Multi-mode solar thermal power generation device

Can a molecular solar thermal energy storage system be a hybrid device?
Two main issues are (1) PV systems' efficiency drops by 10%-25% due to heating, requiring more land area, and (2) current storage technologies, like batteries, rely on unsustainably sourced materials. This paper proposes a hybrid device combining a molecular solar thermal (MOST) energy storage system with PV cell.

How does a molecular solar thermal system work?
This layer employs a molecular solar thermal (MOST) energy storage system to convert and store high-energy photons--typically underutilized by solar cells due to thermalization losses--into chemical energy. Simultaneously, it effectively cools the PV cell through both optical effects and thermal conductivity.

Can a molecular solar thermal system be combined with a PV cell?
This paper proposes a hybrid devicecombining a molecular solar thermal (MOST) energy storage system with PV cell. The MOST system,made of elements like carbon,hydrogen,oxygen,fluorine,and nitrogen,avoids the need for rare materials.

What is PV power generation?
Under the intelligent control strategy, PV power generation is used for heating during periods with high solar radiation, and used for domestic hot water, lighting or energy storage during periods with low solar radiation.

How efficient is a solar thermal energy storage system?
The solar thermal energy storage efficiency ?experiment of the MOST system has been determined to reach up to 2.3%,representing the highest recorded efficiency to date. 34 Additionally,the inclusion of the MOST system as a non-heating temperature stabilizer with optical filter effect can further enhance the efficiency of the PV cell.

How are solar thermal processes used?
Solar thermal processes, on the other hand, are used in two distinct ways: electricity generation by mechanical heat engines in large power plants, and household heat supply by means of solar hot-water systems.

Moreover, solar parabolic trough collectors and molten salt thermal energy storage are used to preheat water entering a bottoming steam-driven power generation cycle. An electrolizer is installed to separate water into hydrogen and oxygen for charging a hydrogen storage tank, procuring hydrogen for fuel cell vehicles, and producing methane by combining ...

Liu et al. [27] introduced solar thermal energy into a combined cooling-heat-power (CCHP) system by storing and releasing solar thermal energy and excess heat from the flue gas pipeline through a thermal storage unit. On typical days during the summer, winter and transition seasons, the system achieved primary energy savings

of at least 11 % higher than ...

Solar energy is a green, stable and universal source of renewable energy, with wide spectrum and broad area characteristics [1] is regarded as being one of the renewable energy sources with the greatest potential to achieve sustained, high intensity energy output [1], [2].The conflict between population growth and water shortage has become one of the most ...

ABSTRACT Aiming at the randomness and strong disturbance of linear Fresnel solar thermal power generation system, a sliding mode predictive control strategy is proposed. First, the dynamic mathematical model of the ...

A renewable energy multi-generation system based on proton exchange membrane fuel cell (PEMFC) and solar energy is proposed. The hybrid system is mainly composed of PEMFC, solar dish collector (SDC), solid oxide electrolyzer cell (SOEC) and dual Rankine cycle (DRC), which can provide electricity, heat, hydrogen and hot water.

The solar thermal power generation system adopts a dual-axis timely tracking instrument device, which realizes that the sunlight and the central axis of the heliostat instrument device are kept ...

To mitigate this issue, a hybrid device has been developed, featuring a solar energy storage and cooling layer integrated with a silicon-based PV cell.

A suitable comparison of three modes of energy production at the expense of solar thermal energy, the first law and second law efficiencies for power generation as, combined cycle, cogeneration cycle, and tri-generation cycle system was computed at mean operating conditions and illustrated in Fig. 17. The effect of waste heat recovery is very ...

The ideal layer thicknesses of 450 nm for the electron transport layer, 600 nm for the perovskite layer, and 30 nm for the hole transport layer, with respective carrier densities of 10 19, 10 17, and 10 18 cm -3, enabled the optimal device to achieve a short-circuit current of 34.31 mA/cm 2, an open-circuit voltage of 0.88 V, a fill factor of 85.3 %, and a power conversion ...

This paper reports on the development of a hierarchical control strategy for a multi-generation solar plant. The plant includes a linear Fresnel reflector, an organic Rankine cycle, an absorption chiller, a thermal storage tank, circulation pumps, and valves.The hierarchical control strategy consists of three successive layers in addition to a wireless monitoring system.

The aim of this study is to optimize the integrated performance of a hybrid combined cooling, heating, and power system driven by natural gas as well as solar and geothermal energy resources from ...

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The research on hydro-thermal-wind-solar power generation is roughly classified and summarized in Table 7. The original problem of hydro-thermal-wind-solar power generation was divided into four sub-questions of energy, and then an effective method for achieving long-term coordination was proposed to fully meet the needs of the grid [74].

The utilization of solar energy has received extensive global attention, as reflected by advances in the fields of photovoltaic power generation, solar thermal power generation, solar desalination, solar thermal chemistry, etc. [1], [2], [3], [4].Among these technologies, solar heating system employs the clean and free solar energy to supply heat to ...

According to the form of solar energy utilization, the coupling form of solar energy and coal-fired power generation is mainly divided into three categories, which are the distributed PV and coal-fired power generating combined system [27], coal-fired power system hybridized with concentrated solar thermal system, and coal-fired power system combined with the PV/T ...

Liquid carbon dioxide energy storage is an efficient and environmentally friendly emerging technology with significant potential for integration with renewable energy sources.However, the heat recovery and utilization during compression and expansion are not implemented well. This paper proposes a multi-mode solar-thermal-assisted liquid carbon ...

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