

Examining the influence of inlet and outlet temperatures on overall thermal performance, with a focus on balancing efficiency and system longevity. [5]

Investigating the role of advanced control systems in optimizing the thermal performance of condensing boilers and adapting to varying conditions. [6]

Exploring the potential synergies between condensing boilers and renewable energy sources to further enhance overall efficiency [7].

Conclusion. This research aims to provide a comprehensive analysis of the energy-saving capabilities and thermal performance of condensing boilers. By evaluating their efficiency, identifying influencing factors, and proposing optimization strategies, this study contributes valuable insights to the ongoing efforts towards sustainable and energy-efficient heating systems. The findings will be beneficial for policymakers, engineers, and stakeholders seeking to make informed decisions in the pursuit of a more sustainable energy future.

1 MenY. et al. A review of boiler waste heat recovery technologies in the medium-low temperature range Energy (2021)

2 FirthA. et al. Quantification of global waste heat and its environmental effects Appl. Energy (2019)

3 WangC. et al. Experimental study on heat pipe thermoelectric generator for industrial high temperature waste heat recovery Appl. Therm. Eng. (2020)

4 YanS.R. et al. Energy efficiency optimization of the waste heat recovery system with embedded phase change materials in greenhouses: a thermo-economic-environmental study J. Energy Storage (2020)

5 H. Li et al. Review on heat pipe based solar collectors: Classifications, performance evaluation and optimization, and effectiveness improvements[J] Energy (2022)

6 TrafczynskiM. et al. Energy saving potential of a simple control strategy for heat exchanger network operation under fouling conditions Renew. Sustain. Energy Rev. (2019)

7 Huan Yang a, Xiaolong Lin a, Hejitian Pan a, Sajie Geng a, Zhengyu Chen b, Yinhe Liu Energy saving analysis and thermal performance evaluation of a hydrogen-enriched natural gas-fired condensing boiler International Journal of Hydrogen Energy Volume 48, Issue 50, 12 June 2023, Pages 19279-19296

8 A.G. Olabi Compressed air energy storage systems: components and operating parameters–A review J Energy Storage (2021)

UDK 697.326

RESEARCH ON THE ENERGY EFFICIENCY OF SOLAR PANELS

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Abstract. Solar energy is a pivotal component in the global transition towards sustainable power sources. This research aims to provide a comprehensive analysis of the energy efficiency of solar panels, examining various technologies, influencing factors, and potential avenues for improvement. By addressing both technological and environmental considerations, this study contributes to the ongoing discourse on enhancing the performance and sustainability of solar energy systems.

Introduction. Solar photovoltaic (PV) technology has emerged as a leading solution for renewable energy generation. This research focuses on evaluating the energy efficiency of solar panels, considering their role in mitigating climate change and meeting the growing global demand for clean energy.

Solar Panel Technologies. Comparative analysis of different solar panel technologies, assessing their efficiency, cost-effectiveness, and suitability for various applications. [1]

Exploring advanced solar cell technologies, such as tandem and multijunction cells, and their potential to achieve higher efficiency levels. [2]

Investigating the impact of sunlight intensity and the angle of incidence on solar panel performance, considering geographical variations.

Analyzing the benefits and challenges of bifacial solar panels, which can capture sunlight from both the front and rear sides. [3]

Highlighting potential advancements in solar panel technology and innovations that could further enhance energy efficiency.

Discussing the role of supportive policies and market dynamics in promoting the adoption of energy-efficient solar panels. [4]

Examining the influence of inlet and outlet temperatures on overall thermal performance, with a focus on balancing efficiency and system longevity. [5]

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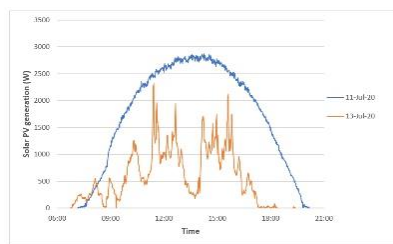


Fig 1. Solar panel activity [8]

Conclusion. This research provides a comprehensive overview of the energy efficiency of solar panels, addressing technological aspects, environmental considerations, and future prospects. The findings aim to inform policymakers, researchers, and industry stakeholders on strategies for improving the efficiency and sustainability of solar energy systems, contributing to the global transition to cleaner and more efficient energy sources.

1 J. Yang et al. Synthesis and application of silver and copper nanowires in high transparent solar cells *Adv. Powder Mater.* (2022)

2 Firth A. et al. Quantification of global waste heat and its environmental effects *Appl. Energy* (2019)

3 Wang C. et al. Experimental study on heat pipe thermoelectric generator for industrial high temperature waste heat recovery *Appl. Therm. Eng.* (2020)

4 Yan S.R. et al. Energy efficiency optimization of the waste heat recovery system with embedded phase change materials in greenhouses: a thermo-economic-environmental study *J. Energy Storage* (2020)

5 H. Li et al. Review on heat pipe based solar collectors: Classifications, performance evaluation and optimization, and effectiveness improvements *J. Energy* (2022)

6 Q. Hou, D. Zhou, J. Feng Coordinate attention for efficient mobile network design *Proceedings of the IEEE/CVF conference on computer vision and pattern recognition, 2021* (2021), pp. 13713-13722

7 Huan Yang a, Xiaolong Lin a, Hejitian Pan a, Sajie Geng a, Zhengyu Chen b, Yinhe Liu Energy saving analysis and thermal performance evaluation of a hydrogen-enriched natural gas-fired condensing boiler *International Journal of Hydrogen Energy* Volume 48, Issue 50, 12 June 2023, Pages 19279-19296

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