



## An energy-efficient vertical-shaft seawater desalination plant

Tzu-Chin Lin, Falin Chen\*

*Institute of Applied Mechanics, National Taiwan University, Taipei, Taiwan 10674, Tel. +886-2-3366 5692;  
email: falin@iam.ntu.edu.tw (F. Chen)*

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### ABSTRACT

We propose a design of a seawater desalination plant (SDP) consisting of two vertical shafts underground. One shaft is designed for producing freshwater, in which the reverse osmosis modules (ROMs) are installed several hundred meters deep. The other shaft is used to reserve the brine rejected from the ROMs. The pressure required to force the seawater to penetrate through the ROMs is provided by the hydrostatic pressure of seawater of 550 m deep or more. Consequently, the main energy consumption of the SDP is the power required to pump the freshwater up to the ground. Therefore, if coupled with other sporadic energy consumptions, the energy consumption per cubic meter of freshwater produced is approximately 2 kWh/m<sup>3</sup>, which can be generated by, for instance, wind turbines or photovoltaic panels on the ground. In the case where the generated brine can be fully recovered, the entire SDP is a non-polluted freshwater production facility, which is quite in line with today's energy and environmental requirements.

*Keywords:* Seawater desalination plant; Reverse osmosis modules; Vertical shaft; Energy efficiency; Cost reduction

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\* Corresponding author.