Multi-energy solar power generation

Overview

An integrated renewable energy supply system is designed and proposed to effectively address high building energy consumption in Zhengzhou, China. This system effectively provides cold, heat, and electricity by incorporating various clean energy sources such as wind, solar, hydrogen, and geothermal energy. Technical and economic analyses are conducted to optimize the integration of these renewable sources. Technical and economic analyses are cond. An integrated renewable energy supply system is designed and proposed to effectively address high building energy consumption in Zhengzhou, China. This system effectively provides cold, heat, and electricity by incorporating various clean energy sources such as wind, solar, hydrogen, and geothermal energy. Technical and economic analyses are conducted to optimize the integration of these renewable sources. Technical and economic analyses are conducted to optimize the integration of these renewable sources. Rigorous system modeling and dynamic simulation using TRNSYS software evaluate the seamless integration and optimal functioning of the PV/T subsystem within the CCHP system. The interaction between Photovoltaic/Thermal (PV/T) and borehole heat exchanger (BHE) coupling is investigated, analyzing their impact on individual system performance. Furthermore, key indicators, including overall electricity consumption (OEC), life cycle cost (LCC), heat pump coefficient of performance (COPHP), and system coefficient of performance (COPSYS) are analyzed. The robust response surface methodology (RSM) and Box-Behnken experimental design approach are employed to show remarkable agreement between predicted and simulated values, with a maximum deviation of only 1.45%. The optimal configuration consists of a PV/T area of 132 m2, 20 wind turbines, 12 alkaline fuel cells, and 17 borehole heat exchangers, resulting in highly favorable outcomes: an OEC of −35648.72 kW•h/year, an LCC of $209. ••A novel co-generation system integrated PV/T-HP with CCHP, a rarity in prior R-CCHP designs.••The comprehensive system a...

Article Content

Multi-objective capacity estimation of wind - solar - energy ...

Promote the upgrading of the wind and solar power and energy storage planning: x5: Through technological innovation, industrial policy and other means to promote the wind and solar power and energy storage planning''s technical and economic level. Standardize the wind and solar power and energy storage planning standards: x6

(PDF) Research status and future of hydro-related sustainable ...

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 trends.

Open-source multi-year power generation, consumption, and ...

There are some publicly available DER datasets. Twenty four of the available datasets are reviewed by Kapoor et al. 4 Most impactful and notable among them is the Pecan Street data that contain energy usage, EV charging, rooftop solar generation, and energy storage data collected from more than 1000 submetered, mostly residential buildings located in Pecan ...

Development and application status of multi energy ...

Multi energy complementary power generation system multi energy complementary power generation system is the optimal combination of hydropower, wind power, solar power, pumped storage, thermal power and other power sources. It can overcome the shortcomings of single new energy power generation, such as insufficient

An Energy Management System for Multi-Microgrid system ...

Connecting multiple heterogeneous MGs to form a Multi-Microgrid (MMG) system is generally considered an effective strategy to enhance the utilization of renewable energy, reduce the operating costs of MGs by sharing surplus renewable energy among them, and generate income by selling energy to the main grid (Gao and Zhang, 2024).Hence, MMGs are proposed to ...

Multi-objective planning and sustainability assessment for ...

Ding et al. proposed a multi-energy system based on wind power, electricity to gas, solid oxide fuel cell (SOFC) and gas ... evaluated near-zero energy building integrated with new multi-generation solar system by emergy analysis and found that the sustainability index of the energy system without desalination scheme was better than that ...

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.

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

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 proposed, which includes a ...

Multi energy complementary optimization scheduling method...

IES (The Integrated Energy System), consisting of distributed wind and solar power generation and multiple types of loads for cooling, heating, and electrical systems, is an ...

Assessment of Solar Energy Generation Toward Net ...

With the continuous rise in the energy consumption of buildings, the study and integration of net-zero energy buildings (NZEBs) are essential for mitigating the harmful effects associated with this trend. However, ...

A Hybrid Renewable Energy (Solar/Wind/Biomass) ...

To solve this issue, a hybrid renewable energy system (HRES)—a combination of multiple energy sources—is created. Power plants play a crucial role in producing the electricity needed for a grid and saving ...

Capacity-Operation Collaborative Optimization for Wind-Solar ...

In pursuit of widespread adoption of renewable energy and the realization of decarbonization objectives, this study investigates an innovative system known as a wind-solar-hydrogen multi-energy supply (WSH-MES) system. This system seamlessly integrates a wind farm, photovoltaic power station, solar thermal power station, and hydrogen energy network at ...

Technical and economic analysis of multi-energy ...

The output power of the module and the energy balance equation are given by Eqs. (1–3). (1) E Pv = ... Transient optimization of a new solar-wind multi-generation system for hydrogen production, desalination, clean electricity, heating, cooling, and ...

Optimization of multi-energy complementary power generation ...

Against the backdrop of evolving power systems and the increasing integration of wind, solar, thermal, and storage technologies, scientifically optimizing the configuration of ...

Multi-objective energy dispatch with deep reinforcement learning ...

Renewable energy sources such as wind and solar energy are affected by environmental and climatic conditions, the power generation varies greatly, which may lead to major failures of the power generation system, and its own uncertainty is a major problem in the design of dispatch models .Existing energy dispatch models can be roughly divided into ...

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 ...

Multi-criteria design of multi-energy system for remote area using ...

Multi-energy systems (MES) play a key role in solving many significant problems related to economic efficiency, reliability, and impacts on the environment. The multiplicity of ...

Assessment of Solar Energy Generation Toward Net-Zero Energy ...

With the continuous rise in the energy consumption of buildings, the study and integration of net-zero energy buildings (NZEBs) are essential for mitigating the harmful effects associated with this trend. However, developing an energy management system for such buildings is challenging due to uncertainties surrounding NZEBs. This paper introduces an ...

Research on Multi-domain Energy Harvesting Models Based on ...

The “PV+” applied power generation model is a novel model for clean, site-specific use of solar power, transforming some areas of electricity use from consumers of energy to suppliers of energy. It is conducive to improving the efficiency of solar energy harvesting and reducing long-distance transmission and distribution losses (Gorjian et ...

Multi-energy synergistic planning of distributed energy supply ...

Multi-energy synergistic planning of distributed energy supply system: Wind-solar-hydrogen coupling energy supply. ... The surplus electricity from wind and solar power generation can be used for electrolysis to produce hydrogen, and the waste heat generated by the EL, GT, and FC can be recovered to meet the heat demand, improving the energy ...

Further study on carbon fixation using green power for a solar ...

Table 4 shows the design parameters of the main components of the solar-/methane-driven multi-generation system depicted in Fig. 1. Fig. 4 presents the energy conversion of solar heat, solar power, and methane into cooling, heating, power, and methanol. Note that in the traditional multi-generation system without carbon storage, co-production ...

Cost and thermodynamic analysis of wind-hydrogen production via multi ...

Integrating RES such as solar and wind power into multi-energy system designs enables the localization and decentralization of useful energy outputs while reducing carbon emissions . ... Water electrolysis is a proven method for hydrogen generation within multi-energy systems . The incorporation of hydrogen production with multi-energy ...

Research on complementarity of multi-energy power systems: A ...

This paper makes a review of the research on complementarity of new energy high proportion multi-energy systems from uncertainty modeling, complementary ...

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 ...

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 ...

Optimal configuration of concentrating solar power generation in power ...

Concentrating Solar Power (CSP) is an emerging renewable energy technique experiencing fast development worldwide [1, 2].Unlike other renewable energy technologies such as wind power or photovoltaic (PV), which are neither fully dispatchable nor entirely predictable, CSP usually has a thermal energy storage device (TES) that can mitigate the variability and ...

IET Renewable Power Generation

With the development of electrochemical energy storage technology, a lot of literature has established a wind-solar-fire-storage multi-energy complementary optimization scheduling model including electrochemical energy storage. ... In the power generation segment, both hydrogen fuel cells and hydrogen gas turbine technology are commonly used ...

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

For different kinds of multi-energy hybrid power systems using solar energy, varying research and development degrees have been achieved. To provide a useful reference ...

A Hybrid Renewable Energy (Solar/Wind/Biomass) ...

As a backup energy source for Tunisian conditions, Soares and Oliveira suggested a hybrid renewable power generation system that depends on thermal solar energy and biomass sources. A consistent operation close to the …

Optimization study of wind, solar, hydro and hydrogen storage …

In the field of wind-solar complementary power generation, Liu Shuhua et al. developed an individual optimization method for the configuration of solar-thermal power plants and established a capacity optimization model for the integrated new energy complementary power generation system in comprehensive parks .Lin Lingxue et al. proposed an …

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 CO 2 producer, proposed a series of policies to promote the development of renewable energy ina''s installed capacity of wind energy …

Multi-Point Layout Planning for Multi-Energy Power System …

Abstract: Aiming at the problem of multi-point layout planning of a multi-energy power system, the output characteristics of a multi-energy power system composed of wind power generation, …

4-E analysis and multiple objective optimizations of a novel solar ...

Solar thermal powerplants (STP) seems to be clear winner since it facilitates superior power generation with lower running costs in a sustainable and cleaner manner. …

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