Modeling and optimization of a hybrid power system supplying RO water desalination plant considering CO₂ emissions

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ABSTRACT

Seawater desalination is an attractive choice especially for remote areas where freshwater is rare. Egypt is moving toward the desalination of water as an alternative solution to the decrease in freshwater. The main objective of this study was to design an optimal, economic, and efficient hybrid system that feeds the electric needs of a small-scale brackish reverse osmosis desalination unit and a tourism motel located in Hurghada, Egypt. The optimization problem of sizing different components of hybrid system is a complicated one; it needs a special tool capable of solving it rapidly and effectively. Three different hybrid system scenarios are discussed to select the most optimum combination of them. These scenarios are the following: wind/PV/battery, wind/PV/diesel, and wind/PV/battery/diesel. In this study, a modified particle swarm optimization technique is applied for optimum sizing of the proposed hybrid system scenarios. The optimization problem is solved to minimize the annual total investment cost considering CO₂ emissions cost.

Keywords: CO₂ emissions; Diesel generator; Hybrid systems; Photovoltaic; MPSO; Stand-alone; Wind turbines

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