

Desalination and Water Treatment

www.deswater.com

1944-3994/1944-3986 © 2013 Desalination Publications. All rights reserved doi: 10.1080/19443994.2012.700786

## 51 (2013) 702–712 January



## The modular design of photovoltaic reverse osmosis systems: making technology accessible to nonexperts

Amy M. Bilton<sup>a,\*</sup>, Steven Dubowsky<sup>b</sup>

<sup>a</sup>Department of Aeronautics and Astronautics, Massachusetts Institute of Technology, Cambridge MA 02139, USA Tel. +1 617 253 5095; Fax: +1 617 258 7881; email: bilton@mit.edu

<sup>b</sup>Department of Mechanical Engineering, Massachusetts Institute of Technology, Cambridge MA 02139, USA

Received 29 February 2012; Accepted 3 June 2012

## ABSTRACT

Photovoltaic reverse osmosis systems can provide water to many underserved communities. These systems need to be custom-tailored for the water demand, solar insolation, and water characteristics of a specific location. Systems can be constructed from modular components to be cost effective. Designing a custom system composed of modular components is not a simple task. For a given modular inventory, a large number of possible system configurations exist. Determining the best system configuration is a daunting task for a small community without expertise. This paper presents a computer-based modular design method that can enable nonexperts to configure such a system for their community from an inventory of modular components. The method employs fundamental engineering principles to reduce the number of possible configurations and optimization methods to configure a system. Examples cases for a range of communities demonstrate the power of this approach.

Keywords: Photovoltaic reverse osmosis; System design; Optimization

<sup>\*</sup>Corresponding author.

Presented at the International Conference on Desalination for the Environment, Clean Water and Energy, European Desalination Society, 23–26 April 2012, Barcelona, Spain