Deployment of a Shallow Water Wave Energy Converter at the EMEC Billia Croo Test Site

Construction Method Statement

April 2018

Content

1 Introduction

This Construction Method Statement (CMS) will support the Marine Licence application for the installation, operation and decommissioning of a Wave Energy Converter (WEC) of the Belgian wave energy developer Laminaria NV. The CMS provides an overview of the commencement dates, working methods including the frequency and the hours of operation and information on key elements of the construction of the WEC.

1.1 Project background

Laminaria NV plans to install their first full-scale WEC (rated power: 200 kW) at the Billia Croo wave energy test site at the European Marine Energy Centre (EMEC) in August 2018. The WEC will be deployed in berth two for 18 months and the project will be fulfilled with the decommissioning of the WEC in September 2019.

The WEC consists of a buoyant Power Take Off (PTO) system (the main floater) and will be connected by four individual mooring lines to a variable buoyancy gravity base anchor. The mooring lines will transfer the main floater movements towards the PTO systems located at the bottom of the floater to convert the incident wave energy to electricity.

The following figures indicate the location of the Billia Croo test site (area which is marked with navigational cardinal buoys) and a rough indication of the deployment area of the WEC. The coordinates have been identified in a broader area than required to allow for micro-sitting of the WEC in the indicated area. This allows to locate the most appropriate deployment position with the least possible impact on seabed habitats. More details about the project can be found in the *Project Information Summary* of Laminaria.

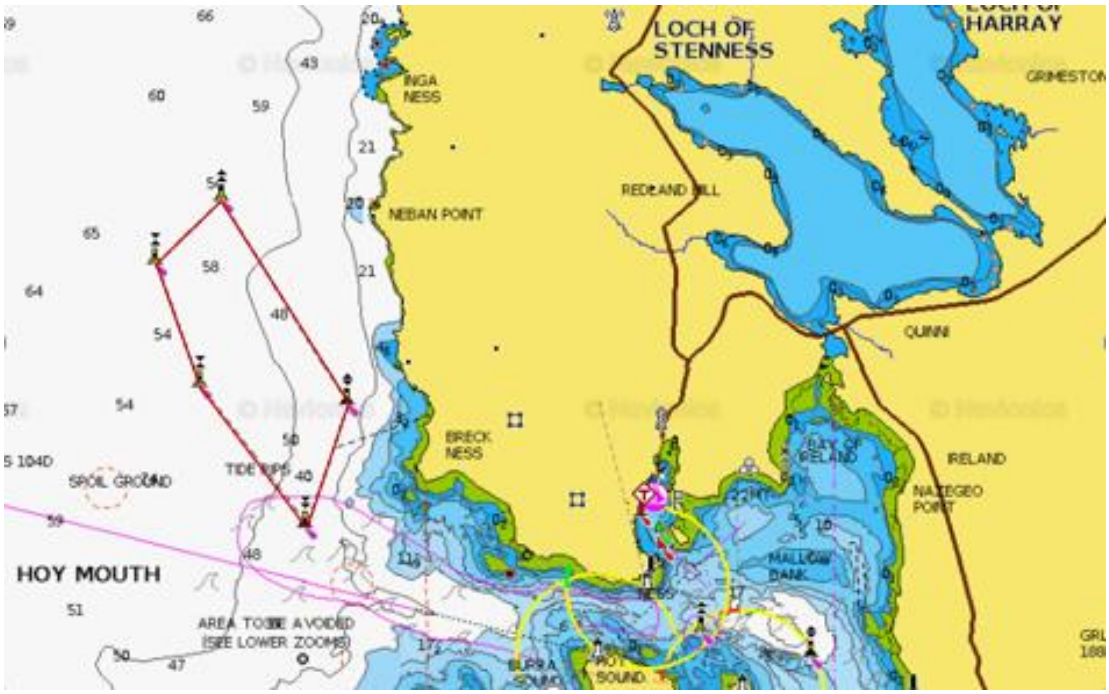

Figure 1: Indication of the Billia Croo wave energy test site[1]

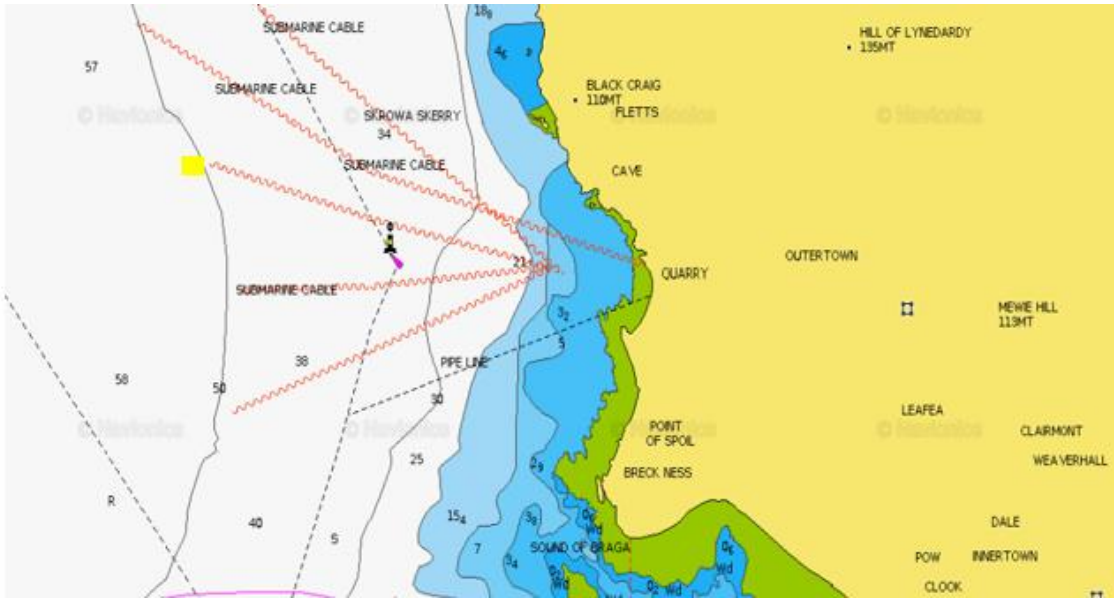

Figure 2: Indication of the deployment area of the Laminaria WEC[1]

2 Installation methods

This part of the CMS provides an overview of the installation methods for the different parts of the WEC. Due to the design of the Laminaria WEC, the installation can be fulfilled in one step.

[1] Chart from Navionics: https://webapp.navionics.com/?lang=en#boating@9&key=%7Df%7DfJb_%60S [09.03.2018]

2.1 WEC installation

The Laminaria WEC consists of one main floater (buoyant Power Take Off (PTO) structure) and a variable buoyancy gravity base anchor. The main floater will be connected to the anchor in Zeebrugge and towed to the Orkney Islands by a multi-cat vessel. The same multi-cat vessel will be utilised for the installation, recovery and decommissioning of the WEC. Additionally, the multi-cat vessel will be used to connect the umbilical, which is connected to EMEC's subsea cable, to the WEC by a cable terminator. Figure 3 shows a drawing of the overall assembly during the towing of the WEC from Belgium to Scotland.

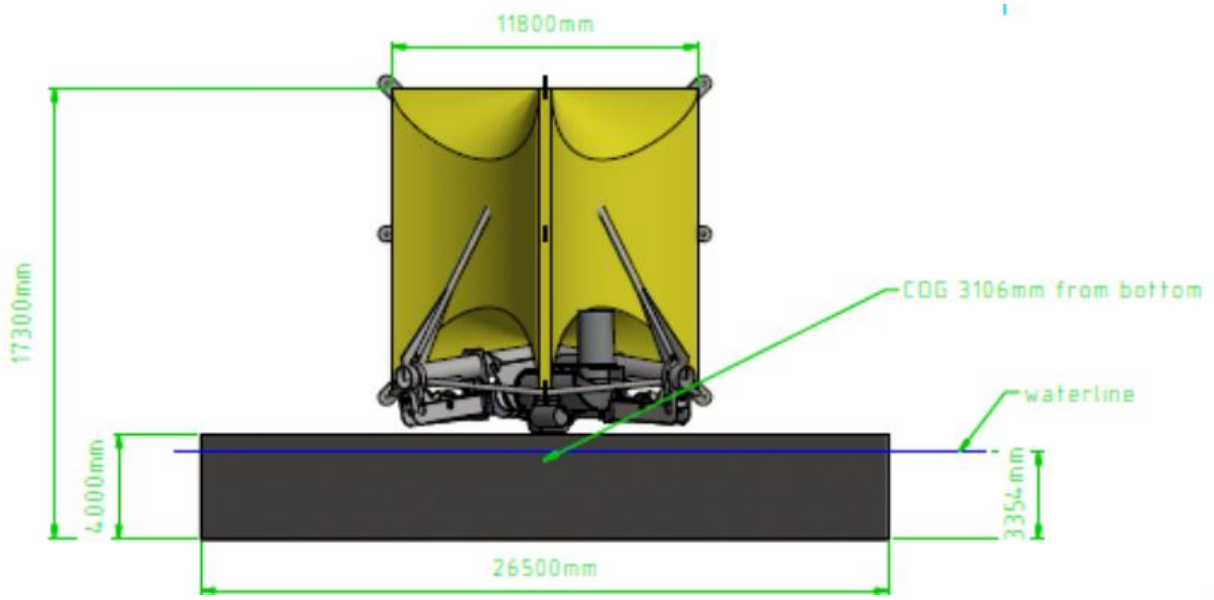

Figure 3: Drawing of the assembly during the towing of the WEC

No further construction work will be required in Orkney. With good weather conditions and available vessels, the WEC can be installed shortly after the arrival. The concrete anchor will include chambers which are filled with air or water to keep the anchor afloat. When the WEC is in position, the air of the chambers will be released slowly and the chambers will be filled with water. This allows a regulation of the buoyancy to prevent the anchor from increasing submerging speed with increased submergence. The anchor will be submerged until the main floater is slightly submerged too. The positive buoyancy of the main floater is able to stabilise the entire WEC structure. The mooring lines of the WEC will be spooled-off and the anchor submerged slowly to the seabed. The chambers will be filled with increasing levels of water to support this process. Once the anchor is deployed on the seabed, the properties of the gravity base anchor will transform the anchor to a reliable anchor system. The main floater will be submerged for the commissioning process.

The table below provides an overview on the components to be installed and the materials used:

Table 1: Material list of the Laminaria WEC

Components installed	Materials to be used	Approx. weight / volume
Main floater		
Mooring line	Steel wire rope in rubber matrix	4 x 200 kg
Sheaves	Ertalyte (PET-P)	8 x 200 kg
Sheaves	Nylacast Oilon	8 x 200 kg
Wet bearings	Feroform T14 by Tenmat	8 x 8.5 kg
Pulley bracket	Steel	8 x 420 kg
Drum	Super duplex stainless steel	2 x 1300 kg
Main shaft	Super duplex stainless steel	2 x 2100 kg
Main hull	Steel s355	250 tons
Paint	Hempadure Multi-Strength 45703	170 L
Umbilical electrical cable	Rubber and copper	4000 kg, 150 m
EMEC's subsea cable		
Roller bearings	Steel	4 x 150 kg
Gearbox	Steel	4 x 2.5 tons
Gearbox and rollerbearing oil	Offshore Environmental Oils HDEO EP	4000L
Gearbox and rollerbearing oil	Offshore Environmental Oils EO220	4000L
Generator	Steel, copper, magnets	2 X 800 kg
Electric induction motors	Steel, copper	2 X 600 kg
Electric switch gear		
PLC		
Power electronics		
Anchor		
Structure	Concrete	1000 m^3

3 Commencement dates and durations

This part of the CMS provides an estimated schedule for the installation works. The time required for towing the WEC from Belgium to Scotland will depend on the weather conditions and the speed of the vessel to ensure safe transportation. Due to the deployment in a marine energy test centre, inshore works and cable instalments are not required.

Table 2: Milestones and durations during the instalment phase of the Laminaria WEC

Milestone or activity	Anticipated commencement period
Seabed survey	One day / July 2018
Towing of the device to the Lyness port	Five to 10 days / July 2018
Installation of the WEC	One day / August 2018
Connection to the subsea cable	One day / August 2018
Seabed survey (scour identification)	One day / October 2018

Laminaria will work closely together with Leask Marine as marine operator to ensure safe and reliable installation of the device. The knowledge and experience of Leask Marine will support Laminaria in installing the device whilst causing minimal environmental impacts and decreasing the navigational risks to other sea users.

4 Marine coordination and vessels

Due to the design of the Laminaria WEC, only a multi-cat vessel and a small work vessel are required. The coordination of the vessels will depend on the availability of the two vessel types, the weather conditions and the navigational conditions close to the site. Laminaria will work closely together with local stakeholders and Leask Marine during the deployment period of the WEC. Before the installation phase, Notices to Mariners will made public in a timely manner which indicate the detailed positioning of the device and the time frame in which the device will be towed to site. Additionally, before each recovery operation of the WEC, further Notices to Mariners will be updated.