



Comparison of performance and economics of reverse osmosis, membrane distillation, and pressure retarded osmosis hybrid systems

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ABSTRACT

This paper intended to evaluate the performance and economics of hybrid desalination systems including reverse osmosis (RO) stand-alone, RO–membrane distillation (MD), RO–pressure retarded osmosis (PRO), and RO–MD–PRO. Theoretical analysis for evaluating the performance of hybrid systems was carried out using previously validated RO, MD, and PRO numerical models. Moreover, a simple cost model was applied to analyze the effects of seawater total dissolved solids, energy cost, membrane cost, and interest rate. Results showed that the hybrid systems can outperform an RO stand-alone system in terms of its ability to reduce water cost and alleviate the disposal and environmental problems of waste brine. The electricity cost plays a dominant role in determining economic feasibility of hybrid plants. The steam cost for MD heating source plays a dominant role in determining economic feasibility of RO–MD and RO–MD–PRO hybrid systems. The membrane cost and interest rate are also crucial factors affecting the economic feasibility of hybrid systems.

Keywords: Reverse osmosis; Membrane distillation; Pressure retarded osmosis; Hybrid desalination; Economic analysis

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