

## ENVIRONMENTAL EFFECTS METADATA SURVEY FORM

Name

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Project name: Costa Head Wave Farm

Planned  In Operation  Completed

Project description:

*Project Developer:* Costa Head Wave Farm Ltd

*Technology Developer:* Archimedes Wave Swing

*Technology type:* AWS-III

*Resource (wave, tidal):* Wave

*Project scale (test site, prototype, array, commercial):* Commercial array

*Installed capacity (MW):* 200 MW

*Project Website:* <http://www.sse.com/CostaHead/ProjectInformation/>

*Launch Date:* TBC

*Additional Description:* Costa Head Wave Farm Limited (CHWFL) is a partnership between Alstom and SSE Renewables UK Limited (SSER). An Agreement for Lease (AfL) over an area of 24 km<sup>2</sup> roughly 5 km to the north of Mainland Orkney has been granted to CHWFL, giving the company exclusive rights to the development of the seabed in this area. The proposed array will be installed in two distinct phases, with the first phase seeing the construction and installation of 4 wave energy converters (WECs) producing a combined capacity of 10 MW. Phase 2 will involve the installation of the remaining devices, upgrading the array to an anticipated installed capacity of 200MW<sup>1</sup>.

AWS-III wave energy converters will be used for this project. Initial trials of these devices is underway, however the technology is still under development and the first full scale prototype is due for deployment in 2014. The AWS-III is a self-reacting, multi-cell, floating ring shaped WEC. Wave action is converted into pneumatic power via reinforced flexible diaphragms, which in turn power a turbine-generator set that produces electricity. The lack of any exposed moving parts may contribute to extending the operational life and reliability of the AWS-III<sup>1</sup>.

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<sup>1</sup> Xodus Group, Scoping Report Offshore Project Infrastructure. Available [Online] [http://www.sse.com/uploadedFiles/Z\\_Microsites/Costa\\_head/Controls/Lists/Resources/CostaHeadScopingReport.pdf](http://www.sse.com/uploadedFiles/Z_Microsites/Costa_head/Controls/Lists/Resources/CostaHeadScopingReport.pdf)  
Accessed 04/03/2014.

The devices will be attached to the seabed via moorings and each device will be connected to the next with interarray cables. An export cable will transfer generated electricity from the array to shore. A number of export cable routes exist, however further environmental information is required before a final route is determined. Similarly the exact location for the landfall station is not yet known, and will be identified based on environmental, technical and economic criteria<sup>1</sup>.

Moorings: The design of the mooring system to be used has not yet been finalised. Two types of mooring system are currently being considered. The multi-tether “Admiralty Type” mooring system uses drag embedment anchors and combines semi-taught tethers with chain catenaries. The arrangement is comprised of:

- Four vertical synthetic tethers attached to the device which are connected to and tensioned by a lump mass (provided by four clump weights or one steel/concrete ring);
- Four sets of twin chain lines used to connect each anchor point to the vertical tethers; and
- Four drag embedment anchors<sup>1</sup>.

Taut synthetic moorings with vertical load anchors (VLA) allow for a higher density of device layout and rely on the development of specific synthetic lines. The arrangement is comprised of:

- Four synthetic lines; and,
- Four VLAs or piles<sup>1</sup>.

The number of anchors and lines could increase to ensure sufficient redundancy in the system. This is unlikely to exceed eight per system. The type of anchor to be used is also uncertain, the candidates are:

- Drag embedment anchors;
- Piles;
- Vertical Load Anchors (VLA); and
- Gravity based anchors.

Each of the above has specific requirements and performance according to seabed condition<sup>1</sup>.

Export Cables: The AWS-III converters installed in both Phase 1 and Phase 2 will be inter-connected within the array. Each device will export power via its own 11 to 33kV inter-array cable. A number of factors including seabed condition, mooring arrangement and anchoring solution will influence the number, length, spacing and configuration of inter-array cables<sup>1</sup>.

For Phase 1 the inter-array cabling is likely to comprise of one of two configurations:

- Individual umbilical cables per device; or
- A single umbilical used to connect multiple/all the converters in a daisy chain type arrangement<sup>1</sup>.

It is anticipated that the inter-array cables will connect to a single export cable via a connector or a subsea terminal box in Phase 1. Phase 2 will most likely require an offshore substation

within the AfL to bring multiple lower voltage inter-array cables together and export power to shore at a higher voltage. In Phase 2 multiple export cables may be required, but will use the same route along the seabed. The offshore substation is most likely to be a fixed seabed mounted platform, however a floating structure has not been ruled out.<sup>1</sup>

Onshore infrastructure: There are a number of potential landfall sites and grid connection routes that have been identified for this project. Although additional information is required, it is likely that CHWEFL will aim to find a grid connection point at the export cable landfall site<sup>1</sup>.

Vessel Spread: TBC

Location: Costa Head, North of Mainland Orkney

Coordinates:

Status: A Scoping Report for the Costa Head Wave Farm was submitted in

Licensing information: No Licence or consent applications have been submitted for the Costa Wave Farm to date.

Key Environmental issues: An Environmental Impact Assessment has not been undertaken to date for this proposed development.

Environmental webpage:



**Baseline studies and project effects studies: Costa Head Wave Farm**

**General description** The following field surveys were undertaken (or commissioned by) the developer to inform baseline characterisation.

<b>Receptor</b>	<b>Study description</b>	<b>Design and methods (brief description)</b>	<b>Results (brief description)</b>	<b>Status (planned, underway, completed, with dates)</b>
Physical environment	Metocean surveys	A full wave energy resource measurement programme. Geophysical survey completed; data on bathymetry, seabed features and sub-bottom conditions within the AfL and potential cable route corridors to shore were gathered.	Not available	Completed
Benthic ecology	Benthic ecology	Video survey to be conducted across the Agreement for Lease area and the cable route corridor.	N/A	Planned
Ornithology	Distribution and behaviour survey	Two years of boat based transect surveys; population, distribution and behavioural surveys	N/A	Underway
Fish (basking shark)	Distribution and behaviour survey	Two years of boat based transect surveys; population, distribution and behavioural surveys	N/A	Underway
Marine mammals	Distribution and behaviour survey	Two years of boat based transect surveys; population, distribution and behavioural surveys	N/A	Underway
Shipping and Navigation	Vessel traffic analysis	Winter shipping radar survey	Not available	Completed

**Monitoring and adaptive management: Costa Head Wave Farm**

**General description** No environmental monitoring plan has been developed for this project.

<b>Receptor</b>	<b>Monitoring program description</b>	<b>Design and methods (brief description)</b>	<b>Results (brief description)</b>	<b>Status (planned, underway, completed, with dates)</b>