Wave power for clean drinking water

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Credit: RML

Around 1.2 billion people, or almost one-fifth of the world's population, live in areas of water scarcity, mostly in developing countries. Traditional reverse osmosis (R/O) desalination systems offer a solution but require sufficient electrical grid capacity.

As part of the "Blue Growth Strategy', the EU-funded H2020 W2O project has demonstrated the economic practicality of the world's first wave-driven desalination system, Wave2O. This operates completely 'off-grid' to supply large quantities of affordable fresh water.

Wave2O will be piloted in Cape Verde, an island in the Atlantic Ocean off West Africa. A location for the pilot plant has been identified and site assessment studies, including bathymetric surveys, wave energy assessments, and water quality assessments are being carried out. Project coordinator and cofounder of the SME Resolute Marine Limited, Olivier

Ceberio says, "We secured a pledge from the local power and water utility to purchase a full-scale Wave2O plant after trials of a pilot-scale plant have been successfully completed."

Energy from the sea

Two wave energy converters (WECs) and two large 20-foot containers, one housing equipment for producing electricity and another for producing fresh water make up the Wave2O module. The WECs are connected to the containers by flexible hoses carrying pressurised seawater to and from the WECs. "Process seawater is sourced from an offshore well away from any sources of contamination through a multi-stage filtration system before entering a manifold system that splits its flow into two different paths," explains Ceberio.

Wave-induced mechanical energy is used by the WECs to drive two rotary actuators that increase the pressure of the intake seawater to 7 000 kPa before pumping it ashore. Here it is stabilised by a hydro-pneumatic accumulator to remove unwanted pressure pulsations before it enters the R/O system. A secondary flow of seawater is sent to an energy recovery unit (ERU). The ERU recovers energy from high-pressure brine – the by-product of the desalination process – and uses it to increase the pressure of the process seawater to 7 000 kPa. Energy recovery creates higher efficiency conversion, crucial for stand-alone operation.

The pressure-stabilised intake seawater is then merged and enters a standard R/O unit at an operating pressure of 6 200 kPa. Approximately 35 percent of the feed water is processed into fresh water, which is a relatively low recovery rate that has benefits related to reduced maintenance, extended membrane life and lower brine salinity. The highly energetic brine is then used to pre-charge the feed water.

Clean water with reduced carbon emissions

Wave2O could provide access to low carbon energy to millions of people living in rural and isolated communities. "Each plant will produce 4 000 cubic metres of fresh water a day, enough to cover the needs of 40 000 people and reduce CO2 emission by 4 346 tons per year, the equivalent of taking 936 cars off the road," claims Ceberio. "Our target customers are communities in developing countries and island nations that typically lack sufficient grid capacity and cannot afford the capital or time required to build and deploy grid-connected systems," he adds.

The medium-scale, grid independent, renewable energy powered water production system is aimed at developing countries and island nations outside the EU. Within Europe, W2O can benefit overseas countries and territories linked to EU Member States, like the Canary Islands and New Caledonia.

Provided by CORDIS

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