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Design aspects of small-scale photovoltaic brackish water reverse osmosis (PV-BWRO) system

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ABSTRACT

Clean drinking water is essential for survival and good health. Reverse osmosis is a very effective way to produce clean drinking water. Designing small scale photovoltaic powered brackish water reverse osmosis system (PV-BWRO) requires feed water characterization, proper pre-treatment setup, module design configuration, energy consumption evaluation and reject water management. Feed water characterization is done for optimum RO module arrangements and pre-treatment design to prevent fouling and scaling. Success of small scale PV-BWRO system designation depends on ability to minimize cost of water produced. Among all the parameters effecting cost, energy is the most influential. Energy consumption is reduced by including energy recovery device (ERD) in the system. It can be further reduced by including battery for stable supply of energy enabling the pumps to operate at optimum level. Problem with battery is energy loss during charging/discharging and high cost of maintenance and replacing. Instead of storing energy, another option is to store produced fresh water in storage tank. The capacity of the tank is determined based on average consumption of water by the population at the location of the system build. Reject water from RO system need to be managed properly. Improper disposal will cause contamination and disturb ecosystem. Powering RO systems with PV panels have a lot of advantages which includes maintenance free, easy installation and last up to 25 y.

Keywords: Desalination; Reverse osmosis; Brackish water; Small scale; Photovoltaic

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