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NEW TECHNOLOGIES FOR EFFICIENT USE OF SOLAR ENERGY

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Annotation: The rapid growth of global energy demand and environmental challenges has accelerated research into renewable energy technologies. Among them, solar energy remains one of the most promising sources due to its abundance and sustainability. This article explores innovative methods for improving the efficiency of solar energy utilization, focusing on advanced photovoltaic materials, solar tracking systems, and hybrid solar thermal technologies.

Keywords: Solar energy, photovoltaics, renewable energy, hybrid systems, energy efficiency

Main Text

Solar energy plays a central role in the global transition toward clean energy systems. The main challenge in this field remains the low conversion efficiency of conventional silicon-based photovoltaic (PV) cells. Recent advancements in perovskite and tandem solar cells have demonstrated conversion efficiencies exceeding 30%, showing significant promise for mass production.

In addition to material innovation, solar tracking systems have proven effective in maximizing solar radiation capture throughout the day. Dual-axis tracking technologies enable PV panels to maintain an optimal angle relative to the sun, improving annual energy yield by up to 35%. Furthermore, integrating photovoltaic and thermal (PV/T) systems allows simultaneous generation of electricity and heat, increasing overall system efficiency.

Digital technologies such as IoT and AI are increasingly used to optimize solar plant operations through predictive maintenance, real-time monitoring, and smart grid integration. These innovations not only reduce operational costs but also enhance system reliability and sustainability.

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