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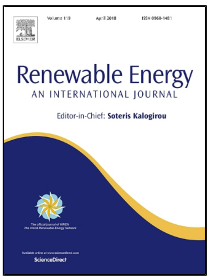

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Preliminary laboratorial determination of the REEFS novel wave energy converter power output

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Abstract

REEFS is a patent pending new wave energy converter that can harness both potential energy as well as kinetic energy. Its design philosophy, working principles and functioning proof of concept have already been presented. However, only recently sufficient laboratorial data was collected to compute preliminary power output. In order to reduce complexity, the REEFS model hydraulic turbine was replaced with a differential pressure measurement device equipped with a valve. The objective of such device is the measurement of the captured hydraulic power using the head loss in the valve to simulate turbine power extraction. This measurement device was previously calibrated in a small scale dam installed in a 7.5 m x 0.3 m x 0.3 m flume. After that, it was connected to the REEFS model and installed in a 36 m long, 1 m wide and 1.2 m height wavemaker flume, where it was tested. Experiments were conducted in order to analyze the impact of sea wave characteristics on the REEFS model energy production. The data processing that led to the preliminary laboratorial power output evaluation is described, as well as the corresponding limitations. Finally, conclusions are presented regarding the laboratorial approach and the REEFS production potential.

Keywords

Novel multifunctional wave energy converter, power output laboratorial evaluation, differential pressure hydraulic power meter, wave breaking, submerged breakwater, physical modelling.

Abbreviations

DPHPM - Differential Pressure Hydraulic Power Meter
LHWRE - Laboratory of Hydraulics Water Resources and Environment
PTO - Power Take-Off
REEFS - Renewable Electric Energy From Sea
WEC - Wave Energy Converter

1. Introduction

The oceans, seas and bays are immense water reservoirs that store about 97% of total earth's water [1]. Due to the remarkable physical properties of the liquid water, these huge water reservoirs are also enormous energy reservoirs. The moon, the sun and in minor extension all the other bodies of our solar system have been transferring some of its mechanical energy to the earth to sustain tides. Earth winds have also being powering the superficial waters of the earth. Along the interface between the atmosphere and the water surface, which accounts for about 2/3 of the earth's surface, the winds are able to transfer some of its energy creating currents and waves. Ocean and sea water waves can easily store huge amounts of wind energy as they become progressively higher, because its mechanical energy is proportional to the square of the wave height and water density is more than 800 times superior to the air density. These aspects explain the property of the ocean and sea waves, mentioned in [2], of accumulating wind energy over hours or days and propagating it thousands of