Nova Innovation | OCEANSTAR Project

Project Information Document

EMEC Fall of Warness

December 2023

Document History

Revision	Date	Description	Originated by	Approved by
1.0	21/12/23	Final draft for issue to MD-LOT	Kate Smith	Gavin McPherson

Disclaimer

Contents

1 Introduction

1.1 Purpose of document

Nova Innovation (Nova) seeks permission to install, operate and decommission a 10 MW tidal array (the "OCEANSTAR Project") at the EMEC Fall of Warness tidal site Eday, Orkney Islands. The OCEANSTAR Project will comprise up to nineteen of Nova's seabed-based tidal turbines and associated offshore infrastructure.

The UK government recently announced that it has increased the maximum price for tidal energy projects by 29% in its Contract for Difference (CfD) renewables support scheme. This announcement, ahead of CfD Allocation Round 6 (AR6) in March 2024 provides the economic certainty required to enable projects like OCEANSTAR to contribute to achieving Net Zero and to maintaining UK's position as a global leader in tidal energy.

To qualify to bid in AR6 projects must have consents in place. The 10 MW OCEANSTAR (Ocean Subsea Tidal Array) project will be implemented under EMEC's site-wide licence for the Fall of Warness under Section 36 of the Electricity Act 1989. Nova is also required to obtain a marine licence from The Scottish Government Marine Directorate under Section 20(1) of the Marine (Scotland) Act 2010.

This Project Information Document (PID) provides Marine Directorate Licensing Operations Team (MD-LOT) and their consultees with information on the OCEANSTAR Project to support Nova's application for a marine licence. This document forms part of the marine licence application and is accompanied by the following additional documents:

1. Marine Safety Navigational Risk Assessment[1].
2. Project Environmental Monitoring and Mitigation Plan[2].
3. Decommissioning Programme[3].

EMEC and Nova will work together to manage installation of OCEANSTAR Project offshore infrastructure and associated activity to ensure that the project is installed and operates in accordance with site-wide consents for the Fall of Warness, both alone and in combination with other activities at the site. This is considered further in Section 1.4 of this document and in the additional OCEANSTAR documents listed above, to provide reassurance to MD-LOT, its advisors and other stakeholders that if a marine licence is awarded, **the OCEANSTAR Project will be implemented and managed in strict accordance with site-wide consents**. This will ensure that the envelope of development across the site and the corresponding predicted impacts is strictly maintained within consented levels, so that the **total number of devices deployed (or any other parameter) does not breach any limit in the overarching section 36 consent for Fall of Warness**.

[1] OCEANSTAR Project Navigational Risk Assessment Addendum, EMEC Fall of Warness. December 2023. pp27.
[2] OCEANSTAR Project Environmental Monitoring & Mitigation Plan, EMEC Fall of Warness. December 2023. pp28.
[3] OCEANSTAR Project, EMEC Fall of Warness. Decommissioning Programme. December 2023. pp16.

1.2 Company background

Nova is one of the world's leading players in driving forward the development of the nascent tidal stream energy industry. Nova was the first in the world to deploy an offshore array of tidal stream turbines (in 2016 in Bluemull Sound, Shetland), and since then its turbines have clocked up more than 65,000 generating hours. Of approximately fifteen offshore tidal stream turbines that are currently deployed around the world, three are Nova's: designed and manufactured in Scotland. Headquartered in Edinburgh, Nova has so far grown to over 30 staff.

1.3 Project overview

The OCEANSTAR Project will have a total installed capacity of 10 MW and involve the deployment of up to nineteen of Nova's 'next generation' M-series direct drive turbines at the Fall of Warness site at EMEC, Orkney Islands. The 'Oceanstar' turbines will each have a power rating of approximately 500 kW. The total generation capacity of the array will not exceed 10 MW and the total number of devices deployed will not breach the limit in the overarching section 36 consent for Fall of Warness. An offshore electrical hub, intra-array cabling and a remote observation platform for environmental monitoring will also be installed as part of the OCEANSTAR Project.

The OCEANSTAR Project will be installed and commissioned in two phases. Phase 1 will comprise the installation, commissioning and monitoring of a single Oceanstar turbine in Q3/Q4 2025. All remaining turbines will be installed in Phase 2 in 2027. The OCEANSTAR Project will be operated at the Fall of Warness site for 25 years, following which decommissioning will take place in 2052.

The OCEANSTAR Project will demonstrate a step-up in Nova's turbine capacity and an increase in array size to up to nineteen turbines. This will showcase the growing maturity of the tidal energy sector, demonstrating bulk manufacturing of tidal energy devices, offshore electrical architecture, and deployment and operational methodologies for large multi-turbine tidal arrays.

The project will also provide the opportunity to understand the environmental effects of tidal at large array scale. In doing so it will de-risk future, larger projects, paving the way for the growth of tidal energy as a sustainable, predictable energy source.

The largest tidal array deployed to date is Nova's Shetland Tidal Array in Bluemull Sound, Shetland. The devices for this array were ordered and built in small batches, which limited the potential to benefit from economies of volume in procurement, manufacturing, deployment and operation. At up to nineteen devices and 10 MW capacity, the OCEANSTAR Project will enable Nova to build and demonstrate a manufacturing assembly line for tidal energy devices, and bulk delivery and deployment of the turbines to the site, alongside delivery of the SEASTAR project, also at the Fall of Warness.

Nova has previously demonstrated operations and maintenance (O&M) of single devices and of small batches of turbines at the Shetland Tidal Array. This included a planned annual service of 3 turbines, which was undertaken over a 3 week period in 2020. Through the OCEANSTAR Project Nova will take this to the next level, by developing and demonstrating streamlined O&M strategies and procedures aimed at minimising downtime, maximising reliability and reducing the cost of energy for tidal power.

1.4 OCEANSTAR Project and Fall of Warness project envelope

Table 1 details the key parameters of offshore technologies and associated infrastructure that may be deployed at the EMEC Fall of Warness site under the 10 MW and 50 MW site-wide consents.

Parameters of the 10 MW consent are as stipulated in the site-wide licence issued by Marine Scotland (operational name) on behalf of Scottish Ministers under Section 36 of the Electricity Act 1989 for the Fall of Warness. The details for the 50 MW consent (not yet issued) are based on the project envelope assessed within the supporting Environmental Impact Assessment (EIA). The final column provides the parameters of the OCEANSTAR Project.

Table 1. Key parameters of 10 MW and 50 MW site-wide consents for the Fall of Warness. Final column provides project-specific values for the OCEANSTAR Project.

Parameter	10 MW consent	50 MW consent	OCEANSTAR Project
Maximum installed capacity	10 MW	50 MW	10 MW
Maximum number of devices	12	35	≤ 19
Maximum number of rotors	18	Not specified	≤ 19
Maximum rotor diameter	25 m	Not specified	13.5 m
Maximum swept area per device	Not specified	5000 m^2	143.1 m^2
Minimum depth surface clearance	2.5 m	2.5 m	10 m
Total materials deposited per device	Not specified	2000 tonnes concrete/densecrete 2000 tonnes steel/carbon steel 100 tonnes plastic/synthetic	46 tonnes steel 7 tonnes plastic/synthetic
Total materials deposited per substructure	Not specified	4000 tonnes concrete/densecrete 4000 tonnes steel/carbon steel	332.5 tonnes concrete 50 tonnes steel
Total seabed coverage per device	Not specified	750 m^2	550 m^2 (Direct contact = 3 m^2)
Maximum number of electrical hubs	Not specified	8	1
Maximum seabed coverage of hubs	Not specified	500 m^2	25 m^2
Total material deposited per hub	Not specified	500 tonnes concrete/ densecrete 1000 tonnes steel/carbon steel 100 tonnes Plastic/synthetic	60 tonnes concrete 100 tonnes steel 5 tonnes plastic/synthetic

The offshore infrastructure associated with the OCEANSTAR Project is within the envelope of parameters specified for the 50 MW Fall of Warness site-wide consent[4]. The 10 MW Section 36 consent allows for a maximum of 12 turbines. **EMEC and Nova will work together to manage installation of OCEANSTAR offshore infrastructure and associated activity to ensure that the project is installed and operates in accordance with site-wide consents for the Fall of Warness, both alone and in combination with other activities at the site. This includes**

[4] At the time of writing, a site-wide Environmental Impact Assessment (EIA) is underway to support an application for a 50 MW licence under Section 36 of the Electricity Act 1989 for the Fall of Warness.

ensuring that the total number of devices deployed (or any other parameter) does not breach any limits of the overarching section 36 consent for Fall of Warness.

Table 2 details the key parameters of offshore works associated with activities at the Fall of Warness, as included in the 'worse case scenarios' assessed within the EIA for the 10 MW and 50 MW site-wide Section 36 licences. The final column provides the corresponding parameters for the OCEANSTAR Project.

Table 2. Key parameters of offshore works associated with activities carried out under 10 MW and 50 MW site-wide consents for the Fall of Warness. Final column provides project-specific values for the OCEANSTAR Project.

Parameter	10 MW consent	50 MW consent	OCEANSTAR Project
Pre-installation activities at Berth	Not specified	Up to 1 week	Up to 1 week
Installation activities	Not specified	Typical duration of up to 1 month per device (maximum of 7 days of drilling per device)	Typical duration of up to 6 days per device.
Inspection and maintenance activities	Not specified	Regular intervals over 3-12 months	Scheduled maintenance once every 5 years (all turbines in one operation). Unscheduled maintenance up to 2-3 times per year (worst case scenario)
Temporary retrieval and redeployment of nacelle, gravity foundations, anchors or scientific equipment	Not specified	Typical duration of up to 1 month	Typical duration of up to 3 neap tides per turbine (allowing contingency)
Inspection, maintenance and replacement of cables and protection	Not specified	Typical duration of up to 1 week	Typical duration of up to 3 neap tides (allowing contingency)

The offshore works and activities associated with the OCEANSTAR Project are within the 10 MW and 50 MW consented envelopes for the Fall of Warness. **EMEC and Nova will work together to manage installation of OCEANSTAR offshore infrastructure and associated activity to ensure that the project is installed and operates in accordance with site-wide consents. Any interaction with Nova's SEASTAR project will also be managed, as well as other developer activity at EMEC, to ensure that any limits of site-wide consents are not exceeded.**

2 Technology

2.1 Turbine technology background

Nova's M-series seabed-based direct drive tidal turbine that will be utilised in the OCEANSTAR Project is the culmination of 12 years of technology development, demonstration and refinement.

The project builds on the work of Nova's operational tidal array in Shetland (which has achieved over 65,000 cumulative turbine generating hours and counting), our manufacturing capability, our R&D innovation and our deployment experience over the last 12 years, supported by private investors, international governments, and other sources.

Details of the Oceanstar turbines and associated offshore infrastructure for the OCEANSTAR Project, for which Nova is applying for a marine licence, are provided in the following sections.

2.2 Turbine description

The M-series Oceanstar turbine that will be utilised in the OCEANSTAR Project is the next generation of Nova's direct drive turbines, building on the success and learnings of the proven M100-D, shown in Figure 1.

Figure 1: Nova's M100-D turbine with its substructure being prepared for deployment at the Shetland Tidal Array, Bluemull Sound. *Source: Copyright © Nova Innovation 2020*

The new Oceanstar devices will use the same direct drive technology as the M100-D but will have a power rating of approximately 500 kW. Total project capacity will not exceed 10 MW and the total number of devices deployed will not breach the limit in the overarching section 36 consent for Fall of Warness. Weighing approximately two times the proven turbine design, the Oceanstar devices will use the same main design features and well proven installation methods.

The Oceanstar turbine has been designed by Nova for operation in tidal sites of depths from 23 m to 53 m with maximum spring tide flow speeds of up to 4.5 m/s. The device consists of a gravity moored base structure, with a detachable steel nacelle containing the drive train, and two bladed horizontal axis rotor, designed for bi-directional operation, eliminating the need for a yaw mechanism. The base consists of a steel structure with concrete/steel ballast positioned on three feet.

The Oceanstar turbine has a rotor diameter of 13.5 m, and a rotor hub height of 13 m. The height from the bottom of feet to the tip of the blades is 19.75m. The devices will be located at depths that ensure that during operation all parts of the turbine are at least 10 m below Lowest Astronomical Tide (LAT) to allow ample draft clearance for shipping[5]. Each device uses a ballasted gravity foundation and therefore requires no other mooring system. Dimensions of the Oceanstar turbines are provided in Figure 2 and Table 3.

[5] This is further considered in the OCEANSTAR Navigational Risk Assessment.

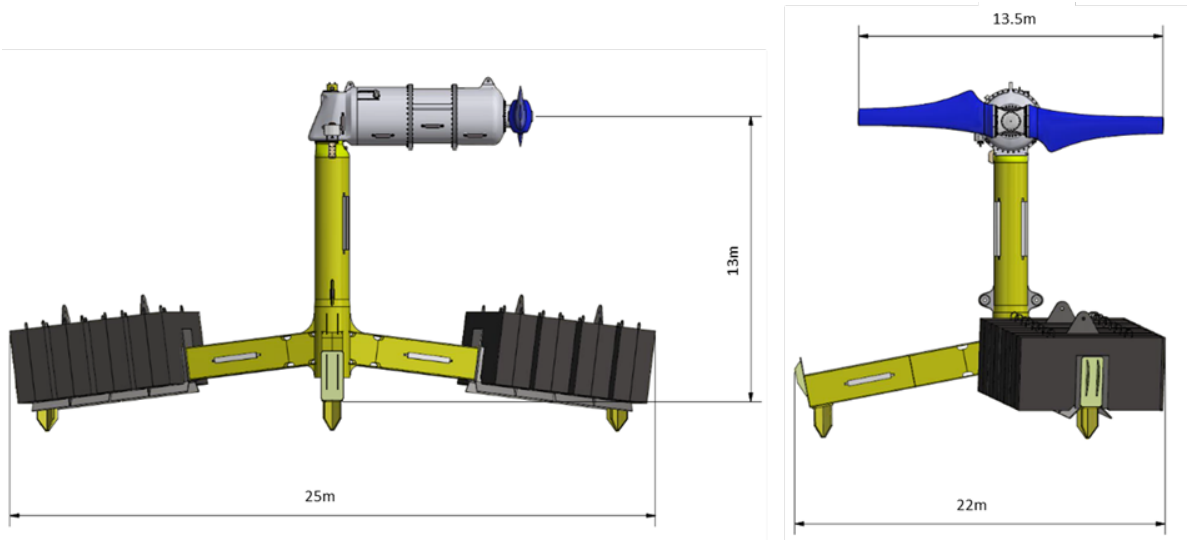

Figure 2. Dimensions of Nova's Oceanstar turbine. *Source: Copyright © Nova Innovation 2023*

Table 3. Key dimensions and weights of Novas' Oceanstar turbine.

Parameter	Value
Nacelle weight	46 tonnes steel 7 tonnes plastic/synthetics
Steel substructure weight (inc. cable attachment)	50 tonnes
Concrete ballast blocks (each)	9.5 tonnes (35 per turbine)
Total weight	435.5 tonnes
Rotor hub height	13 m
Rotor diameter	13.5 m
Blade tip height	19.75 m
Substructure plan view footprint	22 m x 25 m
Points of contact with seabed	3

Source: Copyright © Nova Innovation 2023

The Power Take-Off (PTO) of the Oceanstar turbine consists of a highly efficient and reliable direct drive generator. This is a larger version of the 90kNm generator used in the M100-D (capable of generating up to 250kW), which was demonstrated under the Horizon 2020 funded D2T2 project, which completed in March 2020. The results (validated by independent expert third party Wood) from onshore and offshore testing have confirmed that the direct drive PTO provides a substantial improvement in terms of cost and performance. As with the M100-D device, the power electronics and transformer components are located in the Oceanstar turbine. Other systems such as structural and electrical connections will be based on the systems currently in use at Nova's Shetland Tidal Array in Bluemull Sound. The device includes onboard power electronics, so can supply grid-compliant power directly to the grid. Connection voltage is 3.3 kV (at turbine) to 11 kV (shore voltage).

2.3 Third Party Verification

The OCEANSTAR Project builds on the work of Nova's operational tidal array in Shetland, our manufacturing capability, our R&D innovation and our deployment experience over the last 12 years, supported by private investors, international governments, and other sources.

The Nova M-series seabed-based horizontal axis direct drive tidal turbine that will be deployed in the OCEANSTAR Project is the culmination of this 12 years of technology development, demonstration and refinement. The Oceanstar turbine has been designed by Nova for operation in tidal sites of depths from 23 m to 53 m with maximum spring tide flow speeds of up to 4.5 m/s. As with Nova's M100-D turbine, independent verification of the Oceanstar turbine will be provided by an independent expert third party (third party to be confirmed).

2.4 Array layout

The turbines in the OCEANSTAR Project will be installed at EMEC's Fall of Warness site west of Eday, Orkney Islands. The turbines will be aligned such that their rotors are perpendicular to the primary flow. The precise location and layout of the array will be finalised during the project development phase. The total number of devices deployed will not breach the limit in the overarching section 36 consent for Fall of Warness. Figure 3 shows the currently proposed location and layout of the turbine array to the north of the OCEANSTAR Project area detailed Section 3.1. The purple line shows the array boundary, with the indicative array layout as one row of up to ten turbines and one of up to nine turbines, delineated by the red rectangle. Further details of the project area, including coordinates are provided in Section 3.1.

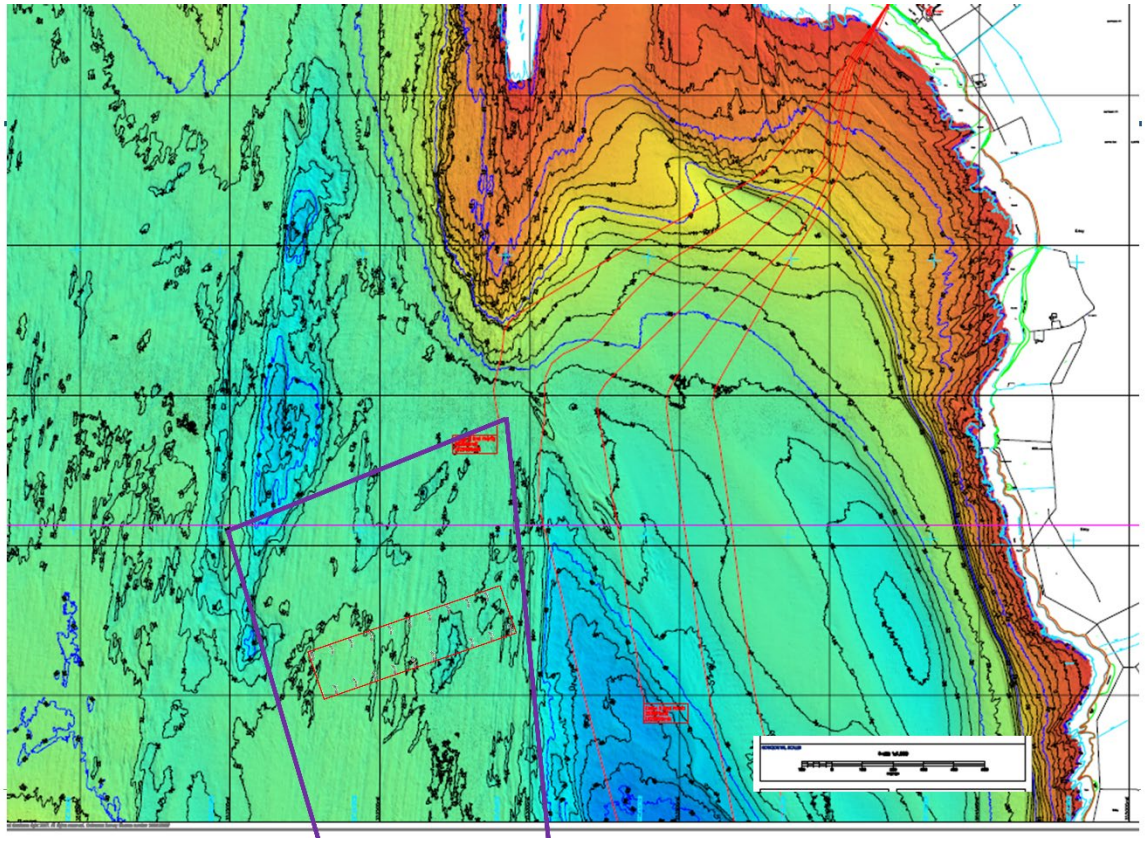

Figure 3. Proposed layout of the turbines in the OCEANSTAR Project.

Figure 4 shows the front elevation profile of the array, viewed from the north in the direction of flow. Turbines within each row will be spaced 67.5 m apart (between rotor centres). The two rows of turbines will be separated by 135 m. The total maximum array area will be approximately 175 m by 660 m. This proposed layout leaves ample room for navigation by vessels above the array – just as vessels have passed over Nova's turbines in Bluemull Sound since 2014 without incident. This means there is no risk of interaction between the array turbines and navigation, including during poor weather when inter-island ferries may traverse this area. A full Navigational Risk Assessment for the OCEANSTAR Project is provided in a separate document.

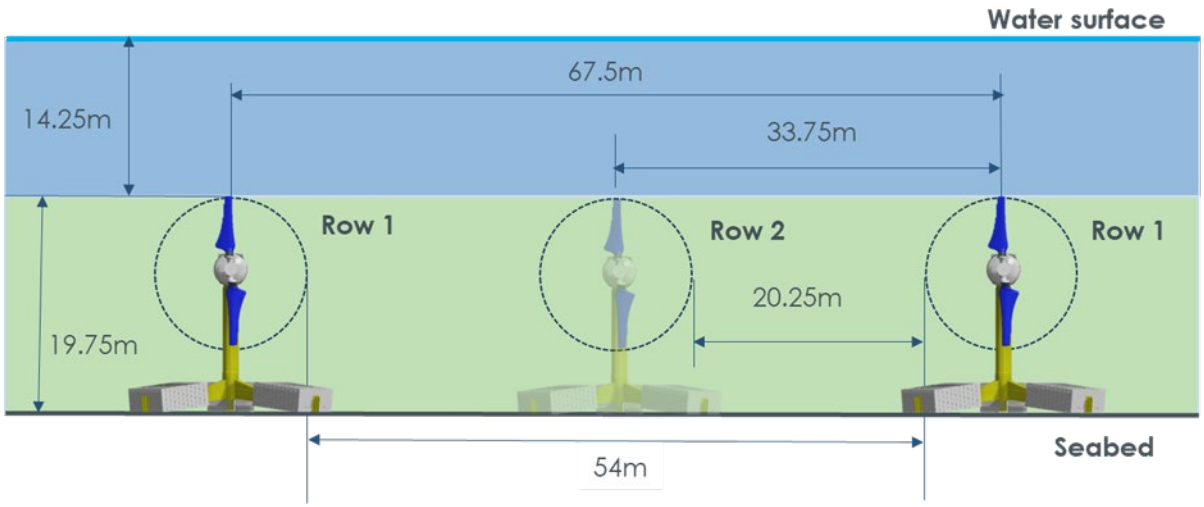

Figure 4. Front elevation profile of the array, viewed from the north.
Source: Copyright © Nova Innovation 2023

2.5 Offshore electrical hub

An offshore electrical hub will be utilised in the OCEANSTAR Project to minimise the number of export cables to shore. The hub will be located within the existing EMEC site boundary in a suitable site that complies with EMEC's site-wide Navigation Risk Assessment for the Fall of Warness. If the hub is a floating structure, it will likely be sited in a sheltered location, agreed with EMEC and identified as being suitable for surface piercing devices. Careful micro-siting will be used for all project infrastructure, informed by discussions with navigational stakeholders, including Orkney Ferries, to ensure safe navigable channels.

The hub will consist of multiple cable terminations (from the intra-array cables) which feed into the transformer via circuit breakers. A cable termination and short jumper cable will then attach to the export cable end-connection.

The hub will consist of a steel hull-structure, with copper, iron and a limited quantity of oil in securely sealed subsystems. The hub will be designed for either permanent or temporary flotation. It will be marked appropriately using buoys/markers and lights. A full Navigational Risk Assessment for the OCEANSTAR Project and any corresponding mitigation measures, including for the offshore hub, is provided in a separate document.

2.6 Intra-array cables

Intra-cables will be used to connect the turbines with the offshore electrical hub, which will then connect to the export cable(s). They will carry both power and communication. All cables will consist of a number of copper conductors and optical fibres, protected by a double armour layer and HDPE sheath. An indicative cross section is shown in Figure 5. The intra-array cables will be laid directly on the seabed, without the need for any additional protection (e.g., concrete mattresses). They are sufficiently heavy to remain in position without the need for additional securing. A similar cable specification has been successfully used at Bluemull Sound.

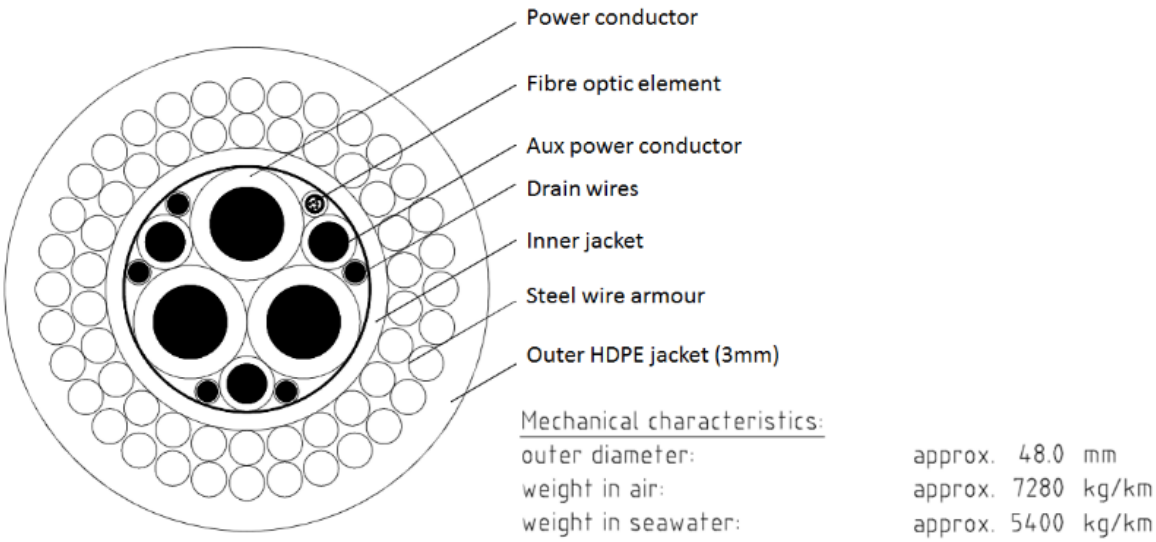

Figure 5. Intra-array cable cross section.

2.7 Export cable

The OCEANSTAR Project will utilise export cables at EMEC that are connected to its onshore station.

2.8 Materials used

Table 4 provides details of the materials to be used in the construction of the OCEANSTAR Project.

Table 4. List of materials to be used in the OCEANSTAR Project.

Components	Type of Deposit	Nature of Deposit	Deposit Quantity	Contingency Allowance
Turbine + rotor x 19 max total	Steel nacelle containing shaft (steel), generator (steel + copper), power converter (electronic components) & transformer (iron, copper, small quantity of biodegradable oil). Rotor consists of hub (steel) & blades (composite outer with steel core).	Permanent	46 tonnes steel each 7 tonnes plastic/ synthetics each	20%
Substructure + cable backpack x 19 max total	Steel	Permanent	50 tonnes each	20%
Ballast blocks x 665 max total	Concrete & steel reinforcement, 35 blocks per device.	Permanent	9.5 tonnes each	20%
Cables (intra-array)	Copper, HDPE, glass fibre, steel armour	Permanent	19.3 kg/m 30 km total	20%
Cable (to shore)	Copper, HDPE, glass fibre, steel armour	Existing	N/A	N/A
Offshore electrical hub x 1 total	Hub: steel Transformer: iron, copper, small quantity of biodegradable oil, plastic/synthetics	Permanent	100 tonnes steel and 5 tonnes plastic/ synthetics	20%

Components	Type of Deposit	Nature of Deposit	Deposit Quantity	Contingency Allowance
Hub/hub mooring ballast	Concrete	Permanent	60 tonne	20%

Source: Copyright © Nova Innovation 2023

3 Project Description

Key elements of the OCEANSTAR Project are as follows:

- Up to 19 turbine nacelles.
- Up to 19 gravity-base steel sub-structures and concrete ballast.
- An offshore electrical hub (either floating or seabed based, to be determined).
- Intra-array cabling.

See Section 2 for details and diagrams.

3.1 Offshore location

The turbines in the OCEANSTAR Project will be installed at EMEC's Fall of Warness site west of Eday, Orkney Islands, shown in Figure 6.

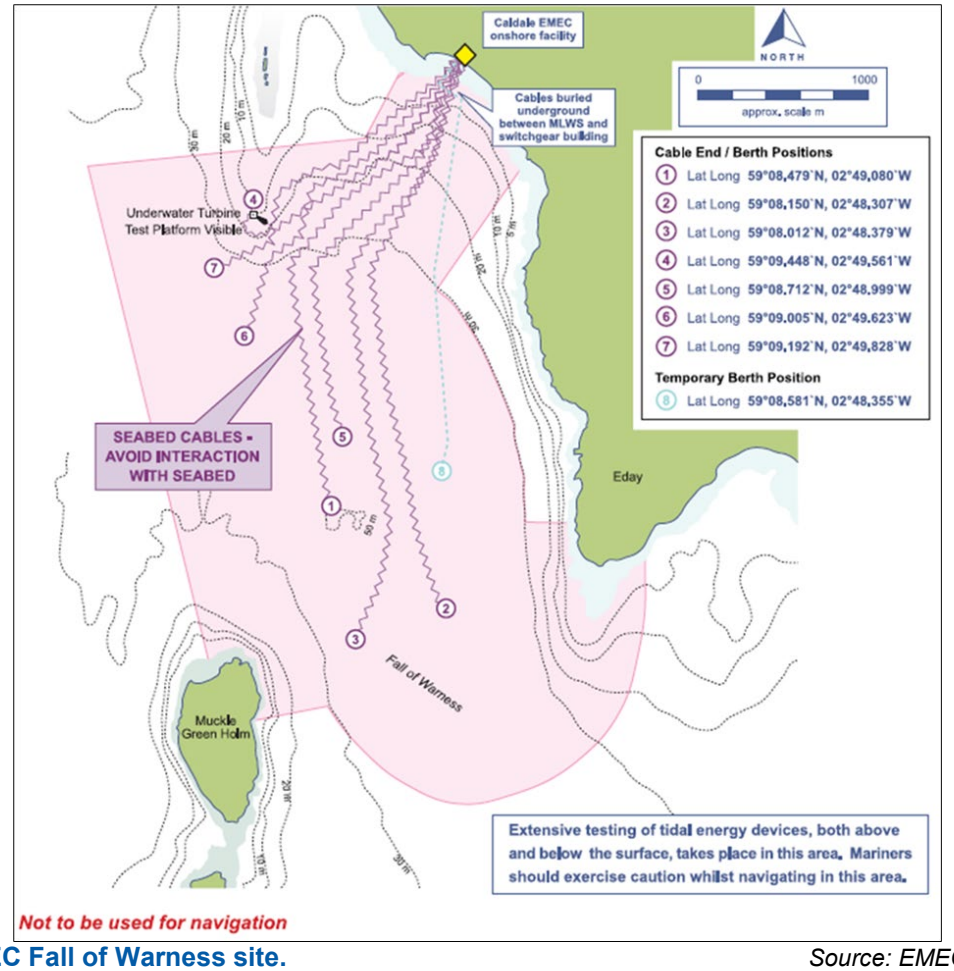

Figure 6. EMEC Fall of Warness site. *Source: EMEC 2022*

Table 5 provides coordinates for the OCEANSTAR Project area at the Fall of Warness site within which the array will be located.

Table 5. Coordinates of the OCEANSTAR Project area at the Fall of Warness.

Location Description	Latitude and longitude (WGS 84)	UTM Eastings	UTM Northings
Array centre point	59° 08' 48.516" N 2° 49' 49.587" W	509700	6556411
OCEANSTAR Project area boundary points	59° 08' 58.524" N 2° 50' 26.736" W 59° 09' 12.611" N 2° 49' 29.143" W 59° 08' 11.029" N 2° 49' 59.275" W 59° 08' 10.975" N 2° 49' 18.196" W	509109 510023 509549 510202	6556720 6557158 6555252 6555252

Source: Nova Innovation 2023

The red quadrilateral box in Figure 7 shows the OCEANSTAR Project area at the Fall of Warness site. The precise location and layout of the Oceanstar turbines within this area will be finalised during the project development phase and will be agreed with EMEC in a Berth Agreement. A proposed location and layout for the array to the north of this Project area, based on a preliminary assessment are provided in Section 2.4. The coordinates of the central point of the proposed array location is provided in Table 5.

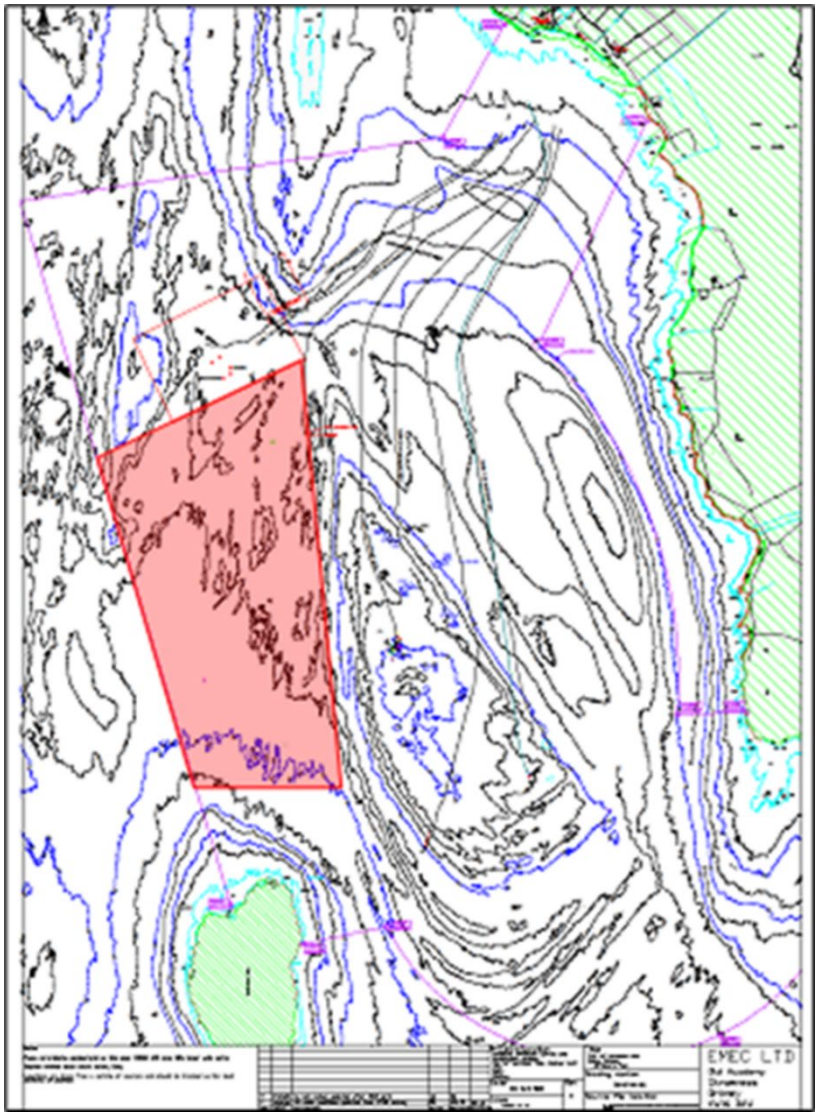

Figure 7. Location of OCEANSTAR Project area at the Fall of Warness.
Source: EMEC and Nova Innovation 2023

3.2 Site preparation

Site preparation will be minimal, consisting of existing cable inspection, and seabed and tidal current (ADCP) surveys.

3.3 Installation method

Tidal turbines and offshore infrastructure associated with the OCEANSTAR Project will be installed using methodologies developed, refined and demonstrated by Nova in the successful deployment of six devices in the Shetland Tidal Array. As with operations conducted by Nova in Shetland, a Multicat vessel will be used, with either a 4-point mooring or dynamic positioning system for positioning when required.

A detailed Construction Method Statement will be supplied post- consent, but all installation methods will be within the project envelope specified for the Section 36 licence for the Fall of Warness.

Offshore infrastructure installation will take place in the following sequence:

1. **Load-out turbine substructure and ballast.**
   The turbine substructure and concrete ballast units will be assembled at a nearby facility or barged to load-out location. A crane will transfer the steel substructure into the water.

2. **Ballast turbine substructure.**
   The substructure will be picked up with a Multicat and transported to a sheltered local position near to the deployment site. The Multicat will pick up the ballast units and lower them onto the relevant locations on the turbine substructure.

3. **Deploy turbine substructure.**
   The ballasted substructure will be picked up and transited the short distance to the deployment location. Once on site, the ballasted substructure will be lowered to the seabed with equipment used to control the position and orientation of this once deployed. Remaining ballast will be deployed on-site, as demonstrated at the Shetland Tidal Array.

4. **Deploy offshore electrical hub and carry out shore cable connection.**
   The offshore electrical hub will be transported by Multicat vessel from Kirkwall harbour. The Multicat will recover pre-deployed export cables (connected to EMEC's onshore station) and connect them to the offshore hub. The hub will be made secure at its final location and marked using buoys and lights as required.

5. **Deploy intra-array cables.**
   Intra-array cables will be installed using a Multicat vessel from a nearby pier. Using 4-point mooring or DP control, the Multicat will lower the turbine-end of each cable (known as a backpack) onto the corresponding substructure. The cable will then be laid until clear of the substructure area. Once released from the moorings (if used), the cable will be laid along a predetermined course (avoiding other array components) to the offshore hub, where it will be connected. This process will be repeated for all intra-array cables. No additional deposits are expected to be required to secure the cables.

6. **Deploy nacelle.**
   The Multicat vessel will collect the turbine nacelle from Kirkwall Harbour and carry it to the installation location. The nacelle will be lowered from the vessel to the substructure, to which it will be mechanically locked. The electrical connection is made by a remotely actuated wet-mate connector.

Nova does not plan to use any ROVs or divers during operations throughout the OCEANSTAR Project. Operations are designed not to require divers or ROVs and have been conducted accordingly, several times by Nova at the Shetland Tidal Array. Equipment deployment and recoveries will be carried out using a combination of the main vessel winch and the vessel HIAB crane, plus vertically lowered and surface-actuated recovery tools.

3.4 Removal method (maintenance)

Scheduled maintenance will take place in summer every 5 years, with each turbine being recovered to Kirkwall for maintenance before being redeployed at the site. All turbines will be serviced in a single operation every 5 years. Unscheduled turbine maintenance is anticipated to be required up to 2-3 times per year. The stages involved in this process are set out below.

1. **Nacelle retrieval.**
   A release mechanism is activated by the service vessel using a Launch and Recovery System (LARS) recovery tool which is lowered vertically. This releases the nacelle from the base from where it is lifted to the surface, secured to the vessel and removed to Kirkwall for servicing. Temporary marker buoys may be used.

2. **Redeployment.**
   On completion of servicing, the nacelle is returned to the site; the device is lowered onto the base using the LARS and the structural connection is completed. The LARS is then recovered.

At the end of the project life all offshore infrastructure will be completely removed from the site. Device removal is carried out using the same method as deployment (in reverse), as has been demonstrated at Shetland Tidal Array. Once the devices and all associated equipment have been removed, the seabed and surrounding locality will return to their natural state with no permanent impact from the devices.

Full details are set out in a separate Decommissioning Programme for the OCEANSTAR Project.

3.5 Vessels

Although larger than the previous generation, the small scale and modularity of Nova's Oceanstar turbines has been carefully chosen to mean that only one multicat workboat vessel is required to carry out offshore works. Typical workboats or multicat workboats such as MV C-Odyssey as shown in Figure 8, or similar, with lengths no greater than 28 m and draught up to 4 m will be used.

Figure 8. Representative turbine deployment and retrieval vessel (Leask Marine C-Odyssey).
Source: Leask Marine

The vessels to be used for offshore operations will be determined in advance of the operation depending on availability. Only vessels on EMEC's approved list of operators will be used for offshore operations.

The size and operational capability of vessels will be as follows:

1. Surveying: small local boat or Multicat vessel (see above).
2. Deployment and retrieval: Multicat vessel.

Offshore operations will be carried out during appropriately slack tides with suitable wave and weather conditions. The installation will be managed by Nova Innovation staff who will be resident in Orkney for the project. All work will be accompanied by the relevant notifications, as set out in the Navigational Risk Assessment for the OCEANSTAR Project.

Operations will typically take place during neap tides and, when possible, will be scheduled during the summer months for improved weather and daylight conditions, however Nova has experience in Shetland deploying, recovering and decommissioning devices in all seasons and during neap and spring tides.

Deployment of substructures and nacelles will take place in two phases. Phase 1 will comprise the installation, commissioning and monitoring of a single turbine in Q3/Q4 2025. All remaining turbines and offshore OCEANSTAR infrastructure will be installed in Phase 2 over a period of 28 weeks covering 14 neap tides during the summer of 2027.

Scheduled maintenance will take place in summer every 5 years, with each turbine being recovered to Kirkwall for maintenance before being redeployed at the site. The full scheduled maintenance operation will take place over 4 weeks during 3 neap tides.

Unscheduled maintenance will be conducted as required, with the recovery of affected turbines to Kirkwall for maintenance before being redeployed at the site. Each recovery/redeployment operation will take approximately 1 day. Nova anticipates up to 2-3 unscheduled maintenance events each year.

Decommissioning is scheduled to take place over 28 weeks during 14 neap tides in summer 2052.

Only one vessel will be on any work-site at any given time during the OCEANSTAR Project. A maximum of two vessels may be present in the project area, but they will be working in different areas e.g. the temporary ballast zone and the final deployment zone.

The equipment deployment and recovery tasks to be carried out are of the same type that Nova has been carrying out routinely in Shetland since 2014. The local harbour master and other vessels that frequent the Fall of Warness site are familiar with these or similar operations, as are the identified vessel providers. No special vessel management arrangements are required, beyond the standard EMEC protocols.

The harbour master, Orkney Islands Council Harbour Authority and Shetland CGOC (which covers both Orkney and Shetland) will be advised in advance of all operations. All quayside and harbour works will be undertaken in compliance with the direction of the harbour master.

All vessels involved in the installation, maintenance and decommissioning of the device will comply with all aspects of the International Regulations for Preventing Collisions at Sea (COLREGS). All vessels used will carry all equipment as required under the vessels' registration, e.g. the Code of practice for the safety of small workboats and pilot boats.

Notices to Mariners will be used to inform stakeholders of offshore operations. During all offshore operations we will adhere to the good practice guidelines associated with the Scottish Marine Wildlife Watching Code, hard copies of which are kept in Nova’s offices and onboard all vessels engaged in operations.

A full Navigational Risk Assessment for the OCEANSTAR Project and any corresponding mitigation measures is provided in a separate document.

3.6 Device monitoring systems

Following successful commissioning, performance monitoring of the devices will be undertaken remotely via a fibre optic cable. This will allow the devices to be monitored either from the shore or remotely via a secure internet connection in the EMEC substation on Eday.

The fibre optic cable is embedded in the power cables for each turbine and can be accessed by a secure ISDN/broadband communications link, allowing each individual turbine to be accessed remotely over the internet. It is also therefore possible to control and monitor the turbines locally and remotely from Nova's Edinburgh office.

All important or emergency signals are sent automatically via internet and SMS to Nova engineers who can log on and monitor the devices.

An OCEANSTAR Project-specific Emergency Response and Cooperation Plan (ERCOP) will be developed in agreement with MCGA, with a copies stored in EMEC's office, in Nova's office, and with another brought aboard any vessel by the Nova Representative overseeing any offshore operations.

3.7 Environmental monitoring systems

A programme to monitor the presence and behaviour of marine wildlife around the operational turbines has been developed following a review of the potential for the project and associated activities to result in adverse environmental impacts.

Nearfield wildlife monitoring around the turbine will use turbine-mounted optical cameras and a seabed-based remote observation platform that will house optical cameras and a multibeam sonar. Full details are provided in the OCEANSTAR Project Environmental Monitoring and Mitigation Plan.

4 Project schedule

Prior to any installation works commencing, site investigations and preparation to inform OCEANSTAR Project development will be carried out.

The OCEANSTAR Project will be installed and commissioned in two phases, as follows:

1. Phase 1: Installation, commissioning and monitoring of a single turbine in Q3/Q4 2025.
2. Phase 2: Installation, commissioning and monitoring of all remaining turbines and other offshore OCEANSTAR infrastructure in 2027.

OCEANSTAR will be operated at the site for 25 years, following which decommissioning of all offshore infrastructure will take place in 2052. The proposed OCEANSTAR Project schedule is outlined in Table 6.

Table 6. Proposed OCEANSTAR Project schedule.

STAGE	Year										
	2023	2024	2025	2026	2027	2028	…	2049	2050	2051	2052
DEVELOPMENT											
PHASE 1 INSTALLATION											
PHASE 2 INSTALLATION											
OPERATIONAL PHASE											
DECOMMISSIONING											

The installation and commissioning of Phase 2 will take approximately 12 months, following which the array will be operated for up to 25 years. Following this, the OCEANSTAR Project will be fully decommissioned, in line with the methodologies in the approved Decommissioning Programme. Decommissioning will take place over 28 weeks during 14 neap tides in the summer of 2052.

EMEC and Nova will work together to manage installation of OCEANSTAR Project offshore infrastructure and associated activity to ensure that the project is installed and operates in accordance with site-wide consents for the Fall of Warness, both alone and in combination with other activities at the site. The total number of devices deployed (or any other parameter) does not breach any limit in the overarching section 36 consent for Fall of Warness.