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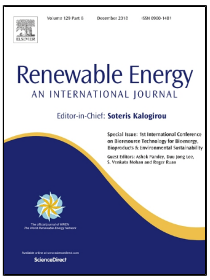

PV water pumping systems for domestic uses in remote areas: Sizing process, simulation and economic evaluation

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PV water pumping systems for domestic uses in remote areas: Sizing process, simulation and economic evaluation

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Abstract

PV water pumping technology is recognized as a sustainable and environmentally friendly solution to provide water for domestic use. The appropriate design and smooth operation mostly rely on available solar irradiation, domestic water demand and appropriate configuration of the proposed system. Therefore, the aim of this work is to examine an optimum PV system configuration that is capable of supplying a solar submersible pump system to fulfill domestic water needs of five isolated houses located in a Moroccan remote area. A detailed approach for the design of an optimized PV water pumping system based on real water usage data is proposed. Besides, system design work and performance assessment were carried out based on hourly climatic conditions. Overall, two approaches were investigated for an optimum design of the proposed system. Annual simulations indicated that the direct coupling, as a first option, appears to be unfitting configuration for water pumping in this case. In turn, results proved that second system including a MPPT DC converter with less PV arrays could pump more water and its performance remarkably surpassed the direct coupling configuration. In addition, economic analysis has shown that proposed systems are cost competitive against the conventional water supply methods.

Keywords:

Photovoltaic; water pumping; design; regulation; simulation; economic analysis