



Design of autonomous PV/RO desalination systems – case studies for Egypt and Greece

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Received 24 June 2016; Accepted 26 February 2017

ABSTRACT

The aim of the present work is to develop a design and sizing methodology for autonomous reverse osmosis (RO) desalination systems and assessing their feasibility taking into consideration the following parameters: climatic conditions, water demand profile, water salinity, RO capacity (from 1 to 48 m³/d), energy recovery techniques, photovoltaic (PV) power generation with its battery storage and required accessories such as DC/AC inverters and charge controllers. Based on the design tool calculations, the RO water desalination system, the intake pump, high-pressure pump, network pump and energy saving recovery pump are sized. According to the required daily electrical energy and the meteorological site parameters, the required PV system is designed by sizing the peak power of PV modules, the battery bank capacity in Ah, the required battery charge controllers, as well as the DC/AC inverters. The specific energy consumption (SEC; kWh/m³) and the specific energy cost (euro/kWh) are obtained for different plant capacities namely 50, 100, 220, 500, 1,000, 1,500 and 2,000 L/h for Egypt (Marsa Matrouh, latitude of 31.35° N, longitude of 27.23° E) and Greece (Milos island, latitude of 37.58° N, longitude of 23.26° E).

Keywords: Reverse osmosis; Water desalination; Energy recovery; System optimization; Cost analysis; Solar irradiation; Photovoltaic generation system; Greece; Egypt

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