THERMAL OPTIMIZATION AND TECHNOLOGICAL TRANSFORMATION OF PHOTOVOLTAIC SYSTEMS

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ABSTRACT

The increasing need for renewable energy sources highlights the significance of improving the efficiency of photovoltaic (PV) systems. This study employs a two-pronged approach to enhance the efficiency of photovoltaic (PV) panels by focusing on thermal regulation and technological adaptation. The first experiment is to define the optimal heat capacity for PV panels under changing weather conditions to maximize electrical production. Utilizing a combination of empirical data analysis and simulation modeling, this study intends to build a dynamic framework for changing PV heat capacity, hence boosting electrical efficiency across varied climatic conditions. The second aspect of the research investigates the practicality of transforming traditional PV panels into Photovoltaic-Thermal (PVT) systems. This inquiry thoroughly assesses the benefits, difficulties, and crucial factors associated with such a conversion, encompassing thermal and electrical conductivity as well as the incorporation of cooling/heating fluids. This study seeks to clarify the circumstances in which each system (photovoltaic vs. photovoltaic-thermal) demonstrates superior performance, taking into account factors such as heat capacity and specific meteorological conditions. This research is important because it has the potential to improve the efficiency and adaptability of PV systems, making solar energy more viable in different environmental conditions. Within the framework of a circular economy, generating energy on-site and consuming it in the same locale means we avoid creating waste and, consequently, prevent environmental pollution.

Keywords: Thermal Management, Heat Capacity, Simulation Modeling, Photovoltaic Systems Conversion, Cooling/Heating Fluids Integration

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