ICSEP 2016

Effect of sun tracking and cooling system on Photovoltaic Panel: A Review

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Abstract

The performance of the Photovoltaic (PV) system depends on solar radiations, ambient temperature and wind speed. A PV panel receives the maximum solar radiation, when the sun rays strike it at right angle. Stationary mounted PV panels are only perpendicular to the sun, for limited period of time. Therefore, it is necessary to track the suns position. In addition to the solar radiation, PV cell performance is greatly affected by the increase of cell operating temperature during its operation. Therefore, cooling of PV panel is essential. A review of effect of employment of sun tracking and cooling system on the performance of Photovoltaic panel is presented in this paper. It also covers review of the description of various advancements made in cooling techniques and various techniques used to get the maximum of solar radiation.

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Selection and/or Peer-review under responsibility of 2nd International Conference on Solar Energy Photovoltaic.

Keywords: Photovoltaic Module; Sun tracking system; cooling techniques

1. Introduction

Energy is the most important factor for the economic as well as social and technological development of both developing and developed countries. From 2002 to 2030, it is expected that the World’s energy demand to increase almost by 60% i.e. with annual increase of 1.7% [1].

Nomenclature

<table>
<thead>
<tr>
<th>RE</th>
<th>Renewable Energy</th>
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<tr>
<td>PV</td>
<td>Photovoltaic</td>
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<tr>
<td>STC</td>
<td>Standard Test Condition</td>
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</table>

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Today, regularly used energy resources are fossil fuels like natural gas, coal, oil and uranium. These are non-renewable energy resources and have an adverse affect on our environment [2]. RE resources have enormous potential to meet the present world energy demand and has ability to reduce the local and global atmospheric emissions. PV technology is commonly used RE technology. The PV system performance mainly depends upon solar radiation, wind speed and ambient temperature [3]. This paper presented the literature review on the sun tracking and cooling systems. Many researchers and experts studied these factors. Literature showed that, the sun tracking and cooling systems has the great effect on the performance of PV panel. The paper is composed in three main sections. First Section contains the introduction part; middle section provides a description of the cooling systems and its effect on the performance of PV panel and this section also presents a brief literature review and description for sun tracking systems. Last section presents the conclusion.

2. Literature Review

This section highlights the contribution of different researchers on solar tracking system and the effect of different cooling methods on the performance of solar systems.

2.1 Cooling systems with integrated photovoltaic panel

Agroui [4] experimented and tested the performance of polycrystalline PV modules under various conditions with temperature ranging from 61–75 °C and the irradiance ranges from 780–1250W/m². The author noted that, the performance of PV module degrades with rise in working temperature and the modules efficiency reduced by 35% and the maximum output power has the reduction of 18%. PV module efficiency reduces at a rate of 0.40–0.6% for 1°C increment of module temperature [5, 6].

![Fig.1. Cooling technique for PV modules [3]](image1)

![Fig.2. Photovoltaic conversion efficiencies of the PV-modules [12]](image2)
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