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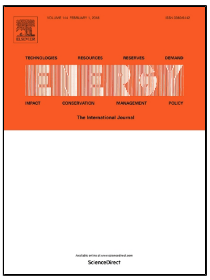

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Performance analysis of Solar powered airport based on energy and exergy analysis

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Abstract:

In this paper, performance analysis of 12MWp grid interactive solar photovoltaic power plant, located at Cochin International Airport, India is carried out using energy and exergy analysis. The thermal performance of the PV plant installed within the airport premises has been investigated based on actual weather data and monitored values of the plant.In order to evaluate the exergy and energy performance of the PV plant, a parametric approach with destruction is applied. The energy efficiency of the plant varied between 16.4% and 13.33% and its value depends on the electrical energy output and insolation only. The annual average exergy efficiency is found to be 9.77%. Theoretically, cost of exergy destruction in terms of unit electricity cost is estimated.The thermal destruction is huge in an MW scale solar PV plant. A considerable amount of thermal losses (4.44MW) can be avoided by integrating cooling technique to the SPV system. Thus the thermodynamic analysis of PV system provides more clarity about system performance and serves as a useful reference for future PV power plants in an airport environment.

Keywords: utility scale PV, exergy efficiency, energy efficiency, thermal destruction, sustainable

1. Introduction

The use of conventional energy sources is increasing the concentration of green house gases in the atmosphere (Shukla et al., 2017). In this aspect, renewable sources of energy are gaining much importance all over the world. Theoretically, 1% of sun's energy is enough to satisfy the energy requirement of the whole world. Solar energy is infinite and available worldwide (Sukumaran and Sudhakar 2017a). So the future prospect of solar energy is huge and significant. Proper and effective tapping of solar energy can even replace the use of fossil fuel. The quantity and quality of sunlight depending on the location, altitude, atmospheric conditions and the solar path (Sukumaran and Sudhakar 2017b). The performance of grid connected PV system is normally estimated by calculating its energy yield (daily, monthly and yearly), capacity utilization factor and performance ratio(Sharma and Chandel, 2013). All these parameters depend on the electrical energy output and none of

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