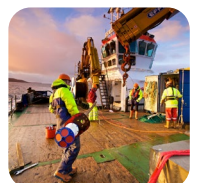
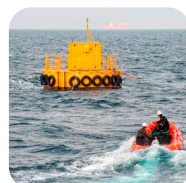


WEDUSEA | OE Buoy

Project Information Summary

EMEC Billia Croo Wave Test Site

April 2026



Purpose

This Project Information Summary gives a high-level view of the company, the device, and the proposed project. This document is being submitted in lieu of a Construction Method Statement. This document is the foreword to the project’s Marine Licence application, and will feed into the rest of the application supporting documentation, including but not limited to the following documents:

- Project Environmental Monitoring Plan
- Navigational Risk Assessment Addendum
- Decommissioning Program
- Third Party Verification

Document History

Revision	Date	Description	Originated by	Reviewed by	Approved by
A	16/11/22	Initial Version	SNB	TL	JMC
1	13/12/22	Revision for Release	SNB	TL	JMC
2	22/05/2025	Revised Draft	AM (EMEC)	DL (EMEC)	SB (Ocean Energy)
3	10/07/2025	Final Draft	AM (EMEC)	DL (EMEC)	SB (Ocean Energy)
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1 Introduction

1.1 Company background

The WEDUSEA consortium is a specially selected pan-European team of highly experienced engineering teams who have a strong track record of developing wave energy technology and being involved in other European funded projects. The multidisciplinary team consists of 14 partners from 5 countries (Ireland, United Kingdom, France, Spain, and Germany).

1.2 Technology background

The OE Buoy device is a floating oscillating water column (OWC) with a large, submerged, chamber open to the sea and filled with water. The Plenum chamber is to the bow and the opening of the water tunnels as at the aft end of the device. The water column connects to a trapped air volume in the plenum chamber through the submerged horizontal tunnels. The water pressure fluctuations due to the wave motion combined with the body motion of the device causes varying water pressure in the air plenum. This plenum is connected via ducting to an air turbine and the air is forced out of the plenum and drawn in during the wave cycle. This flow of air spins the turbine to generate electricity. The turbine is of a self-rectifying type, so it spins in the same direction on both the outflow and inflow stroke. The OWC system is supported by a large buoyancy chamber and the principle of the WEC operation is shown in Figure 1. The self-rectifying air turbine to be used in this demonstration is a Wells Turbine which has only one moving part, not in contact with the sea, which is the rotor connected to the electrical generator. This makes the turbine highly reliable with only two mechanical bearings requiring limited maintenance. This turbine will be coupled with an innovative air control system, in the plenum chamber, to prevent stall and increase efficiency as well as protecting the machinery from overloading flow extremes or loss of grid connection to prevent runaway.

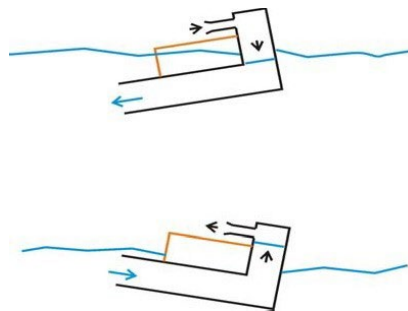


Figure 1. Operating principle of OE buoy

Ocean Energy (OE) have been developing the OE Buoy wave energy device for nearly 20 years. They have been progressively working up through TRLs, progressing from small scale then large-scale tank testing to intermediate scale in open sea conditions at the Irish Galway Bay Test Site. More recently they have built and transported from Portland, Oregon to Hawaii a 500kW device which was deployed at the US Navy Wave Energy Test Site (WETS) in August 2024. This will demonstrate the technology at TRL 6 having a technology operating in a relevant environment. The proposed project, WEDUSEA, is now required to progress the technology towards commercialisation. WEDUSEA will demonstrate a 1MW utility scale device, in a more energetic operational environment at EMEC, which will result in the progression to complete TRL 7 – the system prototype demonstrated in operational environment, at the end of the project.

The concept for this project is to Enable Future Array Deployment and will take the learnings from the construction of the 500kW device at WETS and apply these to the OE Buoy 1MW machine. There will be innovations introduced in the hull construction which involves standard ship-yard operations. The device is constructed from stiffened steel plate panels, and these are ideally suited to automated/robotic welding enabling production line type assembly during industrial roll-out.

When the device is operational most of the structure is below the waterline and so the visual intrusion is minimal. Figure 2 shows the intermediate scale OE12 device in operation during the FP7 CORES project in Galway Bay, Ireland.



Figure 2. Intermediate scale device in Galway Bay

The philosophy of the SME, Ocean Energy, has been to approach the development of the OE Buoy by progressing sequentially up the TRL levels – passing stage gates during this process. This allows significant de-risking of the development and confidence in scaling up for tests with higher costs. The first concepts were tested at a scale of 1:50 in a small wave tank in Cork, Ireland and then a 1:15 scaled test in a larger wave basin in Nantes, France. The power performance was confirmed with the scale up and this gave confidence to move to the intermediate size testing of the OE12 in the open sea in Galway Bay at a scale of around 1:3. These tests were carried out with different power take-off configurations and culminated in an FP7 funded collaborative project (CORES). This brought the technology up to TRL4/5 and so to progress further, Ocean Energy were successful in receiving support from the Irish Government, the US Department of Energy and the US Navy to construct the 500kW OE35 for testing at WETS. The device is expected to be at TRL 6 at the end of the WETS test. Further progress towards commercialisation is required and so the WEDUSEA deployment at the EMEC Test Site, in an operational wave environment which has a wave power density and extremes twice as large as the WETS site, will bring the technology to TRL7.

1.3 Project background

WEDUSEA will demonstrate a grid connected 1MW OE Buoy floating wave energy converter. This rigorous technical and environmental demonstration will happen over an extended 2-year period in Atlantic wave conditions with outcomes directly impacting policy, technical standards, public perception and investor confidence. The project will demonstrate that the technology is on a cost reduction trajectory in line with EU SET Plan targets and will be a stepping-stone to larger commercial array scale up and further industrialisation. The action will also integrate subcomponents such as moorings and PTOs which will improve the efficiency, reliability, scalability, sustainability and circularity of the technology.

Aside from Ocean Energy there are several companies in the consortium who will actively exploit the results of this demonstration through new innovations, products and services. The results will also be disseminated to feed both environmental databases and IEC

electrotechnical standards. This action will take wave energy beyond the state of the art, will build on the experience of the partners in prior EU projects and will enable arrays of reliable devices to achieve the 1GW target set out in the 2030 DG-ENER Offshore Renewable Energy Strategy. Planned engagement will create more public perception, empower and inform policy makers and de-risk larger scale investments to meet 2050 targets. The successful completion of WEDUSEA will enable Ocean Energy to continue along Pathway 4 to contribute 8,000MW (20%) to the 2050 target.

The WEDUSEA OE Buoy device will be situated at Berth 5 in the north-west region of the EMEC site. It will be grid connected via umbilical and export cable rated to 1MW at 11kV. The water depth at the site is approximately 60m. The device is a floating oscillating water column, with a maximum draft of 9.8m. The device remains on station with a traditional 3-point catenary style mooring system comprising anchors, catenary chain to a buoy, and a rope hawser from the buoy to the device.

The deployment phase of this project is to begin in April 2026 with the installation of the mooring components, followed with the device hook-up in June. The device will remain on station for 24 months, with frequent site visits and extensive environmental monitoring which will inform future projects and lends itself to the de-risking sentiment of this project. An extensive environmental monitoring program will be carried out during this period.

The funding for this project was approved by the European Commission in April 2022. The 8 European Beneficiaries are directly funded through the Horizon Europe grant and the UK Associate Partners are funded by UKRI through Innovate UK.

2 Technology

2.1 Device Description

The OE Buoy is a full-scale floating oscillating water column (OWC) device that uses an air turbine, mounted on the deck to generate electricity for export to the grid.

The OE Buoy device is 32m long and 16m wide with a draft of 9.8m and constructed using around 550 tonnes of steel. The design schematic of the device is shown in Figure 3 and Figure 4 where the black portion of the device is below the waterline and the yellow part is above. The Buoyancy chamber, with a volume of 1,874 cu.m., houses the machinery space in a watertight environment with usable space of 1,500 cu.m to house electrical and ancillary equipment. The construction using steel results in a highly reusable material enabling the future Circular Economy after industrial roll-out.

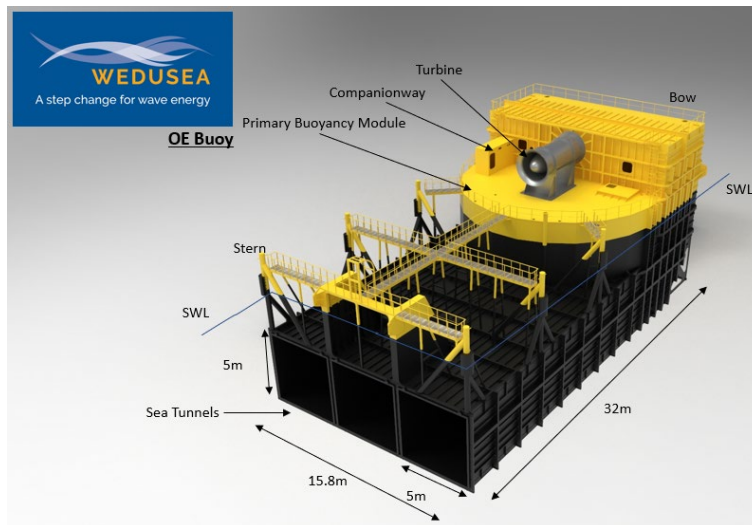


Figure 3. Design schematic of OE Buoy 1MW OWC



Figure 4. WETS OE Buoy being towed from Portland Oregon

2.1.1 OE Buoy Device Hull Construction

The design of the hull will be based on the work undertaken to date for the OE Buoy constructed in Portland, Oregon for deployment at the WETS site in Hawaii. The operational wave conditions at the EMEC site are larger than those experienced at WETS. There will be a re-analysis of the hull required for structural integrity and device stability with potential strengthening in certain limited locations. There will be a requirement to re-design the mooring lug points to withstand higher forces and will determine the design loadings. As the device deployment will be implemented by a “wet” tow to site the design of the towing lugs is also critical. When the design is completed, a full dynamic response analysis will be carried out, both for the operational conditions as well as the extreme values experienced at the deployment site.

The design exercise undertaken during this project in Front-End Engineering Design and Pre-Procurement (FEEDPP) activity will incorporate significant savings in the construction

methods compared to the previous fabrication by using automated welding techniques, prefabrication of structural elements and innovative designs for certain components. This will contribute to an overall lowering of levelized cost of energy (LCOE) by reducing the capital build cost. This will also contribute, in the longer term, to Pathway 1 for the industrial design, manufacturing processes and commercial roll out. The design of the hull will incorporate features to maximise the recycling opportunity for the steel hull following principles of the EcoDesign Directive, thus contributing to the Circular Economy and these can be further refined through discussions with the fabricators to ensure ease of dismantling and recycling at end of life. This work will also fully conform to Standard - IEC TS62600-2. The incorporation of Life Cycle Assessment in the design phase will be carried out and its contribution to commercialisation.

2.2 Mooring system

A 3-point system, catenary chain from anchor to floating buoy, and a hawser rope from the surface buoy to the device will be utilised in this project (Figure 5. Berth 5 OE Buoy mooring layout). The OE Buoy will be aligned to face the predominant wave direction.

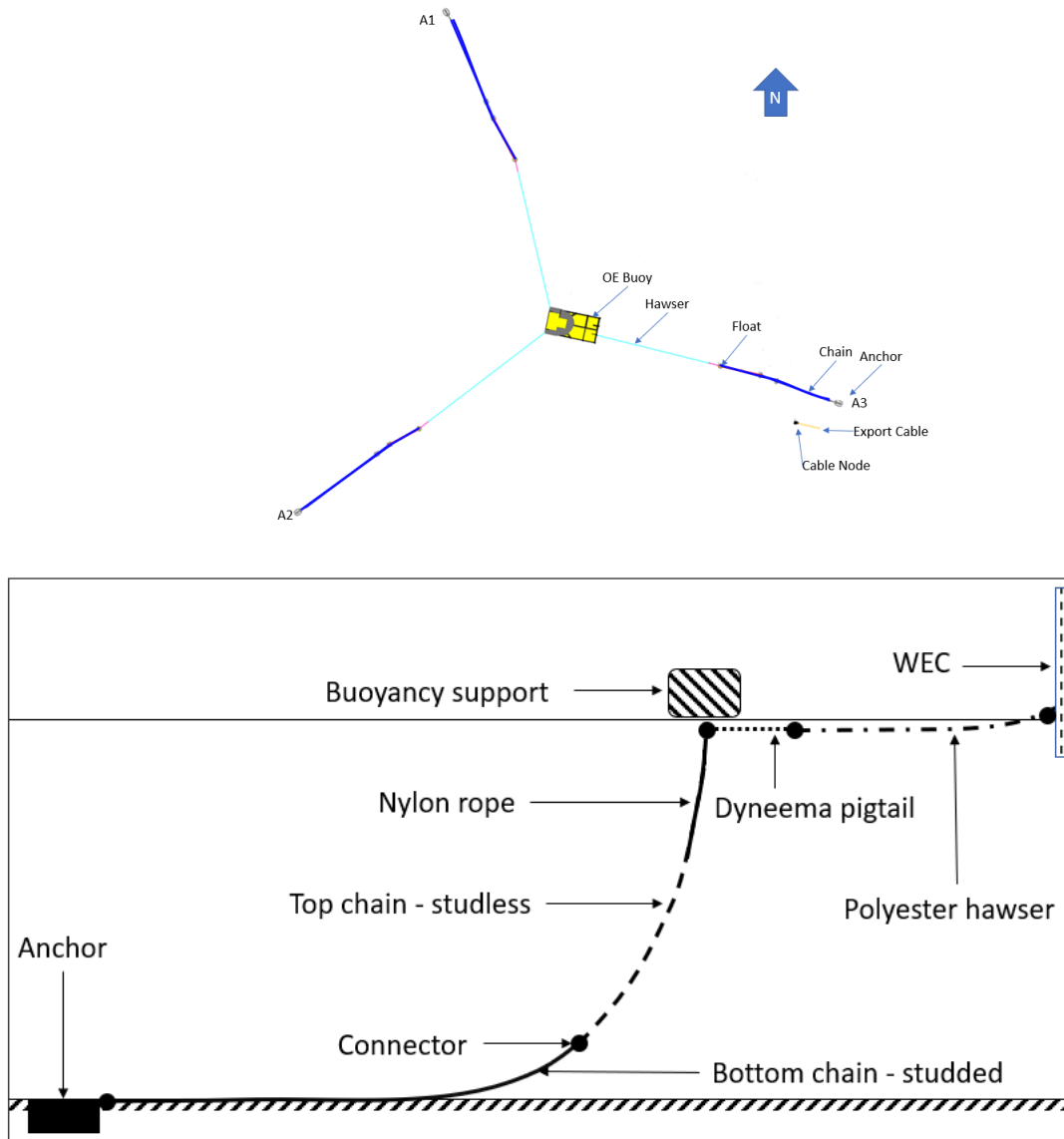


Figure 5. Berth 5 OE Buoy mooring layout

A wire rope safety line is in place between the device and hawser rope. A mooring load shackle will be in connection between the device and hawser line to measure the load in the mooring line. This will be monitored for a no-load case and extreme load case to inform the monitoring and alarm system.

2.2.1 Anchor system

The anchor system connects the mooring line to the seabed, and the use of drag embedment anchors (DEA) has been recommended. A DEA, also known as drag or plate anchors, is a type of anchoring system used to secure objects or structures to the seabed or the ground. It works by burying the anchor in the soil or sediment through drag resistance. A conservative estimation of anchor size requirement has been given as three 5T DEAs minimum.

- The drag embedment anchor has been designed to penetrate the seabed. The holding capacity of the drag embedment anchor is generated by the resistance of the soil or

sediment in front of the anchor. The drag embedment anchor is very well suited for resisting large horizontal loads, but not for large vertical loads although there are some drag embedment anchors available on the market today that can resist significant vertical loads. Initial data from the deployment site indicates a good depth of sand available for drag embedment anchors. An example of a potential anchor is the Stevpris MK6 drag embedment anchor, as shown in Figure 6 may be used. Final details of the chosen anchor can be provided once contracted. An anchor such as the 5T specified for this project would be 4.6m wide, 4.17m long and 2.9m tall.



Figure 6. Drag embedment Anchor

2.3 Materials used

Table 1. Proposed list of materials to be used

Components	Type of Deposit*	Nature of Deposit (P = Permanent, T = Temporary)	Deposit Quantity (tonnes, m ³ , etc.)	Contingency Allowance
Hull	Marine grade steel	P	650 tonnes	10%
Hawser Rope	PMP rope	P	55m 125mm diameter	5%
Pigtail	Dyneema	P	12.2m 80mm diameter	5%
Mooring buoyancy float	UPVC	P	17 tonnes buoyancy	10%
Nylon Rope	PMP rope	P	Line 1&2: 45m Line 3: 40m 160mm diameter	10%
Mooring catenary chain	Steel	P	3 90mm studlink bottom chain – 3 78mm studless top chain	10%

Anchor	Steel	P	6 tonnes	10%
Umbilical Cable	Mixed HDPE, steel armouring, copper cores, fibre optics	P	1x 300m Max (distance between device and export cable via umbilical is expected to be 207 m with move of Berth 5 cable. Therefore, it is not expected to be significantly longer than this.)	~50%
Pulling Head	Stainless Steel	P	192.5 kg	10%

*Types of deposits to consider: Steel/Iron; Timber; Plastic/Synthetic; Composite; GRP; Concrete; Silt; Sand; Stone/Rock/Gravel; Concrete Bags/Mattresses; and Cable.

2.4 Third Party Verification (TPV)

A full TPV, which will reflect the device as a whole within the context of the Billia Croo test site, will be submitted at least three months prior to deployment. Internally within the project, Wood PLC will be conducting oversight of the hull fabrication, system integration and commissioning. A member of DNV sits on the Strategic Advisor Board. Wood PLC reviewed the mooring design produced by Exeter during the Go/ No Go Process, and the EU funding authority (CINEA) appointed three external experts to review the design.

3 Project Description

The project will have an overall duration of 4 years to enable a 2-year deployment period at sea to adequately demonstrate the critical innovations, power production, availability and reliability, especially during the two over-winter periods.

3.1 Onshore Assets

No additional onshore assets will be required for deployment of the OE Buoy device.

3.2 Offshore Location

The OE Buoy device may be positioned in close proximity to the cable connection at Berth 5. Below shows the centre point of the device and the associated marine license boundary. The coordinates of this boundary alongside the outermost boundary points of the Billia Croo test site are shown in Table 2. The device will be docked at Lyness Pier before installation, and OIC will be notified of planned activities well in advance.

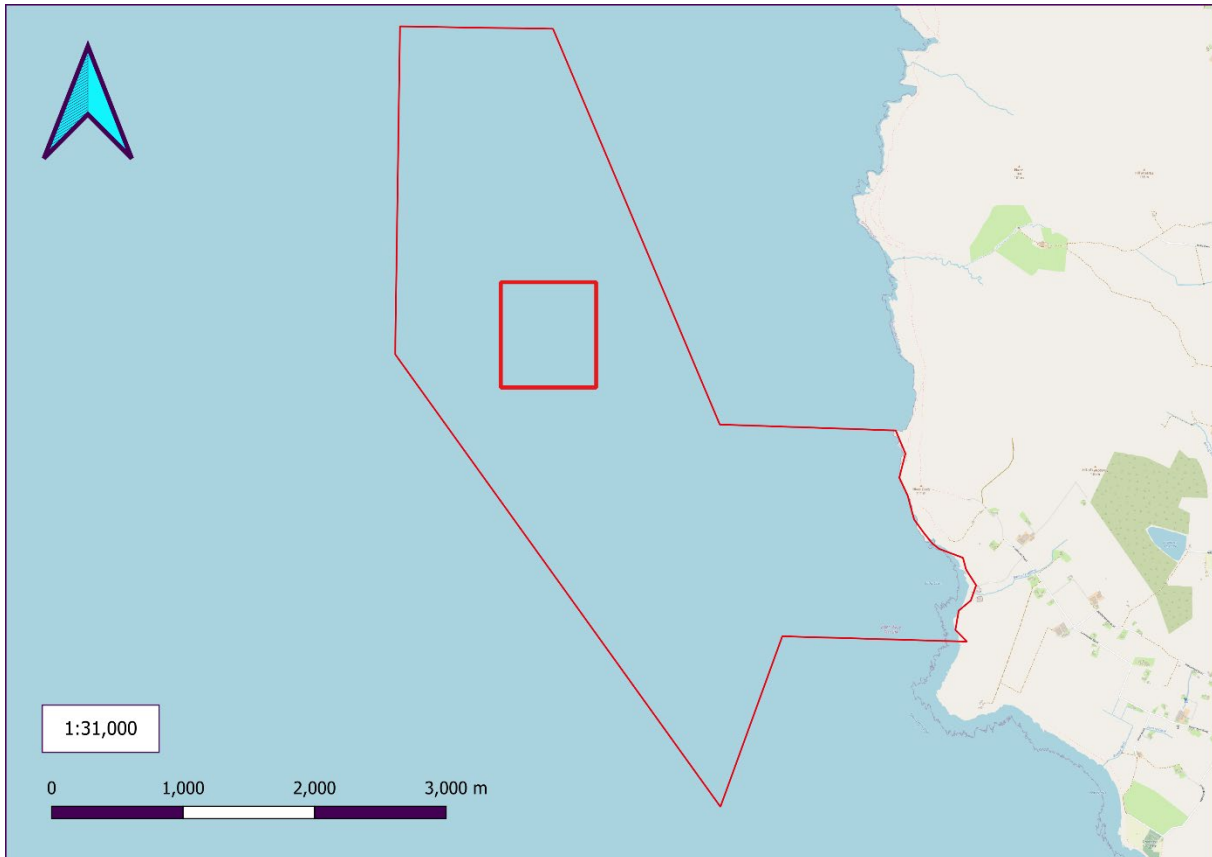


Figure 7. WEDUSEA device position and marine license boundary within Billia Croo test site

Table 2. Coordinates of ML boundary

Location Description	Latitude and longitude (WGS 84)
Test site outermost boundary points (on thin red line)	58°59.240' N 003°25.694' W
	59°00.587' N 003°25.711' W
	59°00.587' N 003°24.491' W
	58°58.393' N 003°22.391' W
	58°57.418' N 003°23.038' W
WEDUSEA site points (bold red line)	58°59.552' N 003°24.110' W
	58°59.122' N 003°24.093' W
	58°59.114' N 003°24.849' W
	58°59.544' N 003°24.867' W

3.3 Installation method

The existing export cable will be recovered, and the new cable extension connected using dry mate connectors or an inline joint. This will be laid in the direction of the devices mooring centre with ancillary equipment pre-connected, and then secured to the seabed with clumps / gravity weights. The moorings will be subsequently installed in the direction of the mooring centre, up to the point of the mooring buoys. The device will be towed to site using two tugs (to assist with station keeping). The OE Buoy will be positioned so that the two adjacent mooring line hawsers can be connected under zero (or close to) pre-tension. Once connected, a single tug will tow against these two hawsers with between 10-20te BP. The final mooring hawser will be connected.

During subsequent operations, an ROV will be deployed to connect a recovery line to the umbilical termination (wet stored on the seabed). This will be recovered to the sea surface, the umbilical cable will be connected to the export cable and the connection node returned to the seabed. The vessel will move towards the WEC, bailing out the umbilical as it goes. A recovery line running through the WEC will be passed across to the installation vessel and connected to the umbilical. The umbilical will be lowered from the vessel and subsequently pulled into the WEC for termination.

3.4 Removal method

Removal of the device from the berth 5 location will be the reverse of the installation methods. The towing bridle will be connected to the device and the hawser lines will be disconnected and the device will then be towed to a suitable nearby harbour. The mooring system will then be removed following best practice established from previous experience of the operators and learnings from the installation phase. Anchors will be removed, the process of which will depend on the type used. A survey will be conducted of the seabed to ensure that all equipment has been removed and to assess the condition of the seabed post deployment phase.

3.5 Anticipated vessel traffic to site

Several phases of the project will require personnel on site. Green Marine are the operations project partner in WEDUSEA, and their vessels will be primarily used. The OE buoy is expected to be installed in under 24 hours, and the umbilical cable within a 3-4 day timeframe. Other contractors may be considered depending on availability of vessels.

3.5.1 Site Investigations

A geophysical survey of the seabed at Berth 5 may be required to determine the extent of the sand cover for anchor installation options. This will be carried out by the contractor's AUV.

3.5.2 Mooring & Umbilical Installation

The Green Isle will be utilised for the mooring installation. The anchors and mooring chain installation would be one visit and the Umbilical installation a second visit. The umbilical connection to the export cable may require an additional support vessel to ferry crew to shore for the use by a dive crew.

3.5.3 Device hook-up

The device will be towed from the marshalling site to Berth 5 by two tugs, to assist in station keeping.

3.5.4 Commissioning

A small vessel is required to ferry crew to the device. This vessel may also be used by a dive crew to perform underwater inspections.

3.5.5 Deployment

Once deployed and in operation, a number of inspection visits to the site and device are scheduled.

3.5.6 Decommissioning

The removal of the device, mooring and umbilical equipment from the Berth 5 site will be the reverse of the installation. Tow barge, multicat and/ or support vessels will be required to carry out these activities based on best practices and learnings from the installation phase. The specific vessels used are to be confirmed and will be determined from a review of the installation process.

3.5.7 Unscheduled site visits

In the event of an unscheduled site visit, depending on the level of criticality of the visits, either a small work boat to ferry crew or the Green Isle will be utilised.

3.6 Device monitoring systems

The monitoring and reporting of onboard status is organised at three different levels on the OE35. Each level will have its own data and acquisition (DAQ) with communication between the DAQ's and to an onshore data repository and server which will be used for interrogation online. These are:

- Hull integrity and security
- Power Take Off (PTO)
- Power Quality

The Hull integrity and security DAQ monitors the hull position with GPS to ensure the device is on station and monitors the feed from a wide range of sensors and instrumentation such as mooring loads, fire safety, lighting and hull security to ensure the OE35 is on station and in the correct condition to generate electricity. The Hull DAQ is interrogated by the PTO DAQ in order to assess the situation required for either PTO start-up or shut down.

The PTO level will determine the safe operation of the power generation system onboard. The PTO includes the air turbine, generator and all other electrical equipment, housed in the machine room, that is required to produce grid acceptable electricity. Also interrogated by the PTO DAQ is the water level in the plenum chamber along with the air and sea pressure. These measurements are used to assess the level of pneumatic power being converted by the turbine. The pressure and flow are measured in the ducting of the turbine along with rotational speed of the shaft and the vibration of the shaft bearings. Electrical quantities as well as temperature of the generator is also read.

The third DAQ determines the power quality of the exported electricity, following the requirements of the IEC TS-62600-30 Electrical Power Quality Requirements.

The primary method of data transfer is via the optical fibres in the umbilical and export cable. There are twelve fibres in the cables, and each DAQ will have a dedicate pair. As a backup to this, there will be a wireless system incorporated to transmit critical data to the shore-based server.

The alarm reporting system assess the condition of critical systems on board the OE35 and in the event of an alarm being triggered, the relevant recipients will be informed and based on the level of alarm triggered and appropriate response will be actioned. A level 1 alarm will indicate a significant failure of one or more systems onboard the device and the response will be to immediately interrogate the system online if possible but also to carry out a visual inspection of the device. The level of criticality of alarm and cause of alarm will have an identified responder and a defined action list.

The details of the instrumentation and sensor list, identification of alarms and responses will be developed as each system is developed during the project. The system design is based on the process that was implemented in the OE35 deployment at WETS Hawaii.

4 Proposed Schedule

Table 3. Project schedule

Site Surveying/ Commissioning	Q2 2026
Installation/ Deployment	Q2/ Q3 2026
Operation Duration	2026 - 2028
Decommissioning	Q4 2028

The project schedule will be updated and refined as Ocean Energy progress towards deployment.

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