

## ENVIRONMENTAL EFFECTS METADATA SURVEY FORM

Name of person updating the form

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Project name: Pico Oscillating Water Column

Project description:

*Project Developer:* Instituto Superior Tecnico (owned by WavEC Offshore Renewables since 2004)

*Technology type:* Oscillating water column

*Resource (wave, tidal):* Wave

*Project scale (test site, prototype, array, commercial):* Pilot plant testing; preparation of test bed for air turbines

*Installed capacity (MW):* 0.4 MW

*Project Website:* <http://www.pico-owc.net/>

*Launch Date:* 1999

*Additional Description:* Shoreline gully Oscillating Water Column; the wave chamber is integrated in a natural gully, fitted into the rocky coastline.

Location:

*Ocean/Water body:* Atlantic Ocean, Azores, Pico Island

*Closest city:* Madalena, Portugal

*Country:* Portugal

*Coordinates (please use Mercator):* 38°33'25.56" N, 28°26'45.24" W

*Depth:* Onshore

Process status: The plant was completed in 1999 but flooding and malfunction of the Wells turbine affected the testing program of the plant, leading to long delays (Falcão, 2000). Full scale testing was only performed during a short period in October 1999. In 2003, the Wave Energy Centre (WavEC; re-named in 2013 as WavEC Offshore Renewables), a non-profit association dedicated to the development and promotion of ocean wave energy, created in Portugal, obtained national funding to proceed with

the refurbishment of the plant, under a specific national funding scheme for pilot projects related to scientific innovated systems (PRIME/DEMTEC).

In 2004-2006 a set of relevant repair works were undertaken under the co-ordination of WavEC, as part of a national funding scheme and a program of monitoring tests accompanied the commissioning of the plant.

The basic function of the plant was reconstituted in autumn 2005. Substantial limitations of the operation persisted, mainly due to the inappropriate design of the turbine support structure, inherited from the original project. The automatic operational modus was insufficient due to the original plant layout and equipment. Since 2005, three minor accidents (affecting guide vanes, bearing, and glassfibre of the air tunnel) and insufficient funding prevented the project from a faster and complete recovery. Progress has been made and the plant started to be capable of operating at rated power autonomously since 2008. EDP provided the investment to refurbish the functional and visual aspects of the Pico OWC. In 2012 the plant started working with autonomous operation. During 2013 electrical problems were diagnosed and several repair works have been done.

Licensing information (brief description): At that time, the licensing of the device and its evaluation with respect to environmental issues was new to the authorities. As EDA (Electricidade dos Açores) was a project partner, some facility in obtaining the required permission can be assumed. However, the regional authorities showed their serious concern regarding the environmentally acceptability of the plant, which proved very difficult to overcome, however no specific studies have been developed for baseline and impacts characterization.

Key Environmental issues: To date, and mainly due to the short operational periods of the plant, there are no systematic monitoring regarding environmental issues however an acoustic monitoring survey has been carried out to characterize both airborne and underwater noise levels.

Environmental webpage: *link to project official environmental webpage (if available)*

Baseline studies and project effects studies: Pico Oscillating Water Column				
General description				
Receptor	Study description including question and/or objective (several can be listed per receptor)	Design and methods (brief description)	Results (brief description)	Status (planned, underway, completed, with dates)
Physical environment				
Benthos				
Fish and fisheries				
Large vertebrates				
Birds				

Marine uses / users				
Other* (can be named)				
<b>Reports or Papers</b>	(Key papers on the areas addressed should be listed here; when possible the files themselves can be made available in downloadable PDF format, alternatively links to the files or project website can be provided when available e.g. SeaGen.)			
<b>Research Projects</b>	(past or on-going environmental research projects at the site)			

Monitoring and adaptive management: Pico Oscillating Water Column				
General description				
Receptor	Monitoring program description including question and/or objective	Design and methods (brief description)	Results (brief description)	Status (planned, underway, completed, with dates)
Acoustic Conditions	Airborne and underwater noise levels. Underwater sound propagation.	<p><u>Underwater sound characterization of the OWC Pico Plant:</u> consisted in the placement, roughly 10 meters offshore the front wall of the plant, of a tripod on which an auto-recording hydrophone had been previously fixed.</p> <p><u>The Underwater noise propagation</u> data was recovered from a boat through a hydrophone hanged in the water via a semi-closed surface marker buoy. The measurements consisted in noise propagation data in function of the distance moving away from the plant. Three transects, corresponding to three different directions in comparison to the plant, were performed until a</p>	<p><u>Underwater sound characterization:</u> recorded acoustic data of approximately 5h30min over 22 hours. Through the data analysis the already expectable existence of an increase of noise when the plant was operating was identified. Another interesting finding was the “visibly” good correlation between the operating data when the plant was running and the data recorded. There were two main phenomena visible: the existence of harmonics related with the rotational speed of the turbine, and the existence of some spreading in a frequency range related with the pressure in the air chamber.</p>	Noise data have been collected and analyzed. The inter-relation between the airborne and underwater device noise is currently under analysis.

		<p>maximum distance of 3km.</p> <p>The <u>airborne noise</u> measurements were almost impossible to carry out from the boat due to the meteorological conditions. Thus they were collected on land.</p>	<p><u>Underwater noise propagation</u>: It was not possible to identify the noise levels of the plant in operation from all transects' measurements.</p>	
<b>Reports or Papers</b>	A list of publications can be found at the plant website: <a href="http://www.pico-owc.net/cms.php?page=540&amp;wnsid=7e429d04081276b4b0104547f23fc06c">http://www.pico-owc.net/cms.php?page=540&amp;wnsid=7e429d04081276b4b0104547f23fc06c</a>			
<b>Research Projects</b>	The underwater noise characterization and the sound propagation of the wave energy device have been analyzed under the national funded WEAM project			