# SIF Round 3 Project Registration

### Date of Submission

May 2024

### Project Reference Number

SeaChange01

## Initial Project Details

### Project Title

SeaChange

### Project Contact

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### Challenge Area

Whole system network planning and utilisation to facilitate faster and cheaper network transformation and asset rollout

### Strategy Theme

Net zero and the energy system transition

### Lead Sector

Electricity Distribution

### Project Start Date

01/03/2024

### Project Duration (Months)

2

### Lead Funding Licensee

SSEN - Scottish Hydro Electric Power Distribution Plc

### Funding Mechanism

SIF Discovery - Round 3

### Collaborating Networks

Scottish and Southern Electricity Networks Distribution

## Technology Areas

Commercial

Demand Side Management

Stakeholder Engagement

## Project Summary

The UK's target of achieving zero-emissions shipping by 2050 is driving a substantial surge in national electrical demand. The maritime sector is notably complex with extreme diversity across ports and their users.

SeaChange is a project with EMEC, PNDC, Ricardo and Scottish and Southern Electricity Networks Distribution which will help develop a replicable, port-level investment model to explore transition scenarios.

This model will not only be used to help idnetify key network investment requirements, but also to inform and enable ports and their users to plot their most viable decarbonisation pathways.

## Add Preceding Project(s)

10061360 - Electric Thames

10098733 - HyNTS Maritime

NIA_ENWL004 - Combined On-line Transformer Monitoring

NIA_ENWL004 - Combined On-line Transformer Monitoring

## Add Third Party Collaborator(s)

PNDC

Ricardo

European Marine Energy Centre

## Project Budget

£166,035.00

## SIF Funding

£149,431.00

# Project Approaches and Desired Outcomes

## Problem statement

The UK's target of achieving zero-emissions shipping by 2050 will drive a substantial increase in electrical demand at ports and harbours across the country. At the edge of the GB grid, the transition of maritime operations presents a significant new load, estimated between 250-4000 GWh/year, whilst the industry itself is an entirely new user group for electricity networks. There are multiple areas to be tackled in the sector, with huge variation in the classes of vessel, the ability to provide shore supplies whilst vessels are moored, and the wide range of ports and harbours. In addition, there are challenges with the port-side infrastructure including transport infrastructure, logistics, cranes, loading equipment which will all be decarbonised. Therefore, it is essential for DNOs to have a better understanding of how these new sources of demand will impact on the network, whilst ensuring that the needs of this new sector are addressed and that they can support the wider operation of the system.

The maritime sector is notably complex with extreme diversity across ports and their users, not only in terms of loads and 'refueling' patterns, but also transition timeframes, solutions (electric propulsion, hydrogen,other) and barriers (finance, industry structure& technology). Critically, removing just one barrier could result in the acceleration of maritime transition. Effective network investment to prepare the grid edge for this variable load requires a holistic approach in partnership with this new stakeholder group.

While the maritime sector is pivotal to global trade and offshore renewables, ports also provide lifelines to island communities. making the sector vital for resilience and viability, therefore, maintaining current levels of reliability and service is essential.

SeaChange will develop a replicable model to explore transition scenarios with this new network user group -- not only to help identify key network investment requirements, but to inform and enable ports and their users to plot their most viable decarbonisation pathways, and therefore addresses Challenge 1 and Scope 1 of this Innovation Competition.

SeaChange will build on relevant innovation projects identified in the PM workbook, to engage with industry stakeholders to better understand the challenges and gain an understanding of current progress. The project will initially focus on areas of the industry which are already progressing such as the trial use of electric ferries in Orkney or the use of shore supplies in other UK ports to help inform and validate the model being developed.

## Video Description

https://www.youtube.com/watch?v=wY0m4WMHZWQ

## Innovation justification

SeaChange will enable maritime decarbonisation by informing strategic investment for networks, ports and their users. While the sector faces great barriers to decarbonisation, all pathways will require significant electrification -- the counterfactual is less efficient reactive network investment.

The project requires insights from a new, diverse stakeholder group (vessel operators, port owners etc ) with limited previous engagement with a DNO, which, along with the uncertainty in their decarbonisation paths (fuel types), makes this project appropriate for SIF funding.

To date, research into grid impacts of maritime decarbonisation has largely focused on the likely pathways for specific maritime sectors or vessel types. SeaChange intends to take a whole-port perspective, working directly with the port authorities and users; this approach will develop the network understanding of these new users, as well as build confidence for port stakeholders on their decarbonisation trajectory. Initially focusing on inter island ferries and cruise ship shore supplies, the project will develop a model which can then be more widely applied.

SeaChange aims to produce a useable modelling tool from Alpha stage:

Discovery -- Mapping landscape through local stakeholder engagement and data collection, focussing on two use cases (likely ferries, cruise ships); on completion, the tool is anticipated to be at CRL 3.
Alpha - Model development and validation of example port (Orkney); on completion, we anticipate the tool will have achieved CRL 4 following real-world verification with stakeholders.
Beta -- Feeding in from earlier phases, the model will be tested for accuracy, and replicability, working with additional UK ports across a wider range of vessel classes and scenarios.
Discovery phase will define transition pathways and energy needs of the sector by building detail into existing toolkits (e.g. those developed by Strathclyde University and NGET) and verifying assumptions through engagement with Orkney port stakeholders. SeaChange will then integrate port and user requirements into an investment process expanding on SSEN's LENZA LAEP+ tool for local network investment planning, signposting opportunities, e.g. for flexibility or co-location.

Our proposed approach will enable understanding of not only technical, but economic and social interactions -- critical for UK ports due to their logistical and economic significance.

Orkney faces substantial maritime demand, including 200+ cruise ships each year as well as early demonstration of electric ferries. Through EMEC, SeaChange will link with the Islands Centre for Net Zero (ICNZ), ensuring project impact beyond SIF.

## Impacts and benefits selection (not scored)

Financial - future reductions in the cost of operating the network

Financial - cost savings per annum on energy bills for consumers

Financial - cost savings per annum for users of network services

Environmental - carbon reduction – direct CO2 savings per annum

Environmental - carbon reduction – indirect CO2 savings per annum

Revenues - creation of new revenue streams

New to market – processes

New to market - services

Others that are not SIF specific

## Impacts and benefits description

**Financial - future reductions in the cost of operating the network.**

Reduced deep reinforcement costs to connect ports to provide shorepower.
Coordinated port level electrification capacity will result in a simpler system design that will be easier to monitor and maintain.

**Financial - cost savings per annum on energy bills for consumers.**

Reduced annual deep reinforcement costs to connect ports to provide shorepower.
Whole systems planning benefits achieved from this project will enable more accurate forward investment with lower costs from unused capacity.
Financial - cost savings per annum for users of network services.

Will review with stakeholders in Discovery.

**Environmental - carbon reduction -- direct CO2 savings per annum.**

Through reduced use of marine diesel.
Through reduced gas and diesel fuel to generate to meet demand from shorepower.
Environmental - carbon reduction -- indirect CO2 savings per annum.

Will review with stakeholders in Discovery.

**Revenues - improved access to revenues for users of network services.**

Ports using batteries to access income from flexibility services.

**Revenues - creation of new revenue streams.**

Larger and faster electrification of ports will require greater network investment.

**New to market – processes.**

Amendments to current DNO local/regional energy planning processes will be achieved, providing greater accuracy for ports compare to current general assumptions.

**New to market - services.**

Whole energy systems modelling and future scenario planning tools for Port stakeholders to help them better map out viable decarbonisation pathways and investment cases.

**Others that are not SIF specific.**

Air quality improvements in ports and port towns and cities.
Supports vital lifeline ferry services.
Supports local employment in port.

## Teams and resources

**SSEN-D**
SSEN Distribution is a DNO responsible for ensuring a safe and reliable supply of electricity to 3.9 million customers incl including significant ports on the Central Southern England and in Scotland. SSEN has delivered many successful innovation projects.

Provide network insights relevant to ports to support the project.
Share learning from previous innovation projects
Provide overall governance for the project and provide access to relevant SMEs and domain knowledge to drive the success of SeaChange.
Accountable for the final delivery of the project work scope and deliverables.

**EMEC**

As the world's leading marine energy test centre and a pioneer in green hydrogen, EMEC has a proven record in a broad range of maritime transition projects, including electric and hydrogen ferries.

Using its diverse experience in the sector to lead on the decarbonisation scenario identification and definitions work package, gathering maritime data and input through local stakeholder engagement to roadmap up to 4 transition scenarios and 2 port use cases in detail. EMEC will also support the high-level process replication and impact assessment.
EMEC leads the 10-year Islands Centre for Net Zero (ICNZ), decarbonizing Orkney, Shetland, and Western Isles, offering additional opportunities for replicability and demonstration.

**PNDC**

As a flagship Innovation Centre at the University of Strathclyde, PNDC integrates academic expertise with its established role as a whole energy systems research and demonstration centre. PNDC brings unparalleled expertise in developing and deploying

innovative energy and transport technologies.

Collaborate with the Institute for Energy and Environment during the Discovery phase, PNDC will leverage its energy systems modeling proficiency to support stakeholder engagement.
Define decarbonization scenarios and port use cases, highlighting the university's commitment to impactful research in sustainable energy with a specific focus on power and energy characterisation.

**Ricardo**

Ricardo led a number of projects to help ports and vessel operators switch to lower carbon fuels. These include projects in the UK, Europe, the US and work for the International Maritime Organization. Ricardo will:

Apply insights from working with UK ports to scale up the potential benefits from the ports covered in Discovery.
Develop an initial CBA drawing on a business case for shore power developed for Southampton Port and previous experience with the SIF CBA model.

**Resources**

Will be provided by the project partners.

**External Parties**

In WP2, 3 & 4 we will interview a selection of ports on their current and future plans for electrification.

# Project Plans and Milestones

## Project management and delivery

SSEN-D will lead all Project Management activities. SeaChange will be delivered in 6 workpackages, with each assigned a lead and resulting in clearly outlined deliverables. All deliverables and dependencies will be tracked using the tools provided by UKRI (Risk Register, Project Plan), and tools developed internally (Gantt Chart, Project Costs, Finance Tracker) to regularly monitor project performance, as per earlier SIF Rounds. Full detail can be viewed within the attached PM Book.

Weekly sessions, as well as effective use of PM tools will allow the project team to continue to monitor cross deliverable dependencies, and milestones to ensure outputs complement each other as a result. This can be seen within the Gantt Chart -- e.g., the outcome of collected data from WP2 will be used in the WP3 to identify scenarios of logical port and system boundaries assessment, also, using the outcomes from both WP2 and WP3, a high-level decarbonisation assessment of a port and an assessment of replicability of the process that can be rolled out across the UK will be produced in WP4.

Several risks and barriers have been identified. A brief list of risks and barriers can be seen below. Full list of risks and barriers, including mitigating actions identified is available in the Discovery PM Book.

**Risk** - Engagement with port authorities / vessel operators will take longer than expected resulting in loss of confidence in the model and project outputs.
**Risk** - The model is too focused on specific ports in SSEN license areas, and the solution may not be scalable to the rest of GB; mobility of the model to other locations.
**Barrier** - If Policy, and regulatory are too great to overcome, the project is not feasible and project stops.

During the preparation of this application and the preliminary research performed, we have not identified any regulatory barriers for the discovery phase and do not expect to require any regulatory changes throughout Alpha stage. However, as an output of Alpha will deliver a recommendation that will determine if and how regulation and policy would need to be updated to enable successful roll out of this approach. The outputs of these activities will inform our decision to progress into Beta Phase.

This Project is not expected to impact on customers reliability of supply during Discovery or Alpha Phases.

This Project will not have any direct or adverse impact on existing or future energy consumers.

## Key outputs and dissemination

The key outputs of Discovery are:

Orkney maritime decarbonisation projects with key findings summarised.
A Whole System assessment tool replicable in other GB ports.
Early-stage impact assessment and Cost Benefit Analysis to gain insights on the impact of maritime electrification across several electrification scenarios.
Roadmap (maximum 4) future port decarbonisation / electrification scenarios

**Workpack 1: Project Management & reporting**

Lead: SSEN Support: All partners
Purpose: Co-Ordination of deliverables, project performance, end stage report and alpha application. UKRI engagement.
Key outputs/ Deliverables:

PM Book
Risk Register
Meeting Outputs

**Workpack 2: Data collection**

Lead: EMEC for historical maritime data, PNDC for regional grid information Support: Ricardo, SSEN
Purpose: To obtain historical maritime data and regional grid information
Key outputs/ Deliverables:

Port/Marine/Vessel information sources and raw data
Energy network information, models and raw data

**Workpack 3: Scenario identification and mapping**

Lead: EMEC Support: All partners
Purpose: To stimulate stakeholders' engagement for port energy decarbonisation, to populate Roadmap for future port decarbonisation scenarios (maximum 4) and framework of use cases
Key outputs/ Deliverables:

Roadmap of ports decarbonisation pathways
Best practice review of similar ongoing initiatives in the UK and abroad
Decarbonisation options for the Orkney use cases

**Workpack 4: High level process definition & assessment of replicability**

Lead: EMEC/Ricardo Support: All partners
Purpose: To define a high-level process outlining steps for detailed decarbonisation assessment for Orkney, replicable across wider GB
Key outputs/ Deliverables:

High-level process outlining steps
Replicable methodology assessment to apply across UK ports

**Workpack 5: Early-stage Cost Benefit analysis**

Lead: Ricardo Support: EMEC
Purpose: To gain early insights on the impact of maritime electrification across several scenarios
Key outputs/ Deliverables:

Early-stage CBA

# Commercials

## Intellectual Property Rights (IPR) (not scored)

To ensure clarity is provided to the Project partners, UKRI and Ofgem regarding the intellectual property (IP) landscape, the Project is using an IP register to track the Background IP provided to the Project, the Foreground IP the Project generates, and the use and access rights to all this IP.

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. For the Discovery Phase, all the IPR arrangements will follow the default recommendations of Chapter 9 SIF Governance Document.

## Value for money

The total project costs are £166,035. The 10% compulsory contribution will be provided by Lead Partner SSEN-D £16,604. We are seeking funding through the Strategic Innovation Fund for the remaining costs £149,431.

The balance of costs and SIF funding across the consortium is:
**SSEN-D**
Costs are £ 23,698 and funding sought is £ 7,094 minus 10% compulsory contribution (£16,604) = £ 7,094
**EMEC**
Costs are £ 64,509 and funding sought is £ 64,509
**PNDC**
Costs are £ 36,141 and funding sought is £ 36,141
**Ricardo**
Costs are £ 41,687 and funding sought is £ 41,687

Where possible, we have benchmarked costs received against those used by equivalent suppliers who are already engaged on SSEN's frameworks.

There are no subcontractor costs associated with this application.

PNDC will build upon the Professor Stuart Galloway's project 'A toolkit to evaluate port-side infrastructure requirements for rural & island communities' (£30,000) and consult with him on this to assist with the high-level modelling design work.

**BAU adoption**
The most suitable route to market will be explored during the project as the project looks to develop the correct approach.
The project partners will work together and involve the relevant teams at SSEN to deliver the desired benefits and implement the solution into BAU without delay.
The proposed solution would be applicable to all other GB DNOs, as well as a wide range of sectors including other Transmission operators, developers, water, road and rail.

## Supporting documents

### File Upload

SIF Round 3 Project Registration 2024-05-22 3_06 - 61.0 KB
SeaChange_PMBook_LIVE.xlsx - 177.2 KB
SeaChange_EndPhasePresentation_April2024.pptx - 17.2 MB
SSEN-022_SeaChange_D6.1.pptx - 5.5 MB
Ricardo - SeaChange Discovery - Use Case Mapping tool and early-stage CBA.pptx - 2.8 MB
D3.3 & D3.5 Decarbonisation Scenarios & Use Case Roadmaps.pptx - 3.9 MB
D3.1 Stakeholder Engagement Report.pptx - 18.1 MB
D2.1 Maritime data report.pptx - 29.3 MB

### Documents uploaded where applicable?

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