

# Energy storage measures in abandoned tunnels of coal mines

Can underground space energy storage technology be used in abandoned coal mines?

The underground space resources of abandoned coal mines in China are quite abundant, and the research and development of underground space energy storage technology in coal mines have many benefits.

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.

Can abandoned coal mine facilities be used to generate energy?

Thus, the abandoned mine facilities are efficiently used to generate both electrical and thermal renewable energy. Fig. 5. Combined design of underground energy storage systems (UPHES and CAES) and geothermal utilization in an abandoned underground coal mine.

What are underground energy storage and geothermal applications?

Underground energy storage and geothermal applications are applicable to closed underground mines. Usually, UPHES and geothermal applications are proposed at closed coal mines, and CAES plants also are analyzed in abandoned salt mines. Geothermal power plants require flooded mines, which generally have closed more than 5 years ago.

What is coal underground thermal energy storage?

Coal underground thermal energy storage (CUTES) is a form of energy storage that makes extensive use of the underground highways in closed mines as a place to store energy and to offer heating and cooling in the winter and summer months, respectively.

Can a mine thermal energy storage system be used in abandoned mines?

Out of this reason, fundamental research in the field of seasonal heat storage in abandoned mines has to be conducted for further technology development and establishment of large scale storage systems. The aim of this feasibility study is to conceptualize a mine thermal energy storage system for the hard coal mine Prosper-Haniel.

Coupled thermodynamic and thermomechanical modelling was implemented for compressed air energy storage (CAES) in mine tunnels using the technique of lined rock cavern (LRC). ... 17 indicated that, economically, CAES with abandoned oil/gas wells or coal mines can be a strong candidate for the large-scale energy storage for wind energy. Moreover ...

In this paper, four mining levels in a closed coal mine in the Asturian Central Coal Basin (NW Spain) have been selected as a case study to investigate the technical feasibility of ...

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Collapse processes in abandoned pillar and stall coal mines: Implications for shallow mine geothermal energy ... In coal measures, ... Energy from closed mines: underground energy storage and geothermal applications. *Renew. Sustain. Energy Rev.*, 108 (2019), pp. 498-512, 10.1016/j.rser.2019.04.007.

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 ...

With the proposal of the goal of "carbon peaking and carbon neutralization" in China, the proportion of coal in the primary energy consumption structure will gradually decrease, and the ...

This paper analyzes the potential of abandoned coal mines as energy storage systems and lists the benefits of these projects in the depressed mining areas by the closure of the mines....

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

Therefore, this paper studies the application status of underground space energy storage, especially the area of underground coal mines, and focuses on the energy storage ...

Those abandoned coal mine underground spaces can be re-utilized as energy storage caverns. This can also bring new infrastructure investments and employment opportunities in renewable energy [8,15]. Thus, the re-utilization of abandoned underground coal mine spaces as storage caverns benefits both coal mines and renewable energy industries [9].

Another reason limiting the energy storage function is that, on an operational mine, the construction of the upper reservoir has an impact on mining the lower coal seams, e.g., safety control of mining beneath an upper reservoir, and protection of the upper reservoir during the lower coal seam mining.

A large number of voids from closed mines are proposed as pressurized air reservoirs for energy storage systems. A network of tunnels from an underground coal mine in northern Spain at 450 m depth has been selected as a case study to investigate the technical feasibility of adiabatic compressed air energy storage (A-CAES) systems.

Therefore, this paper mainly discusses the research status of using coal mine underground space for energy storage, focusing on the analysis and discussion of different ...

Turning abandoned mines into energy storage is one example of many solutions that exist around us, and we

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only need to change the way we deploy them," study co-author Behnam Zakeri said. A...

Challenges and opportunities of energy storage technology in abandoned coal mines: A systematic review  
dx.doi 0 : 10 : F Wu,Y Liu,R Gao ...

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 ...

We have studied three plans for re-use of the abandoned mine roadway tunnels as an energy center. These are the thermostat plan, the thermal accumulator plan, and the CAES plan. Calculations show that the thermostat plan can provide over 15,000 m<sup>2</sup> of building air-conditioning/heating load for each kilometer of roadway, but electric power is needed to run ...

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The geothermal potential of abandoned coal mine reservoirs depends on the characteristics of goaf roof. ... There are two kinds of thermal reservoir in abandoned mines, namely abandoned tunnels and mined out areas. For abandoned tunnel, because of its plenteous data and simple geometry, heat transfer and flow in tunnels can be simulated with a ...

Compressed air energy storage. Sabine Donadei, Gregor-S&#246;nke Schneider, in Storing Energy (Second Edition), 2022. 4.5 Abandoned mines. Abandoned mines which were previously used for the extraction of commodities such as salt, ores, coal, or limestone can sometimes be used for storage of gases and liquids, depending on the local geological situation. Numerous ...

Thermal energy storage (TES) technologies, including sensible (Hasnain, 1998), latent (Sharma et al., 2009) and thermo-chemical (Haider and Werner, 2013), are the strategic and necessary components for the efficient utilization of renewable energy sources and energy conservation.Among these energy storage technologies, STES have been well developed due ...

Abandoned coal mines in Europe offer potential for sustainable energy storage, including underground pumped storage power plants. The initial conditions of these mines, ...

The small city of Heerlen in Limburg, Netherlands has developed a city-wide heat supply and storage system which uses the abandoned coal mines beneath the city (Verhoeven et al., 2014). Water is circulated at 28

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176°C, the ambient temperature of the deepest of the mine levels; pipework is uninsulated and heat losses tiny.

Semantic Scholar extracted view of "Abandoned coal mine tunnels" Future heating/power supply centers" by Pingjia Luo et al. ... large-scale energy storage is the most practical solution to this ... Expand. PDF. Save. Tunneling in abandoned coal mine areas: Problems, impacts and protection measures. L. Tong Lian Liu Yu Qiu Song-yu Liu ...

The Asturian Central Coal Basin in northern Spain has been an exploited coal mining area for many decades and its network of tunnels extends among more than 30 mines.

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 ...

Poland has had a total of 70 mines, but now more than half of them is out of operation. This mining closure raises with respect to the environment and unemployment. Innovative technology is needed to overcome the problems ...

At the moment a seasonal heat storage within an abandoned hard coal mine has not yet been realized in Germany. erefore the HT-MTES (High Temperature-Mine ermal ...

Electricity storage systems are necessary to increase the efficiency of variable renewable energies. Mine water in closed underground coal mines can be used for underground pumped-storage hydropower plants. Subsurface energy storage systems require the excavation of a powerhouse cavern and a network of tunnels as lower water reservoir.

Pumped storage technology has been successfully used for more than 100 years. It is one of the most mature, reliable, and economical technologies in large-scale storage of electrical energy. Abandoned coal mines were changed into pumped storage power stations.

The Anju coal mine plant is selected as the research site. As shown in Fig. 1 (a), the Anju coal mine plant is located in Shandong Province, NE China, which covers an area of approximately 1700 km<sup>2</sup>. This coal mining area has been highly exploited for many years, and its network of tunnels covers more than 30 mines.

As part of the new French law on energy transition, the Demosthene research project is studying the possibility of reusing old abandoned mines to store thermal energy in the Picardy region. The aim is to store the heat required for a small collective unit, which corresponds to a volume of water of 2000-8000 m<sup>3</sup>, depending on the temperature (from 15 to 176°C). An ...

The energy storage and generation from abandoned coal mines and mine reservoirs is about 1.5 times of

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China's total annual power generation in 2014 (Ge et al., 2020). Under the new circumstances, General Secretary Xi Jinping declared at the 75th Session of the UN General Assembly that China aims to reach peak carbon dioxide emissions by 2030 ...

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