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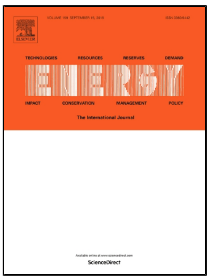

Modeling and performance analysis of a hybrid system for a residential application

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MODELING AND PERFORMANCE ANALYSIS OF A HYBRID SYSTEM FOR A RESIDENTIAL APPLICATION

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Abstract

Hybrid systems, which use more than one renewable energy sources, are quite advantageous, because they can eliminate or at least vitiate the interrupted characteristics of the renewable sources. In the present study, a hybrid system, which consists of a small scale wind turbine and photovoltaic panels, was focused on. The system supplies the required electricity demand for a detached house, with a 117 m^2 area, in five different locations (Izmir, Madrid, Budapest, Paris and Helsinki) according to European zones. A detailed dynamic hourly electricity generation analysis for the two components of the hybrid system was performed. As a result, the coverage ratio of the hybrid system electricity generation for the total electricity demand of the house, simple payback time and energy payback time of the system were calculated for each city. The results revealed that yearly electrical energy demand of the house can be entirely met by the evaluated hybrid system for each city. Maximum yearly coverage ratio of 176.6 % was observed for Izmir, Turkey, while minimum coverage ratio of 103.1 % for Helsinki, Finland. The simple payback time and energy payback time of the hybrid system were determined in the range of 7-25.5 years and 4.6-6.8 years, respectively.

***Keywords*:** hybrid system, wind turbines, photovoltaic panels, electricity coverage ratio, economic analysis, environmental analysis.

1. Introduction

The energy demand of residential buildings for air conditioning (heating, cooling) are increasing and the energy use for this purpose reached high percentages in modern world total energy consumption. Heat pumps are widely used in order to provide the necessary heating/cooling energy to residents due to their capability of providing considerably higher heating/cooling energy than their electricity usage. The electrical energy required to operate a

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