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NEWSLETTER

Performance assessment of thermal energy storage system for solar thermal applications

Authors: Pranav Mehta et al.
Nature Journal, Scientific Reports
Volume 15, Article number: 13876 (2025)

This study investigates the efficiency of thermal energy storage systems (TESS) utilizing phase change materials (PCMs) for solar thermal applications. Researchers evaluated three types of PCMs—paraffin wax, fatty acid, and a cascaded combination of both—under varying mass flow rates and heat transfer fluid temperatures. Key performance metrics such as energy efficiency, exergy efficiency, and heat transfer effectiveness were assessed over a 240-minute charging and discharging cycle. The findings indicate that while higher heat transfer fluid temperatures accelerate charging rates, they may reduce exergy efficiency due to increased entropy generation. Notably, the cascaded PCM system demonstrated significant improvements in heat transfer efficiency, suggesting its potential for optimizing solar energy storage in applications requiring consistent and efficient heat delivery.

Optimizing photovoltaic integration in grid management via a deep learning-based scenario analysis

Authors: Zhiming Gu et al.
Nature Journal, Scientific Reports
Volume 15, Article number: 14851 (2025)

This research presents a novel approach to enhancing the integration of photovoltaic (PV) systems into power grids. Recognizing the challenges posed by the intermittent nature of solar energy, the researchers developed a dual-phase optimization model that incorporates deep learning techniques, specifically Generative Adversarial Networks (GANs). These GANs are utilized to simulate diverse and high-resolution energy generation-consumption patterns, creating synthetic scenarios that reflect the variability in solar power output. These scenarios are then employed within a real-time adaptive control framework, allowing for dynamic adjustments in operational strategies to maintain grid stability and efficiency. The implementation of this model demonstrated significant improvements, achieving up to 96% efficiency, reducing energy expenses by 20%, lowering carbon emissions by 30%, and cutting annual operational downtime by half. This research underscores the potential of integrating advanced AI-driven predictive analytics into energy management systems, facilitating a more resilient and sustainable transition toward renewable energy solutions.

UPCOMING CONFERENCES

12TH International Conference of Fluid Flow, Heat and Mass Transfer (FFHMT 2025)
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London, UK | July 15-17, 2025

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Paris, France | April 14-16, 2026

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Paris, France | April 14-16, 2026

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Ultrafast evanescent heat transfer across solid interfaces via hyperbolic phonon-polariton modes in hexagonal boron nitride

Authors: William Hutchins et al.
Nature Materials, 2025

This study introduces a new method for improving the integration of photovoltaic (PV) systems into power grids by using a dual-phase optimization model powered by Generative Adversarial Networks (GANs). These AI tools simulate realistic energy usage and generation patterns, which are then used to dynamically adjust grid operations in real time. The approach led to notable gains, including 96% efficiency, a 20% reduction in energy costs, 30% lower carbon emissions, and a 50% decrease in downtime—highlighting the value of AI in creating smarter, more sustainable energy systems.

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