# Modeling and Characterization of Photovoltaic Thermal System an Overview

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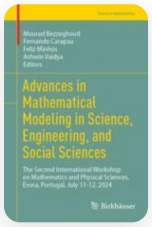

Advances in Mathematical Modeling in Science, Engineering, and Social Sciences

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## Abstract

The enormous dependency on fossil fuel–based energy and mechanization is leading to unprecedented environmental challenges. The adverse impact of human-made technology on the environmental challenges is undeniable, necessitating a balanced approach between energy consumption and environmental sustainability. As societies become increasingly reliant on modern technology, so global power consumption is projected to be increased significantly, highlighting the urgency for sustainable energy solutions. Although renewable energy offers a viable alternative, it faces several

challenges, particularly in the field of solar energy. Using the photoelectric effect principle, PV converts solar radiation into electrical energy and is a promising renewable solution. This technology is hindered by efficiency-reducing factors such as temperature-induced losses, shading effects, dust accumulation, and infrared radiation absorption. To overcome these limitations, hybrid PV technology has been introduced, integrating thermal management solutions to enhance efficiency and cost-effectiveness while optimizing heat utilization. Among different techniques, the cooling mechanism plays a major role in mitigating thermal losses, improving system performance, and extending the operational lifespan of PV panels. This study examines hybrid PVT system, emphasizing its benefits, drawbacks, and categories. PVT systems are still a viable energy source with scope to develop and have possibilities for further study into cost-effectiveness and performance improvement, despite the financial constraints and technological limitations.

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