

# Abandoned mines used as energy storage power stations

Can abandoned mines be used for energy storage?

Closed mines can be used for the implementation of plants of energy generation with low environmental impact. This paper explores the use of abandoned mines for Underground Pumped Hydroelectric Energy Storage (UPHES), Compressed Air Energy Storage (CAES) plants and geothermal applications.

How can abandoned mine facilities be used to generate energy?

Finally, a CAES plant could be established, using the upper mine galleries for underground air storage; the fact that Lieres is a "dry mine" is ideal for this type of system. Thus, the abandoned mine facilities are efficiently used to generate both electrical and thermal renewable energy. Fig. 5.

Can abandoned mines be used as reservoirs for PSPPs?

The use of abandoned mines underground spaces and currently operating mines as reservoirs for PSPPs offers an alternative solution for storing and managing surplus electricity. In 1901, Fessenden proposed the idea of storing natural interstitial energy, for instance, solar energy and wind energy.

Are pumped storage and abandoned mines a good investment in China?

A detailed review of China's latest developments in PSPPs is provided. The combination of pumped storage and abandoned mine demonstrates considerable social and environmental economic benefits. A case study of Panyi mine for developing PSAM in China are presented.

Should closed mines be used for energy storage and geothermal energy plants?

The use of closed mines for the implementation of underground energy storage plants and geothermal energy plants has important environment benefits, but usually higher operation and maintenance costs (O&M) compared to conventional systems.

What is an underground closed mine?

An underground closed mine can be used to store energy for re-use and also for geothermal energy generation, providing competitive renewable energy with a low CO<sub>2</sub> footprint. These initiatives aid to ensure sustainable economic development of communities after mine closure.

1. Introduction

It should not be overlooked that an abandoned mine can be utilized as thermal storage. Pingjia and Ning (2011) studied three plans using abandoned mines, and one of them is the "Thermal Accumulator Plan". In the plan, two underground mines, cold and hot, would be utilized. More precisely, cold water stored in the cold mine would be used in

In China, the concept of UWRs as a response for recycling water resources in western mining areas is different from the use of abandoned mine tunnels as storage space in Europe. ... which is usually combined with energy storage power stations to achieve energy recycling (Watzlaf and Ackman, 2006, ...

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In the context of sustainable development, revitalising the coal sector is a key challenge. This article examines how five innovative technologies can transform abandoned or in-use coal mines into sustainable energy ...

The quest for carbon neutrality raises challenges in most sectors. In coal mining, overcapacity cutting is the major concern at this time, and the increase in the number of abandoned mine shafts is a pervasive issue. ...

Energy Capital & Power - Africa's leading energy event organizer - will host the Africa Energy & Mining 2022 Conference & Exhibition, which will be held in Johannesburg on March 29-31. To learn more about the Africa Energy & Mining series and the post-COVID-19 energy and mining landscape in Africa, please visit

Unlocking the potential of abandoned mines for long-term energy storage. (Credit: Dion Beetson on Unsplash) According to the US Department of Energy, pumped storage hydropower (PSH) accounted for 93% of all utility-scale energy storage in the US in 2021. ... PSH is based on a configuration of two water reservoirs at different elevations ...

For example, Huntorf CAES in Germany and McIntosh CAES in USA [3,4]. The problem is the efficiency of these systems, which is why hybrid type of the HCAES (Hybrid Compressed Air Energy Storage) [2 ...

Underground pumped storage hydroelectricity plants using abandoned coal mines can be used to store excess electricity, supporting the advancement of renewable energy power. It is important to determine whether carbon emissions can be reduced by the combination of underground pumped storage hydroelectricity plants using abandoned coal mines and ...

advantages of closed/abandoned mine pumped storage energy technology are provided. The utilization models of closed/abandoned mine pumped storage power stations are summarized, and the site selection factors are revised based on previous research.

International scientists have invented a revolutionary energy storage method by transferring sand into abandoned subterranean mines. Underground Gravity Energy Storage (UGES) is a revolutionary approach that ...

China has abundant wind and solar energy resources [6], in terms of wind energy resources, China's total wind energy reserves near the ground are 32  $\times 10^8$  kW, the theoretical wind power generation capacity is 223  $\times 10^8$  kW h, the available wind energy is 2.53  $\times 10^8$  kW, and the average wind energy density is 100 W/m<sup>2</sup> the past 10 years, the average growth ...

Most wind and solar energy production in China is carried out in the same regions. The conditions are therefore present for later reutilization of wind and solar energy if suitable closed mines are converted into pumped-storage power stations and these are incorporated into the clean energy power generation system.

## **Abandoned mines used as energy storage power stations**

Based on the geographical resources of many existing abandoned mines in Northwest China, PS power stations with different capacities are established according to the size of the abandoned mines, and PS is used to reduce peaks and fill valleys in the local energy systems, thus improving the absorption capacity of the power grid as the proportion ...

Energy storage is a pivotal component in the advancement of sustainable energy sources [3]. The energy storage system addresses several challenges associated with the integration of new energy sources into the grid [4] provides a solution to the intermittent and unstable problems that have been a barrier to the adoption of new energy power generation.

Yong et al. (2022) carried out a two-stage study to determine whether abandoned coal mines could be used as underground power storage stations and, in doing so, they applied SWARA and the entropy ...

Yuan Liang, Xie Heping, Qian Minggao, Hong Boqian, Cai Meifeng, Wu Qiang, and several others put forward a strategic concept for the transformation and upgrading of abandoned coal mines and the comprehensive utilization of underground space, including: establishing compressed air storage power stations, pumped storage power stations, small pit ...

Compressed air energy storage (CAES) is a technology that uses high-pressure air as a medium to store energy and generate electricity. Underground caverns can provide gas storage space for CAES [1, 2] the process of energy storage, off-peak power, abandoned wind power, and abandoned photoelectric energy are used to compress air.

There are a large number of abandoned mines in the Yellow River basin, which provide a new idea to build pumped storage power stations using abandoned mines (PSPSuM) for renewable energy storage.

The smart micro-grid system using abandoned mines to build gravity energy storage power stations is technically and economically feasible, but it must still consider the ...

This numerical simulation model for the compressed air energy storage in abandoned mines is verified by the simulation results of the Korean CAES pilot test project where Kim et al. [38] considered EDZ and used TOUGH-FLAC to analyze the coupled thermodynamics, multiphase fluid flow, and heat transfer. In their model, the cavern is represented ...

Turning abandoned mines into energy storage is one example of many solutions that exist around us, and we only need to change the way we deploy them," study co-author Behnam Zakeri said. A...

The development of underground pumped storage plant using abandoned coal mine (UPSP-ACM) has a significance to abandoned coal mine resources utilization and energy storage industry. The article studies on

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site selection of UPSP-ACM and proposes a decision framework to determine the optimal location based on the theory of multi-criteria decision ...

**Abstract:** To achieve carbon peaking and carbon neutrality, China has deepened its energy revolution with the largest renewable energy power generation capacity in the world. In the face of the unstable power supply of large-scale renewable energy, a new power system has been proposed and constantly upgraded, which promoted the construction and development of pumped ...

This paper explores the use of abandoned mines for Underground Pumped Hydroelectric Energy Storage (UPHES), Compressed Air Energy Storage (CAES) plants and geothermal applications. ... Moreover, the proposed systems can be combined renewable energy storage, such as wind and solar power and with geothermal energy exploitation, taking ...

Underground pumped storage power stations (UPSPS) is a form of beneficial post mining land use for closed underground coal mines. Its development potential is still largely unexplored in China. In this paper, a two-phase evaluation framework is developed for the site selection of UPSPS from regional to local scale.

Although distributed power generation systems and microgrid projects mostly use batteries currently, small-scale pumped storage technology (such as pumped storage in small ...

The primary purpose of constructing UWRs is to utilize geothermal energy, which is usually combined with energy storage power stations to achieve energy recycling (Watzlaf and Ackman, 2006, Kranz and Dillenardt, 2010).

The number of abandoned coal mines will reach 15000 by 2030 in China, and the corresponding volume of abandoned underground space will be 9 billion m<sup>3</sup>, which can offer a good choice of energy storage with large capacity and low cost for renewable energy generation [22, 23]. WP and SP can be installed at abandoned mining fields due to having large occupied ...

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A massive compressed air energy storage facility has opened in central China, according to PV Magazine. The Nengchu-1 project began construction in 2022 and is now operating at full capacity. It is able to store ...

A feasibility study that considered the natural conditions, mine conditions, safety conditions, and economic benefits revealed that the construction of pumped storage power stations using...

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Energy storage in the long-term. The key takeaway here, however, is that while energy storage methods - such as batteries - lose energy via self-discharge over long ...

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