha stage.
There will be no major procurement activities (including Requests for Information)as part of the project with the plan being robust and well known from the outset.

Commercialisation, route to market and business as usual

HyScale Phase 1 concluded that the BT LOHC system is the most attractive solution for bulk hydrogen storage in areas of the UK without salt caverns. TheHyScale partners believe the proposed model provides a path to deploy long duration hydrogen storage at large scale for energy networks by 2030. LOHC's emerging technology status is particularly relevant here. The HyScale scale up roadmap involves a series of steps (5-10x scale up for each step) increasing the capacity and TRL of BT LOHC technology. Each step involves LOHC plants deployed to sites, ranging from industrial units to Strategic Independent Undertakings (SIUs). This roadmap ultimately leads to LOHC systems at a seasonal storage scale e.g., Isle of Wight/Aberdeen. At this point, the technology will be ready for commercial roll outs at scale.
Alongside this, HyScale establishes a LOHC hydrogen storage value chain and commercial model. The deployment of LOHC plants will require establishment ofowner/operators providing storage and release of hydrogen as a service connected and complimentary to the energy networks. Currently only the technology providers Framatome and Hydrogenious LOHC Technologies have experience in operations of LOHC demonstration plants. Framatome is a system integrator and operating LOHC plants is not its business focus. During Beta, BlueAbundance will gain experience operating the demonstration unit, establishing itself as the first UK operator of LOHC plants.
Funding Strategy
Realising the potential of hydrogen storage at bulk scale requires financial resources. Given the significant demand risk, business model support from UKDESNZ is crucial. To qualify, LOHC would need to increase TRL levels, a primary aim of the HyScale project. DESNZ funding support is provided toowner/operators of hydrogen storage systems and makes the business model investable.
During the HyScale LOHC project and the scale up roadmap, Blue Abundance will raise investment capital to expand its operations, people and financial resources. Blue Abundance's director has experience raising funding for clean tech ventures.Blue Abundance welcomes conversations with Ofgem/Innovate on business scale-up within the SIF program.
Maintaining competitive markets
The HyScale consortium has balanced the need for technical and engineering resources of BT LOHC technology, a rare commodity available only from a handful of entities, with ensuring a competitive long-term market open to several participants. HyScale monitors alternative hydrogen storage systems in WP6. The findings are disseminated publicly. All participants are free to use this knowledge to evaluate other hydrogen storage technologies.
FZJ is the leading research institution globally for BT LOHC systems and its involvement will accelerate the TRL of the technology for network end uses.
As the market expands, Framatome will invest in LOHC engineering and testing infrastructure to deliver LOHC systems to a variety of owner/operators in the UK and beyond, providing operational training during commissioning. The early learning gained by Blue Abundance in the Beta project will not be a barrier to entry for other participants. At the same time, the UK will establish an early lead with a home-grown owner/operator of BT LOHC systems.
DESNZ business model support will benefit all owner/operators, not just BlueAbundance, in time attracting other owner/operators to the sector. HyScale intends to support this process through its dissemination activities.
The HyScale LOHC value chain design inherently ensures competitive markets are established in the long term.
BAU adoption

Learnings from HyScale LOHC will be disseminated to all UK energy networks'hydrogen innovation teams for adoption in the design of future hydrogen infrastructure (ATR, electrolysers, hydrogen peaking plants, domestic and industrial hydrogen gas networks). The optimisation of combined production andLOHC storage capacities will deliver savings and lower energy bills for UK ratepayers.

Policy, standards and regulations (not scored)

Currently, SGN and the project team are confident that there are no regulatory, standards or policy barriers that could impact or hinder the delivery of the Alpha Phase, due to its desktop nature. However, if the trial of LOHC storage in the Beta Phase was to take place utilising live gas network infrastructure, an exemption to the Gas Safety (Management) Regulations (GSMR) would be required to allow volumes of hydrogen in excess of 0.1% to be transported through the network. Should the trial be located on an industrial partner site with hydrogen production and offtake, where no live gas network infrastructure was required, then a GSMR exemption would not be necessary.

For a future hydrogen gas network (and the subsequent addition of LOHC hydrogen storage to such a network) to become BAU for the gas networks, changes to GSMR to allow for the transportation of volumes in excess of 0.1%hydrogen would be required. However, LOHC hydrogen storage could still provide a critical service to industries seeking to decarbonise their own operations through hydrogen. As part of the HyScale Phase 2 project, health and safety regulations relevant to the planning and consenting and operation of the LOHC demonstrator were identified. In the Alpha Phase, this document will be updated to ensure that iti s still applicable, and all project partners are cognisant of the health and safety regulations and approved codes of practice that would apply to the HyScale LOHC demonstration.

Value for money

The HyScale Alpha Phase will constitute a design stage in which the CBA will be established by modelling LOHC storage, enabling flexible operation of electrolysers operating under energy price arbitrage to provide system services. Itis anticipated that the resulting reduction in energy costs and grid flexibility revenues will reduce LCOH, accelerating hydrogen uptake for large industrial offtakers, hydrogen peaking power generation and domestic heating. The project will allow informed decisions to be made about the magnitude of cost savings possible at the 100,000 homes scale, currently estimated to be in the order of tens of millions.

Our resource estimates balance a need for efficiency with the need for stakeholder confidence that the proposed capital spend on the demonstration project and testing plan are robust to demonstrate the technology of LOHCs and prove scalability on a commercial level.

All project resources are highly skilled with vast experience in the emerging LOHC field of work, with the majority being UK based.

Total Project Costs: £503,300
Total Contribution: £51,451 (10.2%)
Total SIF Funding requested: £451,849
SGN
Total Costs: £58,357
Contribution: £6,253 (10.7%)
SIF Funding requested: £52,104
Blue Abundance
Total Costs: £117,760
Contribution: £11,798 (10%)
SIF Funding requested: £105,962
ERM
Total Costs: £163,851
Contribution: £16,988 (10.4%)
SIF Funding requested: £146,863
Framatome
Total Costs: £98,078
Contribution: £9,832 (10%)
SIF Funding requested: £88,246
FZJ
Total Costs: £44,856
Contribution: £4,535 (10.1%)
SIF Funding requested: £40,321
Cadent

Total Costs: £4,890
Contribution: £489 (10%)
SIF Funding requested: £4,401
NGN
Total Costs: £10,872
Contribution: £1,092 (10%)
SIF Funding requested: £9,780
NGT
Total Costs: £3,220
Contribution: £322 (10%)
SIF Funding requested: £2,898
WWU
Total Costs: £1,416
Contribution: £142 (10%)
SIF Funding requested: £1,274
Blue Abundance, Framatome and FZJ have a strategic interest in the LOHC sector and take a long-term view of the HyScale LOHC projects. Framatome andFZJ will staff the project with several team members (up to eight), across multiple disciplines. The costs included in the project funding are only a portion of the actual costs incurred for these direct employees. Blue Abundance requires a single project director for Alpha and only charges his costs as a reflection of the work required independent of his overall experience.
In Alpha, ERM will be deeply involved in the CBA of the LOHC storage system.They possess the in-house models (ISDM, used for the European ClimateFoundation) and modelling skills to achieve this core focus to a very high standard. This is believed to be a cost-effective solution. Blue Abundance has had extensive discussions with ERM on the scope, roles and responsibilities and is confident in their ability to execute on the engagement. Their rate card is in line with market rates and prior projects undertaken.
The project team has the skills, prior knowledge, and stakeholder relationships to ensure this project can be delivered quickly, efficiently, and to quality. The costs are based on experience of running multiple similar scale projects. The partners are aware of the methodologies they will follow and are confident an efficient cost has been proposed.
The finances of all project partners are included in the milestones summary (/application/10131782/milestones-summary)
Compulsory Contribution: All project partners are contributing 10% of their budgeted costs, meeting Ofgem's compulsory contribution rate for SIF projects. All participants are providing a benefit in kind contribution by either investing 10% oftheir labour days, discounting their rate card by 10% or via internal funding to cover 10% of project costs.
SGN will lead this project within their overarching programs of work, ensuring delivery of value for money, managing costs, risk and time with the same robust governance and assurance that is used in any other project.
All these factors make this project extremely good value for money.

Associated Innovation Projects

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

Supporting documents

File Upload

SIF Alpha Round 3 Project Registration 2024-10-30 2_12 - 81.3 KB

Documents uploaded where applicable?

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