

A wave energy driven RO stand-alone desalination system: initial design and testing

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Received 30 September 2008; Accepted 28 May 2009

ABSTRACT

Traditional desalination systems have high energy requirements which can be considered as the limiting factor for their application. Using renewable energy sources for desalination of seawater and brackish water can help to alleviate water scarcity in those areas with no electricity grid connection or supply shortages. This paper describes the development of a stand-alone, off-grid desalination system powered by wave energy. The device is designed to drive a reverse osmosis (RO) membrane. No electricity is required. The system consists of two main parts; a high pressure pump (WaveCatcher) that allows generation of a high pressure head from low head differences, and a wave driven pump to supply the necessary head to the WaveCatcher. The high pressure pump is designed to produce 6 MPa of pressure which is necessary to drive a RO membrane for desalination of water. A 1:6 scale physical model was built and tested; pressures of 42 m were achieved from an initial pressure head of 0.2 m. Delivery of water to the WaveCatcher is to be achieved through the use of an oscillating water column (OWC) pump. The pump consists of a two-part resonant duct, which allows resonance control by varying the angle of the output duct. Maximum lift heights of five times the wave height were reached. The initial experiments showed that the WaveCatcher can generate the necessary pressure to run the RO membrane for the production of drinking water without the use of electricity.

Keywords: Reverse osmosis; Wave energy conversion; Sustainable development

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