

# The impact of pumped storage power stations on thermal power

How does a mixed pumped storage power station affect water temperature?

The construction of a reservoir inevitably changes the water temperature situation of the original river channel. The expansion of pumping and storage units on a pre-existing reservoir, namely, a mixed pumped storage power station, is different from a conventional power station in terms of the thermal structure of the reservoir area.

What are the operation characteristics of a pumped storage power station?

The operation characteristics of a pumped storage power station are as follows: water is released to generate electricity in peak-demand periods, and water is pumped to store energy in low-demand periods, resulting in great differences in thermal and dynamic factors.

How to optimize pumped-storage power station operation?

Propose a novel optimization framework of pumped-storage power station operation. Optimize pumped-storage power station operation considering renewable energy inputs. GOA optimizes peak-shaving and valley-filling operation of pumped-storage power station. Promote synergies of hydropower output, power benefit, and CO<sub>2</sub> emission reduction.

Do pumped storage power stations have a water temperature structure?

However, there are few studies on the water temperature structure and its influencing factors associated with this type of pumped storage power station. The combination of prototype observations and numerical simulations is becoming increasingly important in the study of reservoir water temperature structures.

Can pumped storage power stations save energy?

As a mature, economic and large-scale energy storage technique, the storage of energy by pumped storage power stations is notable [9,10]. The development of pumped storage power stations can effectively store excess power, coordinate and complement other energy sources, and avoid resource waste.

Are pumped storage power stations different from conventional power stations?

There are significant differences in the water temperature distribution between the reservoirs of pumped storage power stations and those of conventional power stations.

Pumped-storage hydroelectric power plants are generally perceived as an environmentally respectful technology. Nevertheless, the pumping of water from a lower reservoir to an upper impoundment, and the return of that water during power generation, can strongly affect the water quality of the reservoirs. In particular, plant operation can alter their thermal ...

In summary, this paper introduces pumped storage power stations and investigates the optimization dispatch problem of complementary systems including ...

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Vigorously developing renewable energy has become an inevitable choice for guaranteeing world energy security, promoting energy structure optimization and coping with climate change [1]. As an important part of renewable energy, the installed capacity of wind power and photovoltaic (WPP) has shown explosive growth [2] the end of 2022, the global ...

Fortunately, pumped storage power stations (PSPSs), which are notable for their ability to efficiently store energy on a large scale to increase the grid stability of renewable energy sources [15,19], can effectively solve this problem, as water is pumped into the upper reservoir when the energy demand is low, and stored water is released to ...

The simulate results show that the pumped storage could improve the operation economic benefit of the hybrid power system, reduce the pollution control cost, and improve the output ability ...

Introducing pumped storage to retrofit existing cascade hydropower plants into hybrid pumped storage hydropower plants (HPSPs) could increase the regulating capacity of hydropower. From this perspective, a ...

The results show that the use of pumped storage power stations does cause a certain degree of damage to the ecological environment, and this damage lies in the operation of pumped storage power stations, which affects the water level of reservoir regulation and the ecological environment [27, 28]. Wang et al. and Li et al. proposed that to ...

When wind power plants, thermal power plants, and pumped storage power stations participate in the spot market together, the flexible regulation capabilities of thermal power plants and pumped storage power stations can effectively reduce the wind power output deviation during real-time operation, thereby lowering the cost of imbalanced settlement.

The modeling results indicate that the integration of four pumped-storage power stations with a total capacity of 250 MW significantly smoothes out the irregularity of the daily ...

With the continuous growth in energy demand and the increasing integration of renewable energy into the grid (Eiman et al., 2021), pumped storage, as a large-scale energy storage technology, plays a crucial role in ensuring energy supply and accommodating renewable energy sources. Under this circumstance, it's urgent to expand the construction scale of ...

Though pumped storage is predominant in energy storage projects, a range of new storage technologies, such as electrochemical, are rapidly gaining momentum. Fig. 2. Energy storage technologies. Source: KPMG analysis. Based on CNESA's projections, the global installed capacity of electrochemical energy storage

Existing studies mainly focus on traditional thermal power units or hydropower units, with few studies

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investigating the impact of pumped-storage power stations on the absorption of renewable energy. Firstly, this paper introduces the composition and function of each unit under the research framework and establishes a joint dispatch model for wind, solar, ...

The paper is aimed at assessing the impact of integrating pumped-storage power stations on the steady-state operation of the Mongolian central power system, as well as its operational reliability ...

With the rapid development of China's economy, the demand for electricity is increasing day by day [1]. To meet the needs of electricity and low carbon emissions, nuclear energy has been largely developed in recent years [2]. With the development of nuclear power generation technology, the total installed capacity and unit capacity of nuclear power station ...

The pumped storage power station is flexible to start, can realize effective storage of electric energy, and has superior peak and frequency modulation effects, which is beneficial to provide ...

Consider the availability of remaining reservoir resources to pumped-storage reserve ancillary services, and establish a day-ahead market clearing model for the wind-thermal and pumped-storage complementary power generation system. Based on ...

Pumped storage power stations in the power system have a significant energy saving and carbon reduction effect and are mainly reflected in wind, light, and other new energy grid consumption as well as in enhancing the proportion of clean energy in the power system [11, 12]. The use of pumped storage and photovoltaic power, wind power, and other intermittent ...

However, the integration scale depends largely on hydropower regulation capacity. This paper compares the technical and economic differences between pumped storage and electrochemical energy storage enhancement modes for hydro-wind-photovoltaic systems. Pumped storage retrofits involve adding pumping stations between adjacent reservoirs.

**Abstract:** With the aim of maximizing the efficient utilization of renewable energy generation in the smart grid, this paper proposes an optimization analysis for the operation of pumped storage ...

Pumped storage power stations can cooperate with or replace some thermal power units to reduce fuel consumption and pollutant emissions of the power grid, so as to achieve energy saving and emission reduction of the power system. ... the lower the unit kilowatt cost, and the vice versa. To eliminate the impact of installed scale on unit ...

Then, considering that the pumped-storage power station has both source-load characteristics, the peak-shaving value of the pumped-storage power station is deeply excavated to share the peak ...

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However, the reasonable planning and optimal dispatch of the power system can avoid the problems caused by renewable energy, thereby consuming more renewable energy power, and contributing to low-carbon emission reduction work [3]. As the most mature and largest energy storage system, pumped storage power plants have been widely used [4].

The optimized capacity configuration of the standard pumped storage of 1200 MW results in a levelized cost of energy of 0.2344 CYN/kWh under the condition that the guaranteed power supply rate and the new energy absorption rate are both  $\geq 90\%$ , and the study on the factors influencing the regulating capacity of pumped storage concludes that the ...

The objective of this study is to quantify, through the use of 3D hydrodynamic modeling, the potential impacts of a pumped-storage hydroelectric plant on the thermal ...

Optimizing peak-shaving and valley-filling (PS-VF) operation of a pumped-storage power (PSP) station has far-reaching influences on the synergies of hydropower output, power benefit, and carbon dioxide (CO<sub>2</sub>) emission reduction. However, it is a great challenge, especially considering hydro-wind-photovoltaic-biomass power inputs.

This paper studies a pumped thermal energy storage (PTES) system for multiple grid services including energy arbitrage, frequency regulation, spinning and non-spinning reserve, ...

Pumped storage power stations are notable for their ability to efficiently store energy on a large scale. The construction of a reservoir inevitably changes the water temperature ...

Water condensation and thermal destruction in the powerhouse may cause a harmful effect on the equipment and the safety of workers in the pumped storage power ...

This paper innovatively proposes a "three-stage" competitive optimization model for pumped-storage power stations, using a quadratic programming algorithm with two consecutive iterations to convert the discrete programming problem into a linear convex programming problem, reducing the difficulty of calculation and improving the calculation ...

More importantly, the multi-scale flexibility of reservoir storage holds the potential for using conventional cascaded hydropower stations as long-duration and seasonal energy storage solutions ...

The advantages of PSH are: Grid Buffering: Pumped storage hydropower excels in energy storage, acting as a crucial buffer for the grid. It adeptly manages the variability of other renewable sources like solar and wind ...

Driven by China's long-term energy transition strategies, the construction of large-scale clean energy power stations, such as wind, solar, and hydropower, is advancing rapidly. Consequently, as a green, low-carbon, and

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