

**JH Solar**

# **Photothermal energy storage power generation process**



## Overview

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Abstract: This study proposes an all-day solar power generator to achieve highly efficient and continuous electricity generation by harnessing the synergistic effects of photoelectric-thermoelectric conversion and latent thermal energy storage. The all-day solar power generator exhibits an average efficiency of 18.5% and a power density of 150 W/m<sup>2</sup>. The generator consists of a photoelectric-thermoelectric conversion module (STHET) and a latent thermal energy storage module (TEG). The STHET module is composed of a photoelectric conversion layer, a thermoelectric conversion layer, and a latent thermal energy storage layer. The TEG module is composed of a latent thermal energy storage layer and a thermoelectric conversion layer. The STHET module is connected to the TEG module via a power management system. The generator is tested under various conditions, and the results show that it can generate electricity continuously throughout the day, even during periods of low solar irradiance. The generator is a promising solution to address energy and water shortages.

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In this study, we propose an all-day solar power generator to achieve highly efficient and continuous electricity generation by harnessing the synergistic effects of photoelectric-thermoelectric conversion and latent thermal energy storage. The all-day solar power generator exhibits an average efficiency of 18.5% and a power density of 150 W/m<sup>2</sup>.

All-day freshwater and power generation via integrated photothermally enhanced thermoelectrics and evaporative cooling † Solar-powered simultaneous electricity and freshwater production is a promising solution to address energy and water shortages. However, current technologies are limited by their. What is solar photo-thermal power generation?

. Solar photo-thermal power generation refers to use large-scale array parabolic or disk-shaped mirror to collect solar thermal energy, to provide steam to turbine generators for power generation [13, 14].

What is photothermal phase change energy storage?

To meet the demands of the global energy transition, photothermal phase change energy storage materials have emerged as an innovative solution. These materials, utilizing various photothermal conversion carriers, can passively store energy and respond to changes in light exposure, thereby enhancing the efficiency of energy systems.

What are the parts of photothermal power generation system?

The photo-thermal power generation system consists of four parts: heat collecting system, heat transmission system, heat storage and heat exchange system, and power generation system (see figure 2). . In contrast, the linear Fresnel-type and disc-type power station were less than 1%.

How does photothermal heat release work?

This device effectively controls temperature through photothermally driven heat release under conditions as low as  $-40\text{ }^{\circ}\text{C}$  and achieves a high energy density of  $380.76\text{ J/g}$  even at  $-63.92\text{ }^{\circ}\text{C}$ . The thermal effect is primarily due to light-induced molecular isomerization, a nonradiative relaxation process.

What is photothermal conversion efficiency?

These carriers are primarily focused on enhancing photothermal conversion rates, while also improving thermal conductivity, sealability, and the control of thermal radiation intensity in PCMs. For commonly used PTCPCEM, the photothermal conversion efficiency is required to be above 50% to 70%.

Can thermoelectric generators convert solar energy into electrical energy?

Inspiring new insight to design and construct novel energy conversion and storage devices. Thermoelectric generators (TEGs), which harness and convert solar-thermal energy into electrical energy, possess immense potential within the field of photothermal conversion (PTC).

## Photothermal energy storage power generation process

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### Enhanced solar-driven thermoelectric power generation and water

This technique employs solar energy to evaporate water, where water is separated from impurities and contaminants to generate clean drinking water. The ...

### The underappreciated role of developing photothermal power ...

This research presents and characterizes the spatiotemporal distributions of both photovoltaic-based and photothermal-based solar power potentials, utilizing satellite ...



### Study on characteristics of photovoltaic and photothermal ...

This paper studies the energy storage and generation characteristics of the photovoltaic power generation coupling compressed air energy storage system for the 5 kW ...

### A photothermal energy storage phase change material with high ...

In recent years, the growth rate of energy

demand and carbon emissions has reached an unprecedented level.<sup>1,2</sup> As a renewable energy source, solar power holds ...



### Highly efficient and stable solar-driven seawater desalination ...

Schematic of the water evaporation process of the CPSES with inner multi-scale CuS-rGO pyramidal photothermal structure and outer CuS-rGO/CF@ Paraffin photothermal ...

### Photothermal Phase Change Energy Storage ...

As illustrated in Fig. 1, when PCMs are combined with carriers, they utilize the photothermal conversion properties of the carriers to achieve energy storage. During periods of abundant sunlight, the carriers ...



### Photothermal energy storage power generation system process

Direct-photothermal energy conversion and storage experiment: The 300 W Xe-lamp was used as the solar simulator in the direct-photothermal energy conversion and storage experiment with ...

## Photothermal catalytic hydrogen production coupled with ...

Abstract Photothermal catalytic water splitting is a potential way to produce renewable hydrogen. However, low-grade heat converted from solar energy in the ...



## Solar thermal power generation technology research

Solar photo-thermal power generation refers to use large-scale array parabolic or disk-shaped mirror to collect solar thermal energy, to provide steam to turbine generators for power

## Composite phase-change materials for photo-thermal conversion ...

Photo-thermal conversion phase-change composite energy storage materials (PTCPCEsMs) are widely used in various industries because of their high therm...



## Comprehensive comparison between photothermal power generation ...

Photovoltaic power generation and photothermal power generation are two forms of solar power generation. The development cost of photovoltaic is relatively lower than photothermal, but a ...

## Long-term energy management analysis of a novel solar ...

Photothermal conversion phase change materials that integrate solar-thermal conversion with thermal management have emerged as a promising solution for energy ...



## Comparative analysis of solar thermal power ...

2) Pollution-free solar photothermal power generation Photothermal power generation is a clean production process, which basically uses physical means to convert photoelectric energy. It has little ...

## Photothermal catalytic hydrogen production coupled with ...

Photothermal catalytic water splitting is a potential way to produce renewable hydrogen. However, low-grade heat converted from solar energy in the photochemical process is inevitably ...



## Photothermal Phase Change Energy Storage ...

To meet the demands of the global energy transition, photothermal phase change energy storage materials have emerged as an innovative solution. These materials, utilizing various photothermal ...

????????????????????-?-?-????????????? ...

??,?????????????Photothermal catalytic hydrogen production coupled with thermoelectric waste heat utilization and thermal energy storage for continuous ...



### All-day solar power generation enabled by photo/thermoelectric

In this study, we propose an all-day solar power generator to achieve highly efficient and continuous electricity generation by harnessing the synergistic effects of ...

### Photothermal Nanomaterials: A Powerful Light-to ...

All forms of energy follow the law of conservation of energy, by which they can be neither created nor destroyed. Light-to-heat conversion as a traditional yet constantly evolving means of converting light into ...

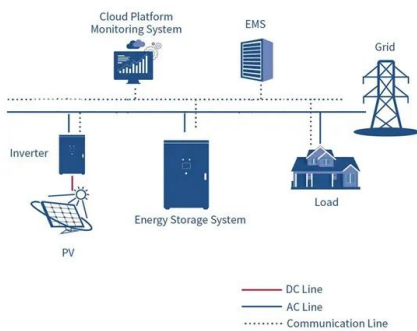


### Principles and applications of photothermal catalysis

In addition, there are photothermal power generation and photothermal energy storage device design (Figure 1 C). 141718 Particularly, intensive attempts and strategies have ...

## Photothermal Devices for Sustainable Uses ...

For example, photothermal energy is susceptible to the weather, and stable power output in all weather conditions can be achieved by coupling with other heating strategies or using a thermal storage device.



## Construction of Multifunctional Photothermal/Photocatalytic ...

1 Introduction Solar energy is increasingly pivotal in addressing energy deficits and mitigating environmental pollution. However, the limited application scope of solar-driven ...

## The difference between photothermal and ...

Photothermal power generation is a clean production process, which basically uses physical means to convert photoelectric energy and has little harm to the environment. The CO2 emission of solar photothermal power ...



## Recent progress on photothermal nanomaterials: Design, ...

Photothermal energy conversion represents a cornerstone process in the renewable energy technologies domain, enabling the capture of solar irradiance ...

## Photothermal Synergistic Hydrogen Production via a ...

Employing UV-vis spectrum for hydrogen generation and vis-IR spectrum to elevate reaction temperatures and induce phase transitions effectively enhances yield and ...



## All-day freshwater and power generation via integrated ...

Solar-powered simultaneous electricity and freshwater production is a promising solution to address energy and water shortages. However, current technologies are limited by ...

## Solar thermal power generation technology research

Solar power generation has attracted extensive attention because of its advantages such as wide source, low operating cost and no pollution to the environment. The large-scale application of ...



## Carbon-based photothermal materials for the simultaneous generation ...

Carbon-based photothermal materials (CPTMs) can introduce temperature and salinity gradients in the SIVG process because of their outstanding photothermal conversion ...

## Solar Thermal Power Generation Technology Development

In order to better understand the development of solar thermal power generation technology, this paper compares four different types of solar thermal power generation ...



## Recent advances in carbon-based materials for ...

Based on the research progress and achievements of photothermal conversion materials and devices in the fields of seawater desalination and photothermal electric energy generation in recent years, the challenges ...

## Hydrogel-Based Photothermal-Catalytic ...

Abstract Photothermal-catalytic (PTC) process is a promising way to produce freshwater and clean hydrogen by integrating solar-driven desalination and water splitting. However, efficient solar ...



## Photothermal catalysis: From fundamentals to practical applications

Photothermal catalysis is an innovative approach that integrates photochemical and thermocatalytic processes to enable an efficient use of full-spectrum sunlight in catalyzing ...

## Photothermal conversion-enhanced thermoelectric generators ...

This study offers invaluable insights into the development of highly efficient solar-thermal energy conversion and storage methods.



## Double-layered phase change materials featuring high photothermal

Abstract Organic solid-liquid phase change materials have attracted great attention in the field of photothermal conversion and energy storage due to their advantages ...

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