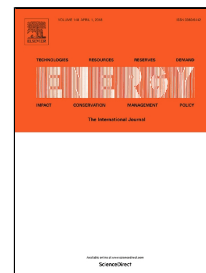


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Sizing methodology for hybrid photovoltaic /wind/hydrogen/battery integrated to energy management strategy for pumping system

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Abstract

The real penetration of renewable energy sources under random variability and unpredictability of weather conditions requires an optimal sizing of hybrid renewable power generation systems. This paper presents a techno-economic optimization model, to perform the optimal sizing of a stand-alone hybrid photovoltaic/wind/hydrogen/battery system. Optimum sizing has been applied to a system consisting of an induction motor coupled to a centrifugal pump, located at Sahline-Tunisia. The optimal-cost design and the new suitable power management approach are the two main objectives. The optimal sizing is assessed on the basis of technical (the Deficiency of Power Supply Probability, the Relative Excess Power Generated) and economic (the Energy Cost as well as the Total Net Present Cost) criteria. The power management strategy optimizes how the spare energy is used. The results highlight the important role of the hybridization of renewable energy sources, photovoltaic and wind turbine, in reducing the cost of the system. It is also noted that the hydrogen chain prolongs the life of the battery, preventing the massive use of the latter. The optimized sizing algorithm gives all the possible configurations of the hybrid system not only for a pumping system but also for any autonomous load located all over the world.

Keywords: Hybrid photovoltaic/wind pumping system; Battery; Fuel cell/electrolyzer storage system; Optimal sizing; Eenergy management.

1. Introduction

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