



Sustainable renewable energy seawater desalination using combined-cycle solar and geothermal heat sources

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ABSTRACT

Key goals in the improvement of desalination technology are to reduce overall energy consumption, make the process “greener,” and reduce the cost of the delivered water. Adsorption desalination (AD) is a promising new technology that has great potential to reduce the need for conventional power, to use solely renewable energy sources, and to reduce the overall cost of water treatment. This technology can desalt seawater or water of even higher salinity using waste heat, solar heat, or geothermal heat. An AD system can operate effectively at temperatures ranging from 55 to 80°C with perhaps an optimal temperature of 80°C. The generally low temperature requirement for the feedwater allows the system to operate quite efficiently using an alternative energy source, such as solar power. Solar power, particularly in warm dry regions, can generate a consistent water temperature of about 90°C. Although this temperature is more than adequate to run the system, solar energy collection only can occur during daylight hours, thereby necessitating the use of heat storage during nighttime or very cloudy days. With increasing capacity, the need for extensive thermal storage may be problematic and could add substantial cost to the development of an AD system. However, in many parts of the world, there are subsurface geothermal energy sources that have not been extensively used. Combining a low to moderate geothermal energy recovery system to an AD system would provide a solution to the thermal storage issue. However, geothermal energy development from particularly Hot Dry Rock is limited by the magnitude of the heat flow required for the process and the thermal conductivity of the rock material forming the heat reservoir. Combining solar and geothermal energy using an alternating 12-h cycle would reduce the probability of depleting the heat source within the geothermal reservoir and provide the most effective use of renewable energy.

Keywords: Adsorption desalination; Renewable energy; Solar energy; Geothermal energy

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