

## Solar-driven desalination with reverse osmosis: the state of the art

Andrea Ghermandi\*, Rami Messalem

*Ben-Gurion University of the Negev, Zuckerberg Institute for Water Research, Desalination & Water Treatment, Beer Sheva, Israel  
Tel. +972 (8) 646 1942; Fax +972 (8) 647 2984; email: ghermand@bgu.ac.il*

Received 30 September 2009; Accepted in revised form 17 June 2009

---

### ABSTRACT

Solar-driven reverse osmosis desalination can potentially break the dependence of conventional desalination on fossil fuels, reduce operational costs, and improve environmental sustainability. The experience with solar desalination is investigated based on the analysis of 79 experimental and design systems worldwide. Our results show that photovoltaic-powered reverse osmosis is technically mature and — at unit costs as low as 2–3 US\$ m<sup>-3</sup> — economically cost-competitive with other water supply sources for small-scale systems in remote areas. Under favourable conditions, hybrid systems with additional renewable or conventional power sources perform as good as or better than photovoltaic-powered reverse osmosis. We suggest that in the short-term, solar RO desalination will gain shares in the market of small-scale desalination in remote areas. Concentrating solar power technologies have the highest potential in the medium-term for breakthrough developments in large-scale solar desalination.

*Keywords:* Concentrating solar power; Photovoltaic; Pressure-driven membranes; Renewable energy; Reverse osmosis; Solar energy; Solar thermal desalination

---

\* Corresponding author.

*Presented at EuroMed 2008, Desalination for Clean Water and Energy Cooperation among Mediterranean Countries of Europe and the MENA Region, 9–13 November 2008, King Hussein Bin Talal Convention Center, Dead Sea, Jordan.*