

[10] Lutyński M 2017 An overview of potential benefits and limitations of Compressed Air Energy Storage in abandoned coal mines IOP Conference Series: Materials Science and Engineering 268. Google Scholar [11] Mendez J, Ordóñez A, Álvarez R and Loredó J 2019 Energy from closed mines: Underground energy storage and geothermal ...

using underground caverns as compressed air reservoir. The energy storage capacity of the compressed air energy storage system using closed underground mines as compressed air reservoir is given by Eq. (2). $E_{CAES} = \frac{1}{2} (m_a + m_f) (h_3 - h_4) \quad (2)$ where E_{CAES} is the stored energy (MWh per cycle), ?

Compressed Air Energy Storage (CAES) is one of the methods that can solve the problems with intermittency and unpredictability of renewable energy sources. The storage is charged by increasing air pressure with the use of electrically driven compressors, which convert the electric energy into potential energy. The pressurized air is stored in compressed air ...

In this paper, abandoned mines are proposed as underground reservoirs for large scale energy storage systems. A 200 m³ tunnel in an abandoned coal mine was investigated as compressed air reservoir for A-CAES plants, where the ambient air is stored at high pressure.

Compressed Air Energy Storage (CAES) is one of the systems that can contribute to the penetration of renewable energy sources. The pressurized air is stored in mining caverns and ...

The use of abandoned underground mines as facilities for storing energy in form of compressed air has been investigated by Lutynski et al. [18] and Ishitata et al. [20] pared to underground storage caverns, CAES reservoirs are subjected to relatively high-frequency load cycles on a daily or even hourly basis.

1. Introduction. Large scale energy storage (LSES) systems are required in the current energy transition to facilitate the penetration of variable renewable energies in the electricity grids [1, 2]. The underground space in abandoned mines can be a solution to increase the energy storage capacity with low environmental impacts [3], [4], [5]. Therefore, underground ...

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 centres. From solar thermal to compressed air energy storage, these solutions offer a path to a more sustainable future while addressing the decline ...

An overview of potential benefits and limitations of Compressed Air Energy Storage in abandoned coal mines. Marcin Lutyński 1. ... Compressed Air Energy Storage (CAES) is one of the methods that can solve the problems with intermittency and unpredictability of renewable energy sources. The storage is charged by

increasing air pressure with the ...

Abstract Compressed air energy storage (CAES) is attracting attention as one of large-scale renewable energy storage systems. Its gas storage chamber is one of key components for its success. ... 6 abandoned mine chambers 7, 8 or gas storage chambers in hard rock formations. 9, 10 The success of a CAES lies in successfully addressing the ...

Underground space in abandoned mines may be used as compressed air storage systems for CAES plants. The simplified schematic diagram of the CAES system is shown in Figure1. The compressor and turbine facilities are installed above the ground, while the compressed air reservoir is underground. The ambient air is compressed during off-peak

CAES, a long-duration energy storage technology, is a key technology that can eliminate the intermittence and fluctuation in renewable energy systems used for generating electric power, which is expected to accelerate renewable energy penetration [7], [11], [12], [13], [14]. The concept of CAES is derived from the gas-turbine cycle, in which the compressor ...

Million cubic meters from abandoned mines worldwide could be used as subsurface reservoirs for large scale energy storage systems, such as adiabatic compressed air energy storage (A-CAES). In this paper, analytical and three-dimensional CFD numerical models have been conducted to analyze the thermodynamic performance of the A-CAES reservoirs in ...

DOI: 10.1016/j.energy.2024.133392 Corpus ID: 273280113; Efficient utilization of abandoned mines for isobaric compressed air energy storage @article{Bu2024EfficientUO, title={Efficient utilization of abandoned mines for isobaric compressed air energy storage}, author={Xianbiao Bu and Sihao Huang and Shi Liu and Yi Yang and Jie Shu and Xianfeng Tan and Hongnian Chen ...

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 ...

Compressed air energy storage. Sabine Donadei, Gregor-Sönke 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 ...

Compressed air energy storage (CAES) is a large-scale energy storage technology that can overcome the intermittency and volatility of renewable energy sources, such as solar and wind energy. Although abandoned mines can be reused for underground CAES of large scale, their feasibility requires further investigations. This study performs a comparative ...

Compressed air energy storage in abandoned mines

For example, numerous studies on compressed air energy storage ... Costs associated with implementing UPSP in abandoned mines can exceed those of conventional PSH projects, such as the Grund mine project in Germany with an investment cost of 180 million euros for a storage capacity of 400 MWh [221].

Accordingly, building compressed air energy storage (CAES) plants along the roadways of abandoned coal mines can serve as a viable energy storage method while repurposing these mines. This study examined the effect of the lower limit of air pressure (LLAP) on the stability of coal mine roadways in CAES applications by considering an ongoing ...

Underground space from abandoned mines can be used as underground reservoirs for underground pumped storage hydropower (UPSH) and compressed air energy storage (CAES) systems [5, 6, 7, 8, 9, 10, 11].

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.

Two main advantages of CAES are its ability to provide grid-scale energy storage and its utilization of compressed air, which yields a low environmental burden, being neither toxic nor flammable.

For more information on the journal statistics, [click here](#) . Multiple requests from the same IP address are counted as one view. Million cubic meters from abandoned mines worldwide could be used as subsurface reservoirs for large scale energy storage systems, such as adiabatic compressed air energy storage (A-CAES).

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.

The subsequently developed Adiabatic Compressed Air Energy Storage (A-CAES) stores compressed heat and uses it to heat the air in the expansion stage ... Preliminary feasibility analysis of a hybrid pumped-hydro energy storage system using abandoned coal mine goafs. Appl. Energy, 258 (2020), Article 114007. [View PDF](#) [View article](#) [View in Scopus](#) ...

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 that arise and could simultaneously make use of abandoned mine infrastructure. The increased electricity generation coming from ...

The present study focuses on the compressed air energy storage (CAES) system, which is one of the large-scale energy storage methods. As a lot of underground coal mines are going to be closed in China in the coming years, a novel CAES system is proposed for application in roadways of the closing coal mines. ... Luo,

P.; Chen, N. Abandoned coal ...

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Compressed Air Energy Storage (CAES) that stores energy in the form of high-pressure air has the potential to deal with the unstable supply of renewable energy at large scale in China. ... It was found that more than 13 major zones in the "Three North" regions, where has massive quantities of abandoned mines for compressed air storage, were ...

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