Solar energy utilization and power generation efficiency

In direct coupling, increased solar irradiance leads to higher power output but also to energy waste, as the surplus energy generated cannot be stored or utilized beyond the electrolyzer"s immediate demand, thus decreasing overall energy efficiency. The approach discussed here mitigates this inefficiency by storing excess PV energy in batteries, enhancing ...

Solar energy utilization is vital for the development of zero-energy buildings. Paper [24] investigated the potential of achieving nearly zero-energy apartment buildings using integrated solar technologies and dynamic occupancy profile in Northern Europe. The results indicated that, in any case, the energy generated onsite with conventional solar technologies ...

In the hybrid system, the efficiency of solar power generation is increased through the effective use of both photovoltaic and thermal power. The thermoelectric generator (TEG) can also generate electricity using the waste heat generated by the solar panel, and the thermoelectric cooler (TEC) can rapidly cool the solar panel. With the help of the harvested ...

The use of renewable energy has garnered attention owing to the energy crisis and increasingly serious environmental problems [1, 2].The development of a solar energy-efficient utilization technology is of great significance for solving such problems [3], and the most widespread application is in photovoltaic (PV) cells.Through the generation of electron-hole pairs, solar ...

This paper aims to investigate the two-stage energy production and energy utilization efficiency in the thermal power industry by taking the fixed-sum carbon emission constraint into account, which is largely different from the previous studies. Table 1. Studies on evaluating the thermal power industry based on DEA modelling. Studies DEA modelling ...

The study delved into how Energy Storage Batteries (ESB) can boost self-consumption and independence in homes fitted with solar panels in Baghdad city capital of Iraq. We examined various ESB sizes, ranging from 2 kWh to 14 kWh, to gauge their influence on a building energy efficiency. The evaluations, spanning daily to yearly periods, indicated that as ...

Power generation by fossil-fuel resources has peaked, whilst solar energy is predicted to be at the vanguard of energy generation in the near future. Moreover, it is ...

However, there are still challenges remaining that need to be addressed to maximize the efficiency of solar energy utilization. For instance, the absorption of solar radiation in connection with the band gap of the used semiconductor is crucial. When a short wavelength photon with energy greater than the band gap of Si is absorbed by a Si solar cell, ...

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Nowadays, many countries promote biomass energy utilization due to its advantages in carbon neutrality (Singh et al., 2021), and the utilization of biomass includes residential solid fuel, biomass open burning, conversion to liquid or gaseous fuels, power generation, industrial materials, and so on (Du et al., 2023a).Among the various utilization ...

To enhance the efficiency of solar energy utilization, a thermoelectric generator (TEG) was incorporated into the bottom of the multi-scale CuS-rGO pyramidal photothermal structure (Fig. 1), and an integrated water evaporation and thermoelectric power generation system (IWETPGS) was built.

In the research paper " Hybrid solar energy device for simultaneous electric power generation and molecular solar thermal energy storage, available in Joule, the team explains the MOST system is ...

Solar Performance and Efficiency. The conversion efficiency of a photovoltaic (PV) cell, or solar cell, is the percentage of the solar energy shining on a PV device that is converted into usable electricity. Improving this conversion ...

Efficient utilization of solar energy for cogeneration is an important application in the built environment, with wide applicability. This review provides a ...

Renewable energy can be defined as a continuous generation of energy directly from the sun (photoelectric, photochemical, and thermal), indirectly from the sun (energy stored in biomass, hydropower, and wind), or from the natural movement of the environment (geothermal and tidal energy), which makes it a sustainable solution for generating power. ...

Hence, accurate prediction of solar electricity generation plays a crucial role in enhancing the utilization of solar energy and bolstering the resilience of the power system. The expansion of the ...

Renewable energy plays a significant role in achieving energy savings and emission reduction. As a sustainable and environmental friendly renewable energy power technology, concentrated solar power (CSP) integrates power generation and energy storage to ensure the smooth operation of the power system. However, the cost of CSP is an obstacle ...

From the perspective of solar energy efficiency, with the utilization of solar seasonal residual energy, the solar energy effective utilization efficiency of systems A and B has been improved by 69.12% and 18.65%, respectively. Moreover, the solar energy effective utilization hours (defined as the total hours of the solar plant running during the whole year) ...

As the world"s largest carbon emitter, China has pledged to achieve carbon neutrality by 2060. An essential pathway to the carbon neutrality goal is to promote the replacement of coal-fired power generation with low or zero-carbon energy sources [1], [2].Solar power, especially solar photovoltaic (PV), will be one of the main

energy sources in the future ...

Such systems are more efficient due to the provision of heat removal from PV panels through circulating fluid/s and utilization of this heat for other applications. Accordingly, PV/T systems consist of PV panels, fluid circulation system attached to PV panels" backside, and routing of the heat for further useful work. Al-Waeli et al. 12] and Diwania et al. [13] provided an ...

Effective use of solar energy depends on the proper knowledge on its use and techniques. This article reviews different solar storage technologies to obtain green sustainable ...

The solar photovoltaic power generation system can reduce carbon dioxide emissions by 147.11 t within 25 years, and the solar collector system can save 170.5 thousand yuan in 1 year. It has ...

This will enable the mixing of heat and power generation to establish the hierarchical cycle organic cogeneration to study concentrated solar energy supercritical CO 2 Brayton cycle power generation, photon-enhanced ...

Previous limiting efficiencies of CPV/T hybrid systems that split incident light into two bands (above and below bandgap) have been calculated and reported. 12,13 Allowing for the thermalization of high-energy photons, however, by introducing a high-energy cutoff in the spectral splitter can vastly improve device performance by trading waste heat generation in ...

Due to the implementation of the "double carbon" strategy, renewable energy has received widespread attention and rapid development. As an important part of renewable energy, solar ...

The presented research aimed to conduct a comprehensive analysis of both individual and hybrid MPPT techniques for efficient solar power generation. The primary ...

The IEA report indicates that global solar photovoltaic generation increased by about 130 TWh in 2019, second only to wind in absolute terms, reaching 2.7% of electricity supply [5].And solar PV increased by 22% year-on-year, far outpacing wind power [5].The annual growth rate of renewable energy generation structure for regions in 2019 is provided in Fig. 1.

A new solar-aided power generation system is proposed. It is based on the unique characteristics of non-concentrating and concentrating solar energy applied to lignite drying. In the new system, solar energy cascade utilisation is achieved by the two-stage solar drying of lignite. Solar irradiance, especially diffused irradiance, can be efficiently used in the ...

Solar-aided power generation (SAPG) is a promising way to achieve clean and efficient production of electricity. An efficient solar/lignite hybrid power generation system was proposed in the paper, in which solar

energy was amplified in solar-driven heat pump cooperating with waste heat recovery and two-stage drying was applied for energy cascade ...

Solar energy increases its popularity in many fields, from buildings, food productions to power plants and other industries, due to the clean and renewable properties. To eliminate its intermittence feature, thermal energy storage is vital for efficient and stable operation of solar energy utilization systems. It is an effective way of decoupling the energy ...

The corrected annual average effective efficiency is 28.66% higher than the existing study. This study helps to evaluate the energy efficiency of photovoltaic systems more accurately and ...

The solar energy utilization efficiency i ... STT evaporation technology includes sea water desalinization, power generation and steam sterilization. For example, by combining carbon nanotube ...

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