ENVIRONMENTAL EFFECTS METADATA SURVEY FORM

Name	Date submitted
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Project name: Wello Penguin at EMEC

☐ Planned ☒ In Operation ☐Completed

Project description:

Project Developer: Wello Oy

Technology Developer: Wello Oy

Technology type: Rotating mass (Penguin)

Resource (wave, tidal): Wave

Project scale (test site, prototype, array, commercial): Full Scale Demonstrator

Installed capacity (MW): 500 kW

Project Website: www.wello.eu

Launch Date: 2011

Additional Description: Wello Oy (Wello) conducted a full scale demonstration of its 'Penguin' wave energy converter (WEC) at the European Marine Energy Centre's (EMEC's) wave test site facility at Billia Croo in Orkney, during 2011-2014. The device nominal capacity was 500kW and during operation, it fed electricity into the local grid via EMEC's pre-installed subsea cable. The device was installed at a new deep water berth (~60m) at the north end of the site.

Wello Penguin being tested at EMEC

The Wello Penguin produces electricity using a rotating mass encassed in a asymetrically designed hull which rolls with the pitch and heave of the waves. The rotation of the mass drives an electric motor which in turn produces electricity. The device itself is 9 metres high with a

draft of 7 metres, weighs over 1600 tonnes (excluding ballast) and has a width of 30 metres. The device is rated upto 500kW and 2013 testing showed that continuous current control ranges for the device were between 160 – 180 kWs with peak performance periods of up to 700kW in sea conditions of 3 metres and up.

Mooring deployment: The mooring system was pre-laid at the test berth. This part of the operation was completed using a multicat-type support vessel. During this process, the following was installed:

- Embedment anchors
- Clump weights and chains attaching each to an embedment anchor
- Subsurface buoys and associated lines/wires attached to clump weights
- Recovery lines and small surface buoys (to allow access to the subsurface buoys when attaching device tethers during device installation)

The multicat vessel used to deploy the mooring spread was fitted with survey equipment for accurate plotting, recording and positioning of the anchors. The multicat was then loaded with the anchors, buoys, the short mooring pennants and marker buoys. Each section of mooring spread was taken out and deployed using the anchor handling winch and roller of the multicat. The anchor was rendered out to the required position on the seabed followed by the ground chain clump weight and riser wire, the main buoy was deployed followed by small mooring pennant and marker buoy and lastly a suitable messenger line to facilitate pick up of the marker buoy. This process was repeated for each of the three mooring sections. Once the anchors and sections of mooring were deployed the anchors were allowed to "soak" for at least 24 hours. On completion of the soaking period a tug was deployed and preceded to pick up each buoy and secured the short mooring pennant to its tow wire and then a suitable sustained pull will be applied to ensure that each of the anchors was fully bedded in.

Device deployment: The Penguin was towed from Lyness to the pre laid moorings at the EMEC test site at Billia Croo. The Penguin had a lead tug (multicat) and a stern tug to facilitate control during the tow and while the moorings were connected. A RHIB was also in attendance throughout on safety standby duties.

Electrical connection: After the Penguin had been attached and secured at its moorings and its roll plates deployed, the electrical connection was undertaken. An ROV with a manipulator was deployed and attached a pick up line from the EMEC cable connector to a pick up buoy on the surface. The cable from the Penguin has a diameter of 51mm and is 200 metres long.

Vessel Spread: The following vessels were used during construction and operation:

Name and type of vessel	Activity
Survey vessel (Lodesman)	Installation / operation. Undertake ROV surveys of the device and moorings
Tug (Einar / Green Isle)	Installation, decommissioning and unplanned maintenance. Act as stern tug from Lyness to Billia Croo, assist with mooring connection, provide safety/emergency response backup.
Large Multicat (Green Isle / C-Odyssey / C-Salvor)	Mooring and device installation, decommissioning, unplanned maintenance. Lay moorings, Main tow from Lyness to Billia Croo, assist with mooring and unmooring the device and with electrical connections.
General purpose Multicat and other vessels (Orcadia; Barge GM700)	Used if large multicat is unavailable.
RHIB (Blaze)	Mooring and device installation, decommissioning, planned maintenance. Transfer crew to and from the penguin, safety response.

Location: EMEC, Orkney (58° 59.58N, 003° 24.59W)

Licensing information: The project has an installed capacity of less than 1 MW; therefore no Section 36 Consent was required. In addition, EMEC test site deployments require no terrestrial planning applications. No Licence to Disturb European Protected Species or Basking Shark was required for this project, therefore only a Marine Licence was necessary.

Licence	Competent Authority	Reference
Marine Licence (Marine (Scotland Act) 2010	Marine Scotland	04064/12/2

Key Environmental issues: The following potential impacts were considered during the environmental assessment:

- Seabed disturbance during installation and removal of the mooring system
- Disturbance to marine mammals and fish from the presence of the mooring system and device
- Potential disturbance of marine mammals and fish from underwater noise
- Disturbance to other sea users from support vessel activity and sustained presence of structures offshore
- Change in local seascape through increased activity and sustained presence of the device
- Disturbance to seabed communities and during connection to and disconnection from the EMEC connector.
- Temporary change in water quality during installation and removal activities
- Effects on air quality from vessel emissions
- Effects on marine birds from vessel operations and device presence on the test site
- Effects on marine fish from EMF emitted during electricity transmission
- Effects on flows and fluxes from the presence of subsea structures
- Employment opportunities for local residents and businesses
- Utilisation of local infrastructure and subsequent investment in local services and economy
- Generation of marine renewable energy will contribute towards government targets

As shown, a number of potential interactions were identified that could potentially arise from the proposed deployment; however, **none of these were anticipated to have a significant effect on the particular receptors within the receiving environment**. This clearly demonstrates the benefits of Wello's approach to technology design and operational planning. The general character of the device and its mooring system, along with the ability to use vessels which are relatively small and can be locally sourced mean that the project is relatively benign in its nature and can bring significant benefits to local maritime support businesses.

Mitigation: The following project mitigation measures were identified during the environmental assessment and included in the project Commitments Register:

- Embedment anchors were selected which removes the need for any subsea excavation and minimises the footprint of the mooring system. This also allows the scale of the clump weights to be minimised - further reducing potential footprint
- The mooring system design allows the use of relatively small workboats; minimising underwater noise generated during activities
- The mooring system is also designed for rapid deployment; reducing time at sea
- Selection of mooring system lines (wire) under tension removes the possibility of entanglement
- Ensuring vessels are well maintained will reduce noise and potential for accidental events

- Noise generating components of the device are only required as back-up therefore any effects will be temporary and minimal
- The size and character of structure should minimise the risk of collision – it has no external moving parts
- Vessel anchoring will be limited to when necessary
- Placement of clump weights will be as accurate as possible to ensure minimal 're-positioning' manoeuvres
- Anchors and clump weights will as far as possible, be removed in a single attempt so as to reduce the duration of noise and other forms of disturbance
- The final stages of operational planning shall minimise sea time for tugs and workboats as far as practically possible
- The back-up cooling system will only be used when absolutely necessary, normally in rough weather where the sea itself will generate most noise
- Vessel crews will keep a lookout for sea mammals and basking sharks at all times.
- Vessel crews will be briefed on marine life sensitivities and will have ID materials supplied

- Vessel operations will be limited to quiet activities if marine mammals or basking sharks are in close proximity (<50 m) to the works, unless safety considerations require an activity to continue[1]

Supplementary Licence Conditions

The following supplementary licencing conditions were specified in the Marine Licence issued by Marine Scotland:

- The device shall be predominantly coloured yellow and fitted with a light flashing yellow once every five seconds (FL Y 5s) and visible from all directions. The light should be mounted on the highest part of the superstructure and have a nominal range of 2 nautical miles.
- The Licensee shall provide Marine Scotland with Third Party Verification of the mooring system prior to installation.
- The Licensee must comply with the Environmental Monitoring Plans (EMP) submitted in support of the Marine Licence Application. Prior to installation the EMP must be signed off and submitted to Marine Scotland.
- A passive radar reflector must be positioned on the highest part of the superstructure.
- Statutory Sanction of the Commissioners of Northern Lighthouses must be sought to Deploy and subsequently remove the proposed buoy station. The 'Application for Statutory Sanction' form enclosed with this letter must be completed as fully as possible for each buoy and returned to the Northern Lighthouse Board either via fax on 0131-220-0235 or via e-mail tonavigation@nlb.org.uk for the necessary sanction to be

[1] Aquatera Ltd, 2011Deployment of Wello Oy's wave energy converter at EMEC's wave test facility in Orkney Environmental Statement

granted prior to deployment. The proposed duration of deployment should be included within the sanction application[2].

[2] Marine Scotland, 2012, Marine Licence Determination Letter

Environmental webpage:

Baseline studies and project effects studies: Wello Oy EMEC				
General description	The following field surveys were undertaken (or commissioned by) the developer to inform project design and licence application process.			
Receptor	**Study description**	**Design and methods** (brief description)	**Results** (brief description)	**Status** (planned, underway, completed, with dates)
Geology	Triscom Marine and Osiris in association with Aquatera carried out a hydrographic and geophysical survey.	The survey was undertaken across a 1km by 1km survey area, lying to the north west of the Hoy Mouth, Orkney Islands. A total of 25 line km were surveyed consisting of 21 north-south main survey lines and 4 east-west cross lines. The primary objectives of the survey were to produce Isopachyte (total sediment thickness) and Seabed Features charts detailing the distribution of sediment cover across the survey area.	The sediments are granular (sands and gravels) and are thought to be of Quaternary age ranging in depth across the site from 0m – 11.5m. These Quaternary sediments are underlain by (Lower Devonian) Sandstone bedrock. Sediment cover tend to thicken from south west to north east, with the granular sediments most prominent in the central northern and north eastern sections of the survey area, where thicknesses reach up to 11.5m. Towards the south west, sediment thicknesses quickly decrease to a point where bedrock lays at, or very close to the seabed, possibly covered by a veneer of granular materials.	Completed 26-28th January 2011

Baseline studies and project effects studies: Wello Oy EMEC				
General description	The following field surveys were undertaken (or commissioned by) the developer to inform project design and licence application process.			
Benthic ecology	Aquatera and Roving Eye Enterprises were commissioned by Wello to undertake a pre-construction seabed survey.	A Seaeye Falcon observation-class ROV fitted with video and 12 MP stills camera systems was deployed from the survey vessel MV Loadsman. Accurate ROV position-fixing was achieved using a calibrated Ultra Short BaseLine (USBL) sonar system and the data overlaid on the video footage collected as UTM (Universal Transverse Mercator) coordinates. The survey protocol used was consistent with the guidelines issued by EMEC (ROV Seabed Survey Guideline REP167-02-02 20100210). The ROV was flown over the seabed at a suitable height to provide a general overview of the seabed characteristics. The transit of the ROV was paused to obtain steady video shots and still images of interesting seabed features, habitats or species encountered along the survey transects.	The seabed environment in the majority of the survey area was composed of rippled fine to medium sands situated in water depths of approximately 60 to 65 m. The seabed in the southwest corner of the area rocky with seabed being composed of pebbles, cobles and occasional boulders. The biota present in this area was more diverse and a range of species were observed, the most widespread being the polychaete *Pomatoceros triqueter*. Overall, the footage collected during the survey operations indicated that the seabed at the test berth was relatively homogenous and comprised of rippled fine-medium sands. This type of relatively high-energy seabed does not support a great abundance or diversity of benthic animals and no sensitive species or communities were recorded in the vicinity. A more diverse rocky seabed type is present to the southwest of the berth approximately 200 m from the nearest planned anchor point and should not be significantly impacted by operations at the site.	Completed 6th March 2011

Monitoring and adaptive management: Wello Oy EMEC				
General description	The following mitigation and monitoring measures were proposed within the project Environmental Monitoring Plan (EMP).			
Receptor	**Monitoring program description**	**Design and methods** (brief description)	**Results** (brief description)	**Status** (planned, underway, completed, with dates)
Seabed communities	Post deployment survey.	Compare with pre-installation survey footage and to investigate the status of the mooring system (refer to the EMP).	N/A	These surveys are no longer required by the Regulator.
	A post-decommissioning survey.	After all structures have been removed to establish the effects of the process on the seabed (refer to the EMP)	N/A	
Birds, marine mammals and fish	Acoustic monitoring of device cooling system.	Wello commissioned Heriot Watt University's International Centre for Island Technology and Aquatera to undertake acoustic environmental monitoring of the device's cooling system whilst the device was berthed alongside the quayside at Lyness.	The study examined the underwater sound pressure levels produced by the Wello Penguin's cooling system. The measured sound pressure levels suggest a source level of 140.5dBrms re 1µPa at 1m. Significant narrowband harmonics are evident generally at low frequencies although it is expected that ambient background noise levels to be reached within approximately 10m from the device. There was a degree of directionality of sound production due to the position of the equipment within the hull. Airborne noise could not be examined due to the generator used to power the device.	Completed – January 2012