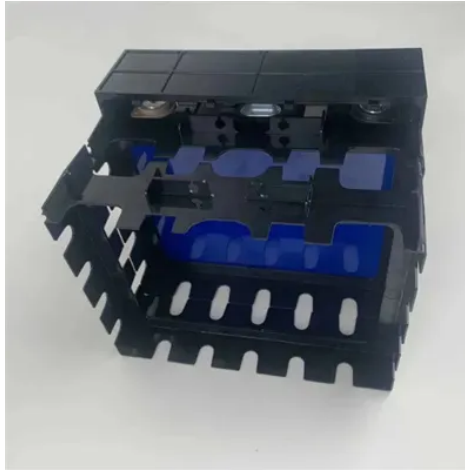


Multi-energy photovoltaic solar power generation



Overview

This paper designs a new multi-generation system based on solar tower power supply, integrating a solid oxide fuel cell-gas turbine system, a supercritical recompressed carbon dioxide cycle, a Rankine cycle, an organic Rankine cycle, a compressed air energy storage system and a liquefied natural gas system. The aim is to overcome the intermittent and unstable nature of the solar power supply and ensure continuous power generation throughout the day, a. This paper designs a new multi-generation system based on solar tower power supply, integrating a solid oxide fuel cell-gas turbine system, a supercritical recompressed carbon dioxide cycle, a Rankine cycle, an organic Rankine cycle, a compressed air energy storage system and a liquefied natural gas system. The aim is to overcome the intermittent and unstable nature of the solar power supply and ensure continuous power generation throughout the day, as well as improving the energy efficiency of the solar power system and minimising exhaust emissions from the integrated system. The system is modelled and evaluated in terms of energy, exergy, environment and economy. The results show the solar system energy efficiency of 10.09%, the total system energy efficiency of 19.28%, a round-trip efficiency of 58.66% and an exergetic round-trip efficiency of 52.06%, preventing the emission of 2090 tons of CO₂ (a total of \$50175 in environmental fines) per year. Finally, the proposed system was applied to a case study in the Xixiangtang district of Nanning, China, where the system, combined with real data, produced 24.8 MWh of electricity on the day with the highest direct of normal irradiance. In addition, the results of the economic analysis show the dynamic payback period is 6.9 years. ••Solar energyCarbon captureSolid oxide fuel cell-gas turbineWaste heat recoveryCompressed air energy storage4E analysesA conductivity constantsAcell active surface area (m²)C⁺ cost rate (\$/h)Ctotal total system cost (\$)...

Article Content

Multi-scale solar radiation and photovoltaic power forecasting with ...

The precise forecasting of solar radiation and PV power is highly desirable to increase its availability in the urban environment (Anderson and Leach, 2004). Although solar energy is considered a promising resource, it poses several threats when it integrates into the power grids (Bella Espinar, José-Luis Aznarte et al., 2010). The main challenge of solar energy ...

Deep learning-based solar power forecasting model to analyze a multi ...

Multi-energy microgrids (MEM) are a new class of power grids focusing on the distributed form of generation and integrating different energy sectors. The primary idea of MEM is to increase renewable energy share in the final energy demand while maintaining the energy balance at all times.

Overview of hydro-wind-solar power complementation

Wind power and photovoltaic (PV) power generation began on a large scale in the 21st century, and both developed rapidly. The continuous development of economy and society as well as the improvement of people's living standards lead to growing demand for energy. ... 2 Hydro-wind-solar multi-energy complementation Hydro ...

Deep learning-based solar power forecasting model to analyze a multi ...

Multi-energy microgrids (MEM) are a new class of power grids focusing on the distributed form of generation and integrating different energy sectors. ... Basic plots on the PV power generation ...

Time series forecasting of solar power generation for large-scale ...

Two multi-layer perceptron ... Short-term prediction of photovoltaic energy generation by intelligent approach. Energy Build., 55 ... Artificial neural network based models for forecasting electricity generation of grid connected solar PV power plant. Int. J. Glob. Energy., 21 (2004), pp. 119-130.

Multi-objective optimization with advanced exergy analysis of a ...

The sequence of optimization potential for the WSH-MES system is found to be as follows: concentrated solar power, photovoltaics, proton exchange membrane fuel cells, wind power, and proton exchange membrane electrolyzers. ... Research status and future of hydro-related sustainable complementary multi-energy power generation. Sustain Futures, 3 ...

Multi-energy complementary power systems based on solar energy...

The multi-energy hybrid power systems using solar energy can be generally grouped in three categories, which are solar-fossil, solar-renewable and solar-nuclear energy hybrid systems.

The economic use of centralized photovoltaic power generation ...

The third is about the design and operation of photovoltaic energy storage systems, such as a photovoltaic fuel cell power generation system can convert solar thermal energy into electrical energy after storage .

Multi-step photovoltaic power forecasting using transformer and ...

As solar energy generation cannot be planned, ... In this study, multi-step day-ahead PV power generation forecasting models were developed using the transformer network. The input of the model was an aggregation of several data sources, such as weather observations, weather forecasts, and solar geometry. ...

Optimization of multi-energy complementary power generation ...

The optimal configuration of multi-energy complementary power generation is explored using the particle swarm algorithm. The objective functions are to minimize CO₂ ...

Research status and future of hydro-related sustainable complementary ...

Results show that the use of hydro-related multi-energy power generation is the current research trend for maximizing profits, reducing losses and so on. In the future, the design, operation and optimization research of multi-energy power generation systems related to hydro, especially hydro, wind and solar energy will be important development ...

Technical and economic analysis of multi-energy complementary ...

The fluid in the PV/T collector absorbs solar energy and then stores it in the hot water storage tank. This stored thermal energy is utilized as a heat source for the water-water heat pump unit. ... due to the combined heat and power generation capability of PV/T mentioned earlier, ... Transient optimization of a new solar-wind multi-generation ...

A review of multistage solar driven photovoltaic-thermal ...

The power generation should consistently equal the loads demand. As a result, the main issues related to integrated cascade solar energy systems for tri-generation are the optimization design and sizing para, as well as the optimal operation control strategies, that may seek to lower the investment cost, life cycle cost, operational cost among ...

Analysis Of Multi-energy Complementary Integration ...

Multi-energy complementary systems usually include thermal power (including gas turbine), wind power, solar power (photovoltaic), hydropower, pumped storage and other types of power ...

Research on optimization of photovoltaic capacity in the multi ...

Multi-energy complementary power generation (MEPG) technology is one of the effective utilization means of renewable energy generation. In this paper, a MEPG system is ...

High-efficiency bio-inspired hybrid multi-generation photovoltaic ...

Here, we demonstrate a hybrid multi-generation photovoltaic leaf concept that employs a biomimetic transpiration structure made of eco-friendly, low-cost and widely ...

Energy Conversion and Management

Solar energy is concentrated by solar concentrators and then divided into two parts through spectral beam-splitting film. The high-grade solar energy is utilized for photovoltaic power generation. The low-grade solar energy is converted into thermal energy, providing heat for DRM reactions, and producing grey hydrogen.

Optimal design of multi-energy complementary power generation ...

Optimal design of multi-energy complementary power generation system considering fossil energy scarcity coefficient under uncertainty. ... It can also characterize the randomness of wind and solar power generation, and calculate the correlation between the two outputs. ... Mid-to-long term wind and photovoltaic power generation prediction based ...

Multi-objective optimization of multi-energy complementary ...

As solar radiation intensity increases, PV power generation gradually rises and reaches its peak between 11:00 AM and 1:00PM, followed by a subsequent decline. During this period, if the BS operates at maximum capacity in Mode 1 and Mode 2, surplus power needs to be transmitted to the grid for full consumption.

Multi-energy complementary power systems based on solar ...

This paper studies a novel tower solar aided coal-fired power generation (TSACPG) system with thermal energy storage (TES) system to realize the high-grade solar ...

Optimal dispatch of a multi-energy complementary system ...

Moreover, the city has limited energy resources with low wind and solar power generation, which means it needs to buy electricity from other provincial power grids. ... Optimal design of hydro-wind-PV multi-energy complementary systems considering smooth power output. Sustain Energy Technol Assessments, 50 (2022), Article 101832.

Potential assessment of photovoltaic power generation in China

For China, some researchers have also assessed the PV power generation potential. He et al. utilized 10-year hourly solar irradiation data from 2001 to 2010 from 200 representative locations to develop provincial solar availability profiles was found that the potential solar output of China could reach approximately 14 PWh and 130 PWh in the lower ...

Multi-Model Ensemble for day ahead prediction of photovoltaic power ...

In literature, regarding PV generation forecast, only the simple persistence is used: $P_{PM}(t) = P_{PM}(t-1)$. In this paper, a better suited model based on the persistence of the daily PK cs index was defined: $P_{PM}(t) = P_{PM}(t-1) + \alpha (P_{PM}(t-1) - P_{PM}(t-2))$. M. Pierro et al. / Solar Energy 134 (2016) 132–146

Innovative solar-based multi-generation system for sustainable power ...

Through rigorous energy, exergy, and exergoeconomic analyses, the quantified system performance yielded key quantitative outcomes affirming its efficacy, including a net power output of 32.296 MW, solar energy to shaft work efficiency of 20.36%, total hydrogen generation rate of 0.0042 kg/s, overall hydrogen production efficiency of 50.12% ...

Optimal Scheduling of Wind-Thermal-Hydro-Storage Multi-Energy ...

On the way of pursuing the goal of “achieving carbon dioxide emissions peak by 2030, carbon neutrality by 2060”, the power system is experiencing a profound change [1]. The transformation pace towards low-carbon, cleaning, and green of the power system is accelerating to build a New Power System [2] the New Power System, the capacity of renewable energy, ...

Multi-energy harvesting: Integrating contact-mode and slide-mode ...

Harvesting energy from the surroundings is a splendid and successful technique for getting uninterrupted power for small digital gadgets, (Zhou et al., 2021). Several possible technologies have been harnessed to accumulate energy from the surrounding environment, including solar cells that accumulate energy from daylight and thermal power plants that ...

High-efficiency bio-inspired hybrid multi-generation photovoltaic ...

Most solar energy incident (>70%) upon commercial photovoltaic panels is dissipated as heat, increasing their operating temperature, and leading to significant deterioration in electrical performance.

Capacity configuration optimization of multi-energy system ...

Wind and solar energy are paid more attention as clean and renewable resources. However, due to the intermittence and fluctuation of renewable energy, the problem of abandoning wind and photovoltaic power is serious in China. Hydrogen production by water electrolysis is the effective way to solve the problem of renewable energy absorption. However, ...

Application of Distributed Collaborative Optimization in Building Multi ...

In Figure 3, in the multi-energy complementary energy system of buildings, various units such as photovoltaic power generation, geothermal system, and energy storage equipment can be regarded as subsystems. Each subsystem must work collaboratively to satisfy the electrical, cooling, and heating load requirements of the building while minimizing ...

Advancements In Photovoltaic (Pv) Technology for Solar Energy Generation

This comprehensive overview illuminates the progress made and the potential of PV technology to shape the future of solar energy generation. Discover the world's research 25+ million members

A theory-guided deep-learning method for predicting power generation ...

This work is designed for the total power generation of PV plants in different regions for a power system. For one energy system, there are many plants located in multiple regions, and the energy system collects power generation from all plants. The solar power system is shown in Fig. 6. It can be seen that the blue squares represent the ...

Multi-Objective Sizing of Hybrid Energy Storage System for Large ...

Hybrid energy storage systems (HESS) are an effective way to improve the output stability for a large-scale photovoltaic (PV) power generation systems. This paper presents a sizing method for HESS-equipped large-scale centralized PV power stations. The method consists of two parts: determining the power capacity by a statistical method considering the ...

Multi-objective optimization and algorithmic evaluation for EMS in ...

This manuscript focuses on optimizing a Hybrid Renewable Energy System (HRES) that integrates photovoltaic (PV) panels, wind turbines (WT), and various energy ...

Research on optimization of photovoltaic capacity in the multi ...

This study aims to exploit the low-cost generation of photovoltaic (PV) plant and high-capacity and low-cost thermal energy storage (TES) system of concentrating solar power ...

Life cycle assessment of grid-connected power generation from ...

Among various types of renewable energy sources, solar energy is promising due to its large energy potential and clean nature we evaluated the energy and environmental impacts of grid-connected power generation from multi-Si PV system in China. In order to obtain more comprehensive and accurate results, our research is designed ...

Advancements In Photovoltaic (Pv) Technology for ...

This comprehensive overview illuminates the progress made and the potential of PV technology to shape the future of solar energy generation. Discover the world's research 25+ million members

A spectral-splitting photovoltaic-thermochemical system for energy ...

To allow these conventional CPVT systems to achieve respectable efficiencies, synergistic coupling between PV power generation and thermal energy conversion (to various forms, including power) is crucial. ... In these systems, multi-junction solar cells were employed for power generation. Thermodynamic analysis indicated that these systems were ...

Supporting strategy for investment evaluation of photovoltaic power ...

Research has shown that in energy system applications, multi-criteria analysis methods such as the AHP method and the TOPSIS method are chosen to manage the uncertainties and ... Evaluation model for investment in solar photovoltaic power generation using fuzzy analytic hierarchy process. Sustainability, 11 (10) (2019), p. 2905. Crossref View ...

Energy and AI

Currently, solar and wind generations have become an essential part of smart grids, smart microgrids and smart buildings, which account for an increasing sharing proportion in electricity supply [16, 17]. Nevertheless, due to the high-randomness, low-predictability and intermittent characteristics of solar and wind energy, reliability and security of large-scale grid ...

Multivariate analysis and optimal configuration of wind ...

configuration of system. Finally, the intelligent control and on-line monitoring of wind-solar complementary power generation system were discussed. 1 Introduction Wind and solar energy have some shortcomings such as randomness, instability and high cost of power generation. Wind-solar complementary power generation system is

Multi-Model Ensemble for day ahead prediction of photovoltaic power ...

A comprehensive ensemble approach composed by optimized and diversified Artificial Neural Networks (ANNs) is proposed for improving the 24h-ahead solar PV power production predictions, which would allow balancing power supplies and demands across centralized grid networks through economic dispatch decisions between the energy sources ...

Multi-energy complementary power systems based on solar energy...

There are mainly two methods of solar power generation, which are solar PV [, ,] and solar thermal power generations [8,9]. The PV power system converts solar energy directly into electricity by solar cells. ... The multi-energy hybrid power systems using solar energy can be generally grouped in three categories. The first category is ...

Collaborative planning of multi-energy systems integrating ...

The vigorous deployment of clean and low-carbon renewable energy has become a vital way to deepen the decarbonization of the world's energy industry under the global goal of carbon-neutral development. Ina, as the world's largest CO₂ producer, proposed a series of policies to promote the development of renewable energy in a's installed capacity of wind energy ...

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