# SIF Alpha Round 2 Project Registration

### Date of Submission

Nov 2023

### Project Reference Number

10053641

## Initial Project Details

### Project Title

SIF Black Start Demonstrator from offshore wind (SIF BLADE)

### Project Contact

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### Challenge Area

Improving energy system resilience and robustness

### Strategy Theme

Net zero and the energy system transition

### Lead Sector

Electricity Transmission

### Other Related Sectors

Electricity Distribution

### Project Start Date

01/10/2023

### Project Duration (Months)

6

### Lead Funding Licensee

SPEN - SP Transmission Plc

### Funding Licensee(s)

SSEN-T - Scottish and Southern Electricity Networks Transmission

## Funding Mechanism

SIF Alpha - Round 2

## Collaborating Networks

Scottish and Southern Electricity Networks Transmission

## Technology Areas

Low Carbon Generation

Control Systems

Offshore Transmission

Electricity Transmission Networks

System Security

## Project Summary

SIF BLADE meets the aim of SIF Round 2 Challenge 3 – improving system resilience and robustness. SIF BLADE will increase the
UK's energy system robustness supporting efficient roll out of new infrastructure, by investigating and demonstrating how novel lowcost, low-carbon technologies can allow offshore wind farms (OWFs) to restore the onshore grid following a black out. Proving this
concept will enable accelerated roll out of OWFs to replace existing fossil fuel generators, whilst reducing any resilience issues that
this may cause.
Doing so requires significant network innovation. Innovation is required to:
· investigate and develop the ability of technology suppliers to provide the necessary novel equipment, by defining intelligent requirements for the equipment from the network perspective;
· develop a black start methodology of restoring the onshore network from offshore wind, including how the OWF can be energised;
how in turn the energised OWF can be used to energise the onshore network; and how the restoration can be spread throughout the
onshore network, all whilst maintaining robustness of the newly energised system;
· understand the business case and market needs for black start services from OWFs;
· understand the roles and responsibilities of a wide, cross-industry range of stakeholders, from transmission system operators (TSOs) to transmission owners (TOs) to OWF operators to technology suppliers.
Due to this cross-industry nature of the network innovation, SIF BLADE needs cooperation between network companies, generators
(OWF operators) and technical experts. The partnership brings together all these necessary stakeholders through SPEN, SSEN, NHVDCC, Strathclyde and Carbon Trust (representing the nine OWA developers, EnBW, Equinor, Ørsted, RWE, ScottishPower Renewables, Shell, SSE Renewables, TotalEnergies and Vattenfall), with NationGrid ESO (NGESO), Siemens Gamesa Renewable
Energy (SGRE), Siemens Energy (SE) and EDF Renewables (EDFR) as project advisers. These leading organisations will provide
an unparalleled consortium for the development of black start services from offshore wind.
Regarding users of the solutions developed in SIF BLADE:
· TOs will use the solutions to ensure their networks remain resilient whilst decarbonising, by being able to restore their networks from offshore wind;
· TSOs will use the solutions developed in SIF BLADE to create markets and procure restoration services in the future;

· OWF operators will use the solutions to provide restoration services to the offshore and onshore network, and hence enable more
wind capacity onto the network;
· ultimately, consumers will benefit from the solutions by having a more resilient, low-cost, low-carbon grid serving their needs.

## Add Preceding Project(s)

NIA2_NGESO047 - Distributed ReStart – Redhouse Live Trial

## Add Third Party Collaborator(s)

The Carbon Trust

University of Strathclyde

WSP UK Limited

## Project Budget

£576,720.00

## SIF Funding

£499,920.00

# Project Approaches and Desired Outcomes

## Problem statement

As the UK transitions to a higher penetration of low carbon generation, there is agrowing need for new sources of restoration services to be developed, asconventional high carbon sources of this capability will no longer be available.
SIF BLADE continues to meet the aim of SIF Round 2 Challenge 3 -- improvingsystem resilience and robustness. SIF BLADE will increase the UK's energysystem robustness supporting efficient roll out of new infrastructure, byinvestigating and demonstrating how novel low-cost, low-carbon technologies canallow offshore wind farms (OWFs) to restore the onshore grid following a blackout. Proving this concept will enable accelerated roll out of OWFs to replaceexisting fossil fuel generators, whilst reducing any resilience issues that this maycause.
In the Discovery Phase, our understanding of the problem has developed.Fundamentally, there is a classic "chicken-and-egg" problem, due to therestoration market for (offshore) wind being immature. This impacts the key usersof the innovation as follows:
1.
OWF developers -- a lack of clarity regarding potential revenues fromrestoration services is inhibiting their investment in restoration capabilities.
2.
Technology suppliers -- point 1 means that the technology suppliers are notbeing pushed by their customers (OWF developers) to invest in and developrestoration technologies.
3.
Transmission owners (TOs) -- point 2 means that the technical capability ofOWFs is unclear, bringing uncertainty as to how to ensure onshore networksremain resilient in a net-zero electricity system, and inhibiting investment insuitable complimentary upgrades to the onshore network to support restorationfrom OWFs.
4.
System operators (SOs) -- point 2 also means that system operators (SOs) arenot yet able to set clear requirements and market signals to OWF developers toprovide restoration services.
5.
Point 4 means that OWF developers do not have a clear business case toinvest (returning to point 1 above).

SIF BLADE will break this vicious cycle in a collaborative manner, giving clarity toall necessary parties (SOs, TOs, OWF developers, technology suppliers) on thetechnical and commercial requirements for restoration services from OWFs. Thisin turn will ensure the GB consumer (the ultimate user of this innovation) will havea low-cost, low-carbon solution to ensure system resiliency in the future.
Through Discovery, the project has evolved by identifying the most promisingtechnical restoration methodologies from OWFs. These will be assessed further inAlpha, with a view of demonstrating in Beta. These include solutions that can beretrofitted to OWFs, and solutions that must be designed-in before construction.
The project has also evolved by identifying the key commercial uncertainties.Restoration services are not binary: there are various ways OWFs can supportsystem restoration, of varying cost and capability. In Alpha, the project willinvestigate the cost to an OWF developer of providing varying levels of restorationservices and the benefit those various services will give to the energy system (i.e.SO and consumer).
Discovery has also identified the OFTO regime as a potential issue making thebusiness case for OWF developers unclear. Assets traditionally owned by anOFTO will need to be part of the restoration methodology, and it is currentlyunclear whether existing regulation will incentivise or allow OFTO assets to playsuch a role.
The project has also evolved by the addition of new partners. Ocean Winds isjoining as an additional OWF developer. TenneT is joining as an international SOto ensure the results of SIF BLADE have international applicability, which will helptechnology suppliers and OWF developers (which are global companies) toprovide restoration services in GB and abroad.
Other relevant network innovation projects:
INCENTIVE
Distributed Restart

## Innovation justification

SIF BLADE is applying to Innovation Challenge 3: Improving energy systemresilience and robustness, with a specific scope of strengthening UK's energysystem robustness to support efficient roll out of new infrastructure. SIF BLADEwill do so by investigating and demonstrating how novel low-cost, low-carbontechnologies can allow OWFs to restore the onshore grid

following a black out.Proving this concept will enable accelerated roll out of OWFs to replace existingfossil fuel generators, whilst reducing any resilience issues that this may cause.

Discovery Phase has highlighted the scale of the challenge in bringing restorationservices from OWFs to commercial reality. This challenge is not an incrementalinnovation; it is a step change in thinking and capability for OWFs, TOs and SOs.SIF BLADE needs to assess and demonstrate:
the technical requirements and capabilities of OWFs to provide restorationservices
the cost of providing these capabilities and the benefit they bring to the system
the business model (including market arrangements and how to work with theOFTO regime)
Alpha Phase will work towards addressing all of these aspects.
SIF BLADE is intentionally a large, collaborative, cross-industry initiative. We haveworked in the open by having a large consortium consisting of 10 OWFdevelopers, 2 networks, 2 technology suppliers and 1 SO. We have beencontacting potential additional partners in parallel and we have 1 additional OWFdeveloper and 1 additional SO joining for Alpha.
Regarding the technical state of the art, in 2020, a demonstration of black startwas carried out at Dersalloch onshore windfarm. In comparison to this SIFBLADE, is focused on offshore windfarms, which have different technicalchallenges (but also benefits) due to their size, location and voltage level. Further,Dersalloch trial relied on diesel generators, and SIF BLADE shall be investigatingalternatives to diesel generators.
Regarding the commercial state of the art, in 2022, ESO launched an electricityservice restoration tender for wind (including offshore). This is a commerciallysensitive tender, and the work ongoing is not available to share by ESO. FromDiscovery, we know some OWF developers have shown interest in this tender,and some have not. But all OWF developers are suffering from a lack of clarity inthe tender process: what are the requirements on OWFs and what will therevenues be. Without clarity, OWF developers are struggling to engage. SIFBLADE sits independent of and parallel to this tender process, to complement it bybuilding industry-wide understanding on the capabilities and potential costs-and-benefits of OWFs providing restoration services.
Currently, the solutions we are investigating are TRL 4; IRL 2; CRL 2. By the endof Alpha, we are aiming for TRL 5; IRL 2; CRL 4. By the end of Beta, we areaiming for TRL: 7; IRL 7; CRL 7.
The scale and ambition of this project is large. This is reflected by the ambitiousaims to enable a step change in capability of OWFs and onshore networks. It isalso reflected by the large cross-industry consortium. For these reasons, the workcannot be conducted elsewhere in the price control. It is a highly strategic, highlyinnovative project that fits well within SIF's structure.

Details on counterfactuals will be developed further in Alpha. However, otherpossible solutions to low-carbon restoration include smaller scale distributionsystem renewables (e.g. onshore wind and hydro). These have been studied inDistributed Restart and show potential, but suffer from not connecting to thetransmission system and only having small capacities. Offshore wind has thebenefit of large capacity and being transmission system connected.

## Impact and benefits (not scored)

Financial - future reductions in the cost of operating the network

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

Revenues - creation of new revenue streams

New to market – products

New to market – processes

New to market - services

## Impacts and benefits description

Financial - future reductions in the cost of operating the network AND cost savingsper annum on energy bills for consumers
Baseline: high-carbon assets dominate restoration market, but will need to beretired to meet net-zero goals, leaving a hole to be

filled by low-carbon assets.Some feasibility has been show for small-scale distributed renewable sources toprovide restoration services, but these suffer from being small capacity. ESOexpects that OWFs may need to provide ~24% of restoration services by 2050.
Benefit: The high-level CBA in the PMT indicates an NPV of ~£200M at a costof ~£144M to have 24% of GB system restoration services provided by OWFs.At this stage, there are several assumptions behind these figures, and moredetailed CBA will be conducted in Alpha. SIF BLADE will accelerate and enableOWFs to provide restoration services, thus allowing ESO's future restorationpredictions to be met. If SIF BLADE proves OWFs cannot provide restorationservices, then this is a key data point to ESO to make other resiliency plansurgently. See Appendix Q3 for more information in this regard.
Metrics: quantify (£) costs and benefits of OWFs providing restoration services.
Environmental - carbon reduction -- direct CO2 savings per annum
Baseline: high-carbon assets dominate restoration market.

Benefit: SIF BLADE will accelerate and enable OWFs to provide restorationservices, thus offering ESO an alternative source of restoration that is lowcarbon, which will allow ESO to cease procuring high-carbon assets forrestoration.
Metrics: quantify (weight of CO2) benefits of OWFs providing restorationservices.
Revenues - improved access to revenues for users of network services ANDcreation of new revenue streams
Baseline: Currently zero windfarms (onshore or offshore) provide restorationservices, and hence zero windfarms gain revenues from restoration servicecontracts with ESO. ESO has launched an electricity system restoration tenderfor wind. However, from consultations in Discovery, many OWF developers donot feel able to participate due to lack of clarity around technical requirementsand potential revenues. It is unclear how successful that tender will be due tomarket and technology immaturity.
Benefit: SIF BLADE will create industry-wide understanding on the technicalrequirements for windfarms to provide black start, the technology specificationsthat will enable OWFs to meet those requirements, the cost of those technologyspecifications, and the potential revenue achievable by providing restorationservices. This in turn will give clarity to all parties. It will allow ESO to setsuitable markets and allow OWF developers to gain revenues from ESO forrestoration services.
Metrics: increased number of participants in future ESO restoration windtenders; (world) first restoration contract awarded to one or more OWFs.
New to market -- products
Baseline: Currently commercially implemented wind turbines do not self-start(they are started by energy from the grid). Also, they are not able to support orgrow an energy island (they rely on exporting energy to a strong, alreadyexisting grid).
Benefit: SIF BLADE is seeking to accelerate self-starting wind turbines tomarket. These can start without external energy sources, by having batterieswithin them. SIF BLADE is also seeking to accelerate wind turbines to marketthat can create and support small energy islands in the energy network ("gridforming" turbines), which do not need to rely on a strong national grid.
Metrics: first self-starting and grid forming turbines installed offshore.
New to market -- services
Baseline: OWFs do not provide restoration services.
Benefit: SIF BLADE is seeking to demonstrate the world's first OWF providingrestoration services, which will allow for such capability to become BAU.
Metrics: first OWF with restoration capability, followed by BAU roll-out nationallyand internationally.

## Teams and resources

The core project partnership will remain the same as Discovery Phase:
SP Transmission (SPEN) -- has a strong need for novel restoration solutionsfrom renewables, and has been involved in the Dersalloch and DistributedRestart projects. SPEN will be responsible for the overall delivery of Alpha, andcontribute in particular to the network restoration modelling studies.
SHE Transmission (SSEN) -- has strong interest in learning the potential ofOWFs to provide restoration services. SSEN will be reviewing the outputs ofAlpha to see how OWF restoration services would impact its Local JointRestoration Plan.
National HVDC Centre (NHVDCC) -- has the need to understand how OWFscan restore the future coordinated offshore network under the Holistic NetworkDesign. In Alpha, NHVDCC will be using its modelling expertise andunderstanding of the coordinated offshore network to investigate theopportunities the coordinated offshore network may bring to onshore systemrestoration.
University of Strathclyde (Strathclyde) -- has conducted a large body of previousstudies in the field of restoration services and has close relationships withSPEN and wind technology suppliers. In Alpha, Strathclyde will be leading themodelling and testing of OWF design scenarios that are capable of systemrestoration.
Carbon Trust -- through its Offshore Wind Accelerator (OWA) programme, hasconducted numerous previous studies on restoration from OWFs. Carbon Trustwill manage the project, particularly the engagement with the OWF developersand Advisory Panel, and will lead on the commercial assessment.
Through Carbon Trust's role as coordinator of the (OWA) programme, CarbonTrust is bringing into the partnership a group of OWF developers that representthe majority of UK and global offshore wind developments (excluding China).These are EDF,

EnBW, Equinor, Ocean Winds, Ørsted, RWE, ScottishPowerRenewables, Shell, SSE Renewables (SSER), TotalEnergies, Vattenfall.
Ocean Winds is an additional OWF developer compared to the DiscoveryPhase, indicating the growing interest in this project from the industry.
Of these OWF developers, Ørsted, Shell and SSER will be "Project Champions".
Project Champions will contribute greater resources to the project and activelyseek demonstration sites. They will work with Strathclyde and SPEN to build theOWF design scenarios for modelling.
SSER is an additional Project Champion compared to the Discovery Phase,indicating the growing interest in this project from the industry.

The project also has an Advisory Panel consisting of technology suppliers(Siemens Energy and Siemens Gamesa) and SOs (National Grid (NGESO) andTenneT).
The Advisory Panel will provide input (e.g. on future technical capabilities ormarket arrangements) and review the outputs of the project.
TenneT is an additional member of the Advisory Panel compared to theDiscovery Phase, indicating the growing interest in this project from the industry.SIF BLADE is keen to include international SOs to ensure SO requirements onOWFs are aligned internationally, to prevent additional costs which would becaused by varying requirements internationally.
In addition to the Discovery Phase, Carbon Trust will subcontract work to aTechnical Delivery Contractor to assist with the Alpha cost-benefit analysis (CBA),as none of the project partners is best suited to do so. We have identified andspoken with possible contractors. They will be formally selected before Alpha kicksoff.
Regarding equipment, in Alpha, modelling studies will take place. The partnershiphas all equipment needed to perform this work.
Regarding necessary external parties, in Alpha Phase, it will be key to engagewith and receive input from DESNZ, Ofgem and OFTOs regarding the OFTOregime and how OFTOs will be impacted by OWFs providing restoration services.This engagement is included in the Alpha scope.

# Project Plans and Milestones

## Project management and delivery

SIF BLADE Alpha phase has been designed as a feasibility study (both technicaland commercial) for an OWF to provide restoration services. Details can be foundin the attached Project Management Template.
The main work packages (WP) of the project include:
WP1: Technical assessment of onshore system restoration from offshorewind
Leads: Strathclyde and SPEN
This WP aims to understand the feasibility of various restoration methodologiesfor OWFs to restore the onshore network. As part of this, the WP will investigatethe needs of the onshore network; the requirements for the OWF to meet theseneeds; the OWF design scenarios able to meet these requirements; and theperformance of the OWF design scenarios to restore the network.
WP2: Commercial assessment of onshore system restoration from offshorewind

Leads: Carbon Trust
This WP will investigate the economic benefit to the energy system (and henceconsumer) of restoration services from OWFs. This will give a signal todevelopers regarding the potential commercial value of restoration servicesfrom OWFs. This WP will identify specific regulatory or market barriers thatinhibit or prevent the business case (such as the OFTO regime).
This WP is dependent on WP1 -- the OWF design scenarios developed in WP1will feed into WP2 to assess the cost and benefits of the OWF designsscenarios.
WP3: Technical assessment of onshore system restoration from coordinateoffshore network
Lead: NHVDCC
This WP will investigate the concept of restoring the onshore system fromOWFs via the future coordinated offshore network.
This WP is dependent on WP1 -- the restoration capabilities of the OWF designscenarios of WP1 need to be fed into WP3 such that they can be studied in thecontext of the coordinated offshore network.
WP4: Beta Phase scoping
Leads: SPEN and Carbon Trust
This WP will define what further work is needed to bring restoration servicesfrom OWFs to commercial reality and should understand what further work ispractically feasible and the best mechanisms for achieving that work.
The key output of this WP is the development of a scope for the Beta Phase.
This WP is dependent on the outputs of WP1, 2 and 3. In the project plan, thereis therefore a key stage gate (or milestone) to complete WP1, 2 and 3 prior tocompleting WP4.
WP5: Project
coordination and management
Leads: SPEN and Carbon Trust
A large consortium has been formed to deliver the work over a short timeframe.WP5 will ensure the effective and efficient running of the Alpha phase. This WPwill enable the delivery of the project on time and budget.In line with bestpractice for innovation projects
an agile approach to project management will be taken, to ensure that theproject continuously adapts based on live outputs from the WPs to best meet itsoverall aims
a risk assessment will be continuously updated -- risks will be identified,assessed and mitigated
a background IP register will be implemented to ensure clarity around what hasbeen shared with the project and under what conditions
The risk assessment is part of the PMT. SIF BLADE is taking a proactive approachto risk management and has included regular risk reviews within its plan.

In Alpha, the technical work will all be conducted through simulations. So in Alpha,there are no plans to demonstrate the feasibility of this technology on the physicalnetwork, therefore no interruptions should be expected for customers. However,this issue shall be considered in Alpha when scoping Beta, which may have sometemporary impact on consumer supplies local to the demonstration site.

## Key outputs and dissemination

The overall aim of the SIF BLADE project is to enable OWFs to support therestoration of the onshore networks, by building understanding and consensus onthe changes required to OWF and onshore network technical specification, andthe changes required to SO procurement strategies for restoration services.

Regarding the Alpha Phase in particular, the key outputs are:
WP1 -- an understanding of the technical feasibility of various OWF designscenarios to provide restoration services: what level of service can variousOWF design scenarios provide; how does this service improve onshore gridrestoration time; what are the implications on OWF and onshore networkdesign? Responsible: SPEN and Strathclyde
WP2 -- an understanding the future commercial landscape for OWFs providingrestoration services: what are the cost implications of the various OWF designscenarios of WP1 (vs a BAU OWF); what benefits do the various OWF designscenarios of WP1 provide the system (vs a suitable system counterfactual, withno restoration from OWFs); how do the costs compare with the benefits; arethere any regulatory barriers to address (e.g. OFTO regime) and how shouldthey be addressed? Responsible: Carbon Trust
WP3 -- an understanding of the technical feasibility of restoring the onshoresystem from OWFs via the coordinated offshore network. Responsible:NHVDCC
WP4 -- an understanding of what further work is required, and a scope of suchfurther work. Responsible: SPEN and Carbon Trust
Regarding dissemination, the large (20-strong) consortium already contains manyof the key stakeholders in the industry, who will be reviewing and inputting into theproject. All of these parties have shown excellent engagement in the DiscoveryPhase. They will all get access to the Alpha Phase deliverables. Most notably, theOWF developers, the technology suppliers and the SOs in the project are keystakeholders to achieve industry-wide dissemination, and we will continue to seek additional OWF developers, technology suppliers and international SOs to theconsortium.
In the project plan, as part of WP5, a dissemination strategy will be developed toshare the relevant outcomes more widely than the consortium. This will involveattending all SIF dissemination events, but also seeking additional opportunitiessuch as relevant industry conferences and papers once we have findings todisseminate (toward the end of Alpha is most likely). We will also host a projectwebpage on the Carbon Trust website and make online press release / socialmedia posts to publicise the Alpha Phase if funded.

# Commercials

## Intellectual property rights, procurement and contracting (not scored)

At thetime of drafting this application we are unable to provide specific pieces ofBackground IPR and Foreground IPR that we would request to be exempt fromthe default treatment as we are still in talks with third parties. However, anexplanation of the situation is provided below.
SIF-BLADE will greatly benefit from input from technology suppliers and OWFdevelopers. This input could involve provision of models, data, or otherinformation. Due to the innovative nature of the technologies in question, andcommercial sensitivities in relation to their operation, it is likely that at least someof the inputs and outputs will be necessarily confidential, meaning that theseinputs and outputs cannot be fully shared with all project partners or anyoneoutside the SIF BLADE project.
We will continue to work with technology suppliers and OWF developers prior toAlpha kick-off and during Alpha to set up these arrangements in good time toenable receipt of their inputs when required.
SIF BLADE Alpha Phase will use an IP register to track the Background IPR, theForeground IPR, and the use and access rights to all this IP. The main contractgoverning the project (the Consortium Agreement) will include detailed, mutuallyagreed terms governing IP that are in line with the SIF Governance Document.
As with Discovery Phase, it is proposed that, for expediency, Carbon Trust willsign the project's Consortium Agreement as the representative of the OWAprogramme to bind the 11 OWF developers to SIF BLADE. With this contracting arrangement, we would expect the OWF developers to have access toBackground and Foreground IPR like any other project partner.
As with Discovery Phase, Alpha will also include an Advisory Panel of keystakeholders (NGESO, TenneT, Siemens Energy, Siemens Gamesa) who maywish to become Project Partners in future. We intend to make all FIP available tothe Advisory Panel.
SIF BLADE may benefit from information exchange with a few additional projects,such as RWTH Aachen's "HVDC BLADE" project. We may seek a collaborationagreement to share FIP between SIF BLADE and HVDC BLADE under NDA.
For the role of Technical Delivery Contractor (who will assist Carbon Trust withWP2), we will formalise who the subcontractor will be prior to kick off. Twocandidates have been identified in the Discovery Phase as having suitableexperience to conduct the CBA of WP2. Carbon Trust has contacted both of theseparties in the Discovery Phase and will procure one of these two as itssubcontractor prior to Alpha kick-off.

## Commercialisation, route to market and business as usual

Commercialisation is at the core of the SIF BLADE project. In particular, SIFBLADE aims to ensure a healthy, competitive restoration market for ESO toprocure future low-carbon restoration services.
Regarding the commercial readiness of the project partners, the OWF developersare highly interested and motivated to participate in system restoration, providedthere are suitable and clear markets available. Currently, however, such marketsare not available.
Discovery Phase has shown that the adoption of restoration services from OWFsas BAU will be reliant on appropriate market creation to incentivise OWFdevelopers and technology suppliers to invest in technology with suitablecapabilities to provide restoration services.
To achieve this, ESO must set achievable requirements on OWFs providingrestoration services. And OWF developers need to know how to meet thoserequirements with technical OWF upgrades, how much it will cost to do so, andwhether the market value of their restoration services will outweigh those costs.
However, none of these aspects is presently known. This uncertainty is hinderingcommercialisation currently. SIF BLADE is absolutely focussed on addressingthese key aspects and to drive restoration from OWFs to market.

Commercialisation plan
Alpha Phase - demonstrate technical feasibility; understand commercialfeasibility (CBA); understand outstanding risks and barriers (technical andcommercial). If Alpha Phase finds no feasibility, cease work (unlikely). If AlphaPhase finds feasibility with no further barriers, cease work (solutions willbecome BAU without SIF BLADE) (unlikely). If Alpha Phase finds feasibility, butwith outstanding risks and barriers, then continue to Beta Phase.
Beta Phase - conduct further technical de-risking (e.g. scaled / real-scaledemonstration); create suitable business models (including recommendations tomarkets and regulations); present evidence to ESO and Ofgem to make anyrecommended changes in approach.
After SIF BLADE -- once market and regulations have been informed by what istechnically feasible, rely on ESO and Ofgem to make the necessary changes toallow OWFs to participate fully in restoration markets.
SIF BLADE is also engaging international SOs to make sure market requirementsare aligned internationally, which will reduce

costs for OWF developers andtechnology suppliers, and hence reduce costs for all SOs and hence allconsumers (including GB consumers).
SIF BLADE will not undermine competitive markets; rather, it will promote newcompetitive markets for restoration services. Upskilling the broad consortium ofOWF developers will enable more participants in future system restorationmarkets, which will increase competitiveness of those markets.
SPEN has involved a senior sponsor, the Head of Transmission, in this project.This shows SPEN's commitment and strong interest in this project. SPEN has anobligation to its customers to run a resilient and robust network and sees SIFBLADE as a project of key strategic importance, with an unparalleled consortiumof OWF developers, to unlock restoration services from offshore wind.

## Policy, standards and regulations (not scored)

We currently do not consider there to be any definitive regulatory barrier toimplementing restoration service provision from offshore wind. However,Discovery Phase has found that there are potential issues in market requirementsand regulation that may require clarification or derogation. These will be exploredfurther in Alpha.
Regarding market requirements, it is likely that new market requirements forrestoration services will need to be set by ESO to enable the uptake of restorationservices from OWFs. This is due to the long-term contracts for restoration serviceprovision, with high availability of service (90%). The Discovery Phase has foundthat these requirements may not be achievable for OWFs, and therefore shorter-term contracts may be required, potentially with lower availability expectations, toaccount for the inherent variability of wind power depending on meteorologicalconditions. Our aim is for SIF BLADE to be an evidence base for ESO to setappropriate market requirements. WP1 will be investigating the technical capabilityof OWFs to provide restoration services, and hence provide evidence as to whatsuitable ESO market requirements might be.
Regarding regulation, the role of the OFTO in the restoration methodology, andwhether current regulation allows for such a role, needs to be examined. This willform part of WP2 of the Alpha Phase. For instance, the restoration methodologymay (or may not) require assets that typically belong to an OFTO to containstorage, which would not be allowed by current regulation.
An additional potential future market barrier is that international SOs may createvarying (non-standard) requirements for restoration services from OWFs. Thiswould mean OWF developers and technology suppliers would need to providedifferent capabilities (underpinned by different technologies) per country. Thiswould increase the technology suppliers' costs and hence increase the costs toOWF developers, and hence the cost to SOs (and ultimately consumers) forprocuring restoration services. SIF BLADE is addressing this through engagementwith international SOs to ensure that requirements on technologies are kept asstreamlined as possible across borders. This will ultimately help to reduce the costfor GB consumers.
In terms of HSE, GSMR and ESMR standards, none of these have been identifiedas of concern to Alpha Phase and compliance with these will not be a barrier tothe project.
At the current stage, SPEN does not consider there to be a possibility that anyfuture Project Phase will require a derogation or exemption from any Projectrelated regulatory requirements, either as a known requirement or as acontingency.

## Value for money

The total project cost for Alpha phase is £576,720.
The project is requesting £499,920 of funding (87% of the total cost), with theremaining £76,800 (13% of the total cost) being provided by project partners. Inaddition to this, there is £134,300 of in-kind contribution. Including the in-kindcontribution, the SIF Contribution is 70%.
This level of funding will lead to outcomes that provide value to the consumer.Alpha Phase will prove the feasibility of restoration from OWFs. Further, Alpha Phase will financially define the benefits of restoration from OWFs to the GBconsumer.
The high-level CBA in the PMT shows positive NPV for offshore wind restorationservices. Further, from the Discovery Phase, it was postulated that the furtherinvestigation into restoration services from OWFs in SIF BLADE Alpha Phaseshould provide a "no regret" investment from Ofgem / the GB consumer. Pleasesee the appendix to Q3 for more detail. However, in essence, if SIF BLADE AlphaPhase shows technical and commercial feasibility, and shows that restoration fromOWFs is necessary for a net-zero electricity system, then the return to the GBconsumer will be significant. However, even if we show there is currently nofeasibility or that restoration from OWFs is not required, then this is highly valuableinformation to the GB consumer as alternative restoration sources will be urgentlyrequired.
The SIF programme is the ideal mechanism to bring together the necessarystakeholders (TOs, SOs, OWF developers, and technology suppliers) tocollaboratively innovate in this space, with the required expertise to ensure themost successful project possible.
The £76,800 (13%) of the total cost that is being contributed to the project is morethan the minimum 10% compulsory contribution giving excellent leverage of SIFfunds.
The Carbon Trust is contributing £66,000 to the project. This comes from theCarbon Trust's Offshore Wind Accelerator

programme.
SPEN is contributing £10,800 to the project.
Regarding in-kind contributions of human resource, Ørsted, Shell and SSER asProject Champions are each contributing £20,000 of time.
The other OWF developer partners are contributing £50,000 in total.
The Advisory Panel is contributing £24,300 in total.
This allocation of technical expertise reflects the commitment to SIF BLADE andhighlights the importance of the research subject.
Regarding facilities, all work will be carried out pre-existing facilities (i.e. SPEN,Strathclyde and NHVDCC's simulation software and hardware).
Prior to kick off, Carbon Trust will procure a subcontractor to assist the delivery ofWP2, in particular to perform the detailed CBA work of WP2. The cost of this willbe £50,000. This is critical to the project as none of the project partners is bestplaced to perform this important work. Two possible subcontractors have beenidentified in the Discovery Phase who have strong experience in this field.

Carbon Trust will pay Siemens Gamesa £10,000 and Siemens Energy £15,300 fortheir role on the Advisory Panel. (The other Advisory Panel members arecontributing their time in-kind.) As leading wind and grid technologymanufacturers, their input in the project is critical to understanding the futuretechnologies available for restoration services.
It should be noted that the OWF developers and technology suppliers present inthe consortium are multinational organisations. Their experts, who will work on SIFBLADE, sit in many different locations globally and may be employed by non-UKentities. However, all such partners have a strong interest in developingrestoration services and OWFs in the UK.

## Associated Innovation Projects

- ○ Yes (Please remember to upload all required documentation)
- ◉ No

## Supporting documents

### File Upload

SIF_BLADE_Show&Tell_v1(f)_20240423.pdf - 1.2 MB
SIF Alpha Round 2 Project Registration 2023-11-13 10_20 - 80.5 KB

### Documents uploaded where applicable?

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