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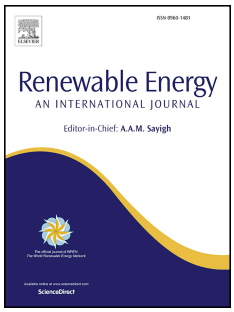

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Measuring reliability of hybrid photovoltaic-wind energy systems: A new indicator

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Abstract

The integration of renewable energy systems has increased in the last decades because of the need for new energy sources freely available and environmental friendly. In this sense, photovoltaic-wind hybrid energy systems are an attractive solution, especially in places with good sun and wind resources. However, due to the stochastic and intermittent behavior of these sources, it is necessary to analyze systems' reliability. In this paper, a new reliability indicator is proposed, based on the minimum hourly electric power obtained from the wind and solar radiation using a probabilistic approach. This indicator is compared with other indicators and the results showed that it increases system reliability by maximizing the use of renewable sources.

Keywords: Hybrid systems, reliability, photovoltaic, wind, probability distributions, indicator

1. Introduction

Increased energy consumption in the world has caused an increase in the exploitation and use of main fossil fuels (oil, gas and coal) adding to environmental problems in the planet. BP Energy Outlook 2030, reported that the total energy consumption will increase by 50% in 2030 compared to 2011, and it is expected an 82% of dependence on fossil resources in 2030 [1].
The renewable energy sources are considered part of the solution to mitigate environmental problems caused by the use of conventional energy sources. Their average annual growth were estimated in 7.6 % being the installation and use of solar and wind fastest growing [1]. The photovoltaic solar energy

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