SP Energy Networks

SIF Beta Round 2 Project Registration

Date of Submission

Nov 2024

Project Reference Number

SIF_BLADE_Beta

Initial Project Details

Project Title

SIF Black Start Demonstration from Offshore Wind (SIF BLADE)

Project Contact

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Challenge Area

Preparing for a net zero power system

Strategy Theme

Net zero and the energy system transition

Lead Sector

Electricity Transmission

Other related sectors (not required)

Electricity Transmission

Project Start Date

01/09/2024

Project Duration (Months)

37

Lead Funding Licensee

SPEN-T - SP Energy Networks Transmission

Funding Mechanism

SIF Beta - Round 2

Collaborating Networks

Scottish and Southern Electricity Networks Transmission

Technology Areas

Electricity Transmission Networks

Project Summary

Enabling a low-cost net-zero GB electricity network that is robust and secure, by demonstrating how novel technology can enable offshore wind farms to restore the onshore grid following a black out. Building on this, optimal market requirements and standard technical specifications will be developed to enable rapid commercial roll-out of this novel technology.

The overarching aim of the Black Start Demonstration from Offshore Wind (SIF BLADE) project is to bring electricity system restoration from offshore wind to commercial reality by building the necessary cross-industry understanding including onshore transmission network owners, transmission system operators, offshore wind farm operators, and technology suppliers.

Project Budget

£5,454,276.00

SIF Funding

£4,850,905.00

Project Approaches and Desired Outcomes

Solution statement and solution focus

Problem evolution

It is critical to national security, the economy and energy consumers that the transmission network is restorable in the event of a shutdown or "black out". Reflecting this, the Electricity System Restoration Standard (ESRS) sets a legally binding obligation to ensure the system is restorable within set timeframes.

It is also critical to legally binding climate commitments that the energy system decarbonises. Reflecting this, the ESO has developed Future Energy Scenarios (FES) as a guide for the energy transition.

Alpha has identified the problem that, without restoration services from offshore wind farms (OWFs), the FES will not meet the ESRS.

There is a 100 GW pipeline of offshore wind farms (OWFs) in the UK, which is currently being designed by OWF developers, with a target of 50 GW built by 2030. Alpha has found that, in order for the network to be restorable, every offshore wind farm (OWF) built after ~2028 will need to have restoration-capability designed in before it is constructed (Alpha has found that retrofit may be technically impossible, or at least prohibitively expensive).

Therefore, there is great urgency that OWFs being designed today -- and to be built in the coming years -- are specified to be restoration capable.

User needs

Alpha has shown preliminary feasibility that OWFs can provide the necessary restoration services. However, Alpha has also found that there are many industry-wide problems that need to be overcome in order for this to happen.

- **GB consumers / UK government -** Need to transition to net-zero, whilst maintaining a robust system at minimal cost.
- **System operators (SOs) -** Need to understand what services OWFs can provide during restoration, and what market signals are necessary to incentivise this.
- **Transmission network owners (TOs) -** Need to understand what OWFs will provide their networks during restoration, how this impacts their local restoration methodologies, and how to integrate this in their control room.
- **OWF developers -** Need to understand what is required from the grid during restoration, need confidence in novel technologies from the supply chain, and need workable market signals to justify investment.
- **Technology suppliers (OEMs) -** Need detail on the technical requirements for their products, and how they will interact with other components on the system during restoration.

Solution evolution

The proposed solution is to address all these user needs by developing a whole-system, integrated, net-zero-compatible restoration methodology that utilises contributions from OWFs and proving its feasibility. This will be achieved by conducting site-specific detailed technical feasibility studies to develop the necessary cross-industry technical understanding: from OEMs to OWF developers, to TOs, to SOs. Following the feasibility studies, a lab-based demonstration will be conducted to prove the methodology. Building on the technical de-risking, standard specifications, tools and market proposals will be developed and disseminated to ensure rapid up-take of the findings across the industry.

This proposed solution meets Innovation Challenge 2: Preparing for a net zero power system. A key element of preparing for a net zero power system is to ensure it remains restorable following a system collapse. However, it also touches on Innovation Challenge 3: improving energy system resilience and robustness.

Relevant projects

Distributed Restart (NIC) - developed small-scale, distribution-level, net-zero-compatible restoration.
INCENTIVE (SIF) - demonstrating how OWFs can provide stability to onshore networks. Such stability provision will be one of many key considerations during restoration.
HVDC BLADE (German government funding) - demonstrated how the HVDC connection of a radially HVDC-connected OWF

can be configured to enable the OWF to provide restoration service. This did not investigate how the OWF itself would provide restoration - this was taken as an assumption.

Innovation justification

Innovation justification

The project meets "Innovation Challenge 2: preparing for a net zero power system", and the specific scope requirement "accessing grid/system support from novel supply and demand side sources". Beta will be ambitious and impactful and focus on a key challenge in the energy transition: how to deploy renewable technologies such that they support the system, rather than weaken it. Alpha found (see question 3) that, without OWs contributing to restoration, there is a real risk that the energy transition will be stalled. Restoration is therefore an essential element of preparing for a net zero power system. Beta meets the partnership requirements through the Carbon Trust's Offshore Wind Accelerator (OWA) programme, whereby 10 OWF developers (generators), representing the majority of the global offshore wind industry, will participate in the project. The project is also linked to Innovation Challenge 3 but is applying under Innovation Challenge 2.

The state of the art is to rely on large synchronous generators to provide restoration services. These are large, reliable generation sources; however, the number of such assets in the system is reducing. The Distributed Restart and Dersalloch innovation projects have shown the potential for small scale onshore renewables to contribute to system restoration. However, this is not yet done in practice, and will have limited benefits compared to large-scale OWFs.

From Alpha, we have learned that restoration from OWFs is technically feasible; however, there is a range of possible contributions from OWFs to system restoration, with varying maturity and risk levels. We have also learned that the currently proposed market - to incentivise OWF developers to install restoration capability - is not sufficiently clear technically or commercially to enable OWF developers to participate.

To address these issues, Beta will conduct network innovation in two key areas: technical feasibility (including developing standard specifications for OWFs and networks) and commercial feasibility (including understanding the costs and proposing evolved market requirements). The project requires an integrated approach to network innovation, whereby TOs, OWF developers and OEMs must innovate collaboratively to produce the integrated restoration methodology. Working with such low-maturity solutions with a large consortium of OWF developers, OEMs and research partners cannot be funded elsewhere in the price control, with SIF being the ideal mechanism.

Alpha has identified a number of solution options:

- "Grid forming" (GFM) batteries (BESS) onshore in combination with BAU "grid following" (GFL) turbines. These individual technologies are all available on the market today, and the innovation in Beta will be to integrate them such they contribute to system restoration. Current status: TRL 5-9; IRL 2; CRL 3. End of Beta: TRL 7-9; IRL 7; CRL 7.
- Self-starting GM turbines. This technology is not available on the market today but is under development by OEMs. Beta will accelerate these enabling technologies to market. Current status: TRL 2-4; IRL 2; CRL 3. End of Beta: TRL 4-6; IRL 6; CRL 7.

Other options for Beta were considered, most notably conducting a large-scale physical demonstration. This has not been selected as solutions are not ready. It is better to focus on building detailed understanding of feasibility in Beta, such that physical implementation can occur in BAU following Beta. Beta encompasses the necessary steps to reach this point.

In Alpha, the project worked in the open through its large, international consortium, which represents the majority of the industry. This consortium is key to ensure challenge of the work. It is also key to dissemination and rapid, industry-wide uptake of the results. In Beta, we are continuing with the large consortium, and adding more OEMs in Advisory Panel.

Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Environmental - carbon reduction – direct CO_2 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 - services

Impacts and benefits description

Financial - future reductions in the cost of operating the network and cost savings per annum on energy bills for consumers:

- Baseline: high-carbon assets dominate restoration market but will need to be retired to meet net-zero goals. Alpha has shown this will be an issue for system restoration, which must be filled either by OWFs or additional low-carbon thermal generation. Corroborating this Alpha finding, in the FES, ESO expects that OWFs may need to provide ~24% of restoration services by 2050 (source: Distributed Restart Closedown Event, 2023: https://www.nationalgrideso.com/document/272746/download).
- Benefit: Alpha has shown that the expected ("medium confidence" in the CBA template attached) benefit of having OWFs contributing to restoration (instead of additional low-carbon thermal generation) is £0.9-1.6bn until 2050. The variation between £0.9bn and £1.6bn arises due to the variation in possible restoration capabilities of future OWFs ("option 1" and "option 2" in the CBA template attached). Even the "medium confidence" figures have been calculated based on conservative cost estimates. Given Beta's funding request of £4.8m, this gives the project a 12-year payback period. See Alpha Deliverable 2.1 and attached CBA for more details.
- 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 OWs to provide restoration services, thus offering a proven alternative source of restoration that is low carbon. Quantitative analysis has not been conducted in Alpha but will in Beta.
- Metrics: quantify (weight of CO2) benefits of OWFs providing restoration services.

Revenues - improved access to revenues for users of network services and creation of new revenue streams:

- Baseline: Currently zero windfarms (onshore or offshore) provide restoration services, and hence zero windfarms gain revenues from restoration service contracts with ESO. ESO has launched an electricity system restoration tender for wind. However, from consultations in Alpha, many OWF developers do not feel able to participate due to lack of clarity around technical requirements and potential revenues. It is unclear how successful that tender will be due to market and technology immaturity.
- Benefit: Beta will create industry-wide understanding on the technical requirements for windfarms to provide restoration, the technology specifications that will enable OWFs to meet those requirements, the cost of those technology specifications, and the potential revenue achievable by providing restoration services. This in turn will give clarity to all parties. It will allow ESO to evolve its market and allow OWF developers to gain revenues from ESO for restoration services.
- Metrics: increased number of participants in future ESO restoration wind tenders; (world) first restoration contract awarded to one or more OWFs; international SOs following the UK to create restoration wind tender.

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 or grow an energy island (they rely on exporting energy to a strong, already existing grid).
- Benefit: Beta will accelerate self-starting GFM wind turbines to market.
- Metrics: first self-starting and grid forming turbines installed offshore.

New to market - services:

- Baseline: OWFs do not provide restoration services.
- Benefit: Beta will accelerate the uptake of restoration capability in OWFs, and push this to become BAU.
- Metrics: first OWF with restoration capability, followed by BAU roll-out nationally and internationally.

Teams and resources

Core partnership:

- SP Transmission (SPEN) -- has a strong need for novel restoration solutions from renewables in its network area and has been involved in the Dersalloch and Distributed Restart projects. SPEN will be responsible for the overall delivery of Beta. SPEN will contribute in particular to the detailed site-specific restoration study at the Branxton location of the SPEN network.
- SSEN Transmission (SSEN) -- has strong interest in learning the potential of OWFs to supplement the hydro power restoration

sources within its network area. SSEN will contribute in particular to the detailed site-specific restoration study at the Peterhead location of the SSEN network.

- National HVDC Centre (NHVDCC) -- NHVDCC is experienced in detailed electrical studies, particularly with regard to the future coordinated network. The NHVDCC will lead the translation of the findings from the Branxton and Peterhead studies to develop technical specifications for the future offshore meshed HVDC network to be restoration capable.
- University of Strathclyde (Strathclyde) - has conducted a large body of previous studies in the field of restoration services and has close relationships with SPEN and OEMs. In Beta, Strathclyde will assist with detailed modelling and electrical studies.
- TNEI -- is an additional partner for Beta. TNEI will build on its work in Distributed Restart and Alpha to be responsible for the CBA and market proposals.
- Carbon Trust -- through its Offshore Wind Accelerator (OWA) programme, it has conducted numerous previous studies on the restoration from OWFs. Carbon Trust will manage the project, particularly engagement with the OWF developers and Advisory Panel, and will lead on the regulatory assessment.

Through Carbon Trusts role as coordinator of the (OWA) programme, Carbon Trust is bringing into the partnership a group of OWF developers that represent the majority of UK and global offshore wind developments (excluding China). These are bp, EnBW, Equinor, Orsted, RWE, ScottishPower Renewables, Shell, SSE Renewables (SSER), TotalEnergies, Vattenfall. EDF has left the consortium due to resource constraints. Ocean Winds is still seeking internal approval for Beta. bp is a new partner for Beta.

Of these OWF developers, Orsted and SSER will be "Project Champions". SSER's engineering team will support a feasibility study in collaboration with SPEN for offshore wind farm connections in the SPEN network area. Orsted is developing an OWF due to connect at Peterhead on SSEN's network, which will be another case study in Beta.

The project also has an Advisory Panel, with the following OEMs. Siemens Energy and Siemens Gamesa (from Alpha), and now with additional OEMs GE-Vernova (grid and wind) and Ingeteam. These companies will provide input to the feasibility studies regarding technical capability of their future technologies and provide indications regarding costs.

The Advisory Panel also includes SOs: NGESO and TenneT (from Alpha), and now with the addition of RTE. These organisations will learn from SIF BLADE, using the information to help evolve or set up their wind restoration markets, and ensuring these are standardised across borders as much as possible.

The project will procure work from a Technical Consultant and one or more OEMs. The Technical Consultant is required to deliver the coordinated electrical studies between Branxton and Peterhead. Giving this to an independent party will enable confidential information sharing more easily and ensure an organisation with the right expertise is delivering the work. The OEMs will be contracted as and when necessary to develop and provide innovative control systems to the feasibility study. The Project Plan includes dedicated time to procure these roles after Beta kick-off.

Regarding equipment and facilities, the partnership has all it needs to perform the work. There are no additional third parties envisaged being required.

Project Plans and Milestones

Project management and delivery

Details of the project plan are in the PMT. To save word count, details shall not be repeated here; rather the PMT shall be referred to. A significantly more detailed project plan has been produced (which is too detailed to fit into the PMT) that can be shared with assessors on request.

The project is divided into two main stages:

- The aim of Stage 1 is to evaluate the technical feasibility, costs and risks of various novel integrated restoration methodologies (including novel offshore wind capability) at various specific locations on the GB network. Stage 1 will inform the work to be done in Stage 2.
- Stage 2 will build on Stage 1 and de-risk the key uncertainties and gaps identified in Stage 1. This will likely involve working with one or more OEMs to develop, verify and demonstrate aspects of the optimal integrated methodologies identified in Stage 1. Stage 2 will also include a commercialisation work package to drive the necessary changes to BAU implementation.

The project plan has been devised such that work packages build up one another. This is highlighted in the Gantt Chart in the PMT.

Stage 1:

- The preparatory work of WP1 will underpin all of WP2-9.
- The technology review of W2 will inform the feasibility studies of WP3-9.
- The feasibility study of WP3 will be the central feasibility study in Stage 1, and WP4-9 will build upon this.
- The feasibility study of W4 and W5 will be secondary feasibility study using alternative technology compared to W3, and will inform WP5, 7, 8 and 9. It should be noted that WP4 and WP5 may be combined into one work package, depending on the technology being considered for installation at Branxton. This will be finalised during WP1.
- The feasibility study of W6 will build on the outputs of WP3, to demonstrate the feasibility of the same technology as W3 at a different location.
- The feasibility study of WP7 will build on the outputs of W4 and WP6, to demonstrate the feasibility of the same technology as W4 at the same location as WP6.
- The feasibility study of W8 will take the outputs of WP3, 4, 6 and 7, to demonstrate the feasibility of restoration involving HVDC-connected windfarms.
- WP9 will summarise WP3-8 and will inform further work in Stage 2.

Stage 2:

- WP10 will take the outputs of WP9 and prepare in detail W11 and 12.
- W11 will take the detailed scope of W10, and conduct detailed de-risking, verification and demonstration activities for the optimal restoration methodologies from Stage 1.
- WP12 will take the outputs of WP11 and Stage 1 and drive the BAU adoption of the novel restoration methodologies.

WP13 (Project Management) will underpin all of the above WPs.

Regarding project management, the key mechanisms employed are:

- Flexibility and control: a flexible, stage-gated approach, with clear decision criteria, has been employed. Stage 1 has been scoped in detail. Stage 2 has intentionally been scoped at high-level currently, with the detailed scoping of Stage 2 to be informed by Stage 1. Other stage gates have also been included between W1 and WP2, and WP10 and 11. These stage gates mean there are at least annual stage gate decisions, intentionally placed between key WPs to enable flexibility but close control over the project scope, delivery and budget as it evolves.
- Risk management: a full Risk Register has been included in the PMT. These risks will be continuously reviewed, updated, and managed.
- IP management: a background IP register will be implemented to ensure clarity around what has been shared with the project and under what conditions.

Key outputs and dissemination

Dissemination and working in the open are critical to success of Beta. The main output will be novel restoration methodologies with contributions from OWFs. These methodologies will be developed for immediate uptake across the industry (SOs, TOs, OWF developers, OEMs) at the end of Beta. The responsibility for this main output lies across the whole consortium, as the restoration methodologies will necessarily be an integration of a large number of components, which are designed and operated by different parties. The large consortium has been intentionally formed to enable rapid industry-wide dissemination of this main output. A dissemination strategy will also be developed during the course of the project to target further public dissemination, such as conferences, papers and social media.

Beneath this main output are the following specific outputs:

- Novel restoration controllers. To have a workable restoration methodology, new controllers will be needed. These will be for individual component control (such as turbines and batteries) and overarching restoration control (to coordinate between the individual components). These will be developed by the OEMs who will be subcontracted into the project. The controllers themselves will not be disseminated, as they will be highly sensitive valuable proprietary IP of the OEMs. However, the specifications for the controllers will be disseminated (see below).
- New TO control room restoration tools and procedures. Following a shutdown, it is the local TO control room that coordinates the restoration. This is relatively simple for traditional synchronous generators but will be more complex for a methodology involving renewables. These TO control room restoration tools and procedures will be developed by SPEN, with input from SSEN, and will be disseminated to all TOs through direct dissemination channels. This will not be publicly disseminated due to security reasons.
- Updated Local Joint Restoration Plans (LURPs). LURPs are pre-agreed plans for how a specific location will be restored following a shutdown. These will need to be updated to include OWFs following Beta. This will be led by SPEN and SSEN for their specific areas. This will not be disseminated as LJRPs are confidential for security reasons.
- New standard technical specifications for OWFs and components. These will give clarity to OWF developers how to specify restoration capability into their future designs, and how OEMs can meet those specifications. This will be led by the Technical Consultant. These will be disseminated to the appropriate teams within the OWF developer partners in the consortium.
- Proposals to SOs for improved wind restoration markets. As mentioned in questions 3 and 4, current market requirements are not sufficiently for OWF developers to invest in the required capability and to participate in the market. Beta will demonstrate to the whole industry (including SOs) the technical details of how OWFs can contribute to restoration, and the costs of doing so. From this, Beta will propose market requirements that are sufficiently clear to incentivise wide participation. These will be developed by TNEI and will be disseminated directly to the SOs in the consortium.

A key aspect in the project is the international nature of the consortium. It is important for efficiency that restoration from OWF is handled similarly across borders (to avoid OWF developers and OEMs needing to provide different services in different countries, which would push up costs for all). Having international SOs in the consortium will enable international uptake of this UK-led initiative.

There will be one key collaboration with another SIF-funded project (INCENTIVE). INCENTIVE is demonstrating how OWFs can provide stability to onshore networks. Such stability provision will be one of many key considerations during restoration, so the outputs of INCENTIVE will feed into SIF BLADE.

Commercials

Intellectual Property Rights, Procurement and Contracting (not scored)

IPR arrangements

The majority of the IPR arrangements will follow the default recommendations of the Chapter 9 SIF Governance Document. There may be some Background IPR and Foreground IPR that fall within the exemptions of Clause 9.2 and 9.14 of the SIF Governance Document.

At the time of drafting this application, we are unable to provide a definitive list of the specific pieces of Background IPR and Foreground IPR that we would request to be exempt from the default treatment as we are still in talks with the relevant parties. However, an explanation of the situation is provided below.

Beta will receive commercially sensitive information from TOs, OWF developers and OEMs (in the form of technical data and software models of their networks, OWFs and products respectively). Due to the innovative nature of the technologies in question, and commercial sensitivities in relation to their operation, it is likely that at least some of the inputs and outputs will be necessarily confidential, meaning that these inputs and outputs cannot be fully shared with all project partners or anyone outside the SIF BLADE project.

We will use an IP register to track the Background IPR, the Foreground PR, and the use and access rights to all these IPs. The main contract governing the project (the Collaboration Agreement) will include detailed, mutually agreed terms governing IP that are in line with the SIF Governance Document.

Contracting and procurement

It is proposed that, for expediency, and in line with the Discovery and Alpha, Carbon Trust will sign the Beta Collaboration Agreement on behalf of the OWF developers in the consortium, as the representative of the OWA program. With this contracting arrangement, and to encourage BAU adoption of the SIF BLADE outputs, the OWF developer partners will have access to Background and Foreground IPR like any other project partner.

Immediately following kick off, we shall set up an Advisory Panel of OEMs (at the time of writing GE-Vernova (grid and wind turbines), Ingeteam, Siemens Energy, Siemens Gamesa, but others may be added before kick-off). To encourage BAU adoption of the restoration methodology, we intend to make all Foreground IPR available to the Advisory Panel, under confidentiality, in exchange for their input into the project.

The Advisory Panel shall also include international SOs. At the time of writing this will be NGESO, TenneT and RTE.

A Technical Consultant contractor will be procured in the opening months of Beta to deliver the coordinated electrical studies between Branxton and Peterhead. Giving this to an independent party will enable confidential information sharing more easily and ensure an organisation with the right expertise is delivering the work. A shortlist of suitable contractors has already been identified.

For Stage 2, one or more OEMs will be procured to develop and provide innovative control systems to the feasibility study, as identified as necessary during Stage 1. The Project Plan includes dedicated time to procure these roles after Beta kick-off. The OEMs may be procured as project partners or contractors.

It should be noted that the OWF developer partners and Advisory Panel OEMs are multinational organisations. Their experts, who will work on SIF BLADE, sit in many different locations globally and may be employed by non-UK entities. However, all such partners have a strong interest in developing restoration services and offshore wind farms in the UK.

Commercialisation, route to market and business as usual

Rapid BAU roll out is central to the project. Indeed, the main aim of the project is to ensure that, immediately following Beta, there is a clear route to market for OWFs to provide restoration services at scale, to give the onshore system the support it urgently needs.

Regarding the commercial readiness of the project partners, the TOs need to integrate OWs into their existing restoration methodologies, but do not have visibility of this capability (as it doesn't yet exist). OWF developers are motivated to participate in system restoration, provided there are clear market requirements and suitably de-risked technologies available. Currently, however, such markets and technologies are not available. OEMs are developing individual components that could contribute to system restoration if suitably configured, but these individual components need to be more clearly specified and will also need to be integrated with other nearby components. If suitable markets are specified, no additional investments will be required at any project partner beyond BAU investment channels.

The following commercialisation activities will happen in Beta:

- Develop detailed technical understanding of new restoration methodologies, and de-risk them through testing and lab-based demonstration.
- Understand the costs and benefits of the restoration methodologies.
- Disseminate to SOs (WP12.4): SIF BLADE is engaging UK and international SOs. These SOs are highly interested in SIF BLADE. They see it as the vehicle to provide evidence for them to update their restoration markets. SIF BLADE will work closely with these SOs to ensure they understand the outputs of SIF BLADE and make the changes necessary. This is the key to the large scale roll out following Beta and is a focus of the project.
- Disseminate to TOs (WP12.2): TOs must understand the novel restoration capabilities from OWFs and how these will be integrated with existing restoration management processes in the TO control rooms. SIF BLADE has a dedicated workstream to upskill the control room teams at TOs, such that they are ready for OWFs with restoration capability.
- Disseminate to OWF developers (WP12.3): the project is using two real windfarm developments (at Branxton and Peterhead) as case studies. Using real windfarms will increase the speed of commercialisation at those two locations. However, the results will also be genericised to ensure they are applicable to all other future OWFs. SIF BLADE will be educating the 10 OWF developers, in order to accelerate BAU roll out at scale.
- Disseminate to OEMs (WP12.3): SIF BLADE will provide clarity on technical specifications, to enable OEMs to develop restoration capability quickly and efficiently.

SIF BLADE is demonstrating world leadership. SIF BLADE is of course highly relevant to SPEN and SSEN networks, but it is also relevant to the wider GB system and internationally. Through the international OWF developers, OEMs and SOs in the consortium, SIF BLADE will help to standardise approaches to restoration from OWFs across borders, which will reduce costs for OWF developers and OEMs, and hence reduce costs for all SOs and hence all consumers (including GB consumers). This in turn will support rapid commercialisation at scale.

SIF BLADE will not undermine competitive markets; rather, it will promote new competitive markets for restoration services. Upskilling the broad consortium of OW developers will enable more participants in restoration markets, 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 an obligation to its customers to run a resilient and robust network and sees SIF BLADE as a project of key strategic importance to unlock restoration services from offshore wind.

Policy, standards and regulations (not scored)

From work in Alpha, we currently do not consider there to be any definitive regulatory or policy barrier to OWFs contributing to system restoration. At the time of writing, we see no need for derogations or exemptions within SIF BLADE.

However, the regulatory landscape is moving very quickly, with some grid code and regulatory changes being announced recently and with others currently under review. The detail of this is set out in Alpha Deliverable 2.3. As a brief overview, the ESRS sets the standard for system restoration. A new grid code modification (GC0156) has recently been announced which mandates generators to have 72 hours of resilience. There is also work ongoing on a new mandatory GFM grid code for generators, in order to support system stability. All of these are quite positive updates that policy and regulation is moving in the right direction regarding system robustness. In Beta, we will maintain an overview of this rapidly moving landscape, flagging where we foresee any issues, and inputting into UK government, Ofgem and ESO consultations where appropriate.

However, as has been flagged several times elsewhere in this application, there is a strong need for ESO to evolve its wind restoration market requirements. SIF BLADE will demonstrate to ESO (and other international SOs) what OWFs can provide in terms of restoration capability, and the approximate costs of that provision. We will do this in a "bottom-up" manner, by looking at the specific, technical needs of the networks and then developing solutions to meet those needs. This is different to the "top-down" approach of the ESO's current market. See attachment for more details on this. We will provide this evidence to the SOs to enable them to evolve their market requirements in an informed manner. The SOs in the Advisory Panel see SIF BLADE as a key piece of evidence for them to update their restoration markets to capture the benefit offshore wind can provide.

Consumer impact and engagement

SIF BLADE will have limited interaction with consumers. Beta is focussing on demonstrating technical and commercial feasibility of OWFs to contribute to restoration. It is not going to be using the live network, so will have no direct interaction with consumers. Consumers will therefore not be involved in the design, development or implementation of the project.

However, SIF BLADE will lead to many direct benefits for consumers, including significant cost savings. Please see question 6 for more details. Regarding indirect or qualitative benefits, SIF BLADE will enable the continued rapid roll out of OWFs in the system. Without SIF BLADE, there is a real risk that OWF development will slow as it would increase the cost of system restoration (essentially keeping additional synchronous thermal generation online out-of-merit). Offshore wind is one of the cheapest sources of energy for GB consumers, so preventing any barriers to its deployment will be beneficial to GB consumers. The financial benefits of SIF BLADE accrue equitably across all consumers but is particularly important to low-income consumers for whom cheap forms of electricity and cost-effective system restoration will have meaningful reductions on their bills and hence improvements to their cost of living.

In addition to financial benefits, it is fundamentally critical for consumers that the system is robust to shutdowns. From our work in Alpha (see Deliverable 2.1), there is a risk that the ESO's FES are not restorable by any means. A slow (or, worst case, impossible) restoration would be devastating for the UK economy and have serious security impacts. It would also raise public scepticism for the energy transition, which could have negative long-term implications on the climate. SIF BLADE will make the transitioning system more robust. It will ensure that -- should the system shutdown or "blackout" -- it can be restored as quickly as possible. This benefit accrues equitably across all consumers, but it particularly important to vulnerable customers, who may suffer worse consequences of prolonged blackouts.

Whilst consumers will not be directly involved in the project, dissemination of the benefits of SIF BLADE to consumers will be a key part of the dissemination strategy, which is included in the Beta scope (see WP12.5 in the PMT). This will include suitably pitched social media explainers.

Value for money

The total cost for Beta is £5,454,276.

The project is requesting £4,850,905 of funding (89% of total cost), with the remaining £603,371 (11% of the cost) being contributed by project partners.

This level of funding will lead to outcomes that provide value to the consumer. Beta will provide a unique platform to provide much needed evidence on how OWFs can support system restoration, and urgently drive this to rapid BAU rollout. As can be seen in the CBA attached to question 6, SIF BLADE Beta will accrue £0.9-1.6bn of benefits until 2050. the GB consumer will see a return on the £4,850,905 investment in 12 years.

SPEN:

- Total costs: £974,970
- SIF funding: £862,970 (89%)
- Contribution: £112,000 (11%)
- Contribution is coming from internal SPEN innovation funds to support SPEN human resources on the project.

SSEN (including NHVDCC):

- Total costs: £815,161
- SIF funding: £733,645 (90%)
- Contribution: £81,516 (10%)
- Contribution is coming from internal SSEN and NHVDCC innovation funds to support
- SSEN and NHVDCC human resources on the project.

University of Strathclyde:

- Total costs: £545,500
- SIF funding: £490,630 (90%)
- Contribution: £54,870 (10%)
- Contribution is coming from internal University of Strathclyde innovation funds to support University of Strathclyde human resources on the project.

TNEI:

- Total costs: £318,625
- SIF funding: £293,640 (92%)
- Contribution: £24,985 (8%)
- Contribution is coming from internal TNEI innovation funds to support TNEI human resources on the project.

Carbon Trust:

- Total costs: £360,020
- SIF funding: £30,020 (8%)
- Contribution: £330,000 (92%)
- Contribution is cash transfer from the Carbon Trust's Offshore Wind Accelerator R&D Programme.

Technical Consultant (subcontractor):

- Total costs: £640,000 (estimated based on preliminary discussions, tbc during procurement process during Beta)
- SIF funding: £640,000 (100%)
- Contribution: £0 (0%)
- No contribution as this is a contractor not a partner.

OEMs (subcontractor):

- Total costs: £1,800,000 (estimated based on preliminary discussions, tbc during procurement process during Beta)
- SIF funding: £1,800,000 (100%)
- Contribution: £0 (0%)
- No contribution as this is a contractor not a partner.

The subcontractors are critical to the successful delivery of Beta. The Technical Consultant is required to deliver the coordinated electrical studies between Branxton and Peterhead, giving this to an independent party will enable confidential information sharing more easily and ensure an organisation with the right expertise is delivering the work. The OEMs will be contracted as and when necessary to develop and provide innovative control systems to the feasibility study. The project plan includes dedicated time to procure these roles after Beta kick-off.

The project will use pre-existing assets and facilities, including the NHVDCC's laboratory. There is no need for any decommissioning costs.

In addition to the contributions identified above, it should be noted that the OWF developers, Advisory Panel OEMs and Advisory Panel SOs are all contributing time to the project free of charge ("in-kind"). They will be contracted into the project by Carbon Trust as with previous phases to deliver certain tasks: guiding scoping, guiding delivery, providing specific inputs on requests, attending meetings and reviewing delivery. In previous phases, these parties' in-kind contributions were quantified and included in the funding application effectively as subcontractors to Carbon Trust. However, due to a change in rules in the UKRI funding application form, it is our understanding that these third-party in-kind contributions can no longer be included in the funding application. Carbon Trust discussed this with the UKRI. We are therefore not declaring these in-kind contributions in the project finances section. However, these parties will be contributing around £369,000 in total to the project. This is a significant amount of time and increases the value of the project to the GB consumer.

Is this an associated Innovation Project?

- [x] Yes (please remember to upload all required documentation)
- [ ] No (please upload your approved ANIP form as an appendix)

Supporting documents

File Upload

SIF Beta Round 2 Project Registration 2024-11-08 1_52 - 88.7 KB
SIF Beta Round 2 Project Registration.pdf - 87.8 KB

Documents uploaded where applicable?

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