Rock cave compressed air energy storage strength

Does a lined rock cavern contain a weak interlayer during blasting?
To evaluate the stability of a lined rock cavern (LRC) for compressed air energy storage (CAES) containing a weak interlayer during blasting in the adjacent cavern, a newly excavated tunnel-type LRC was taken as the research object.

Can sediment voids be used for compressed air energy storage?
Compressed air energy storage (CAES) salt caverns are suitable for large-scale and long-time storage of compressed air in support of electrical energy production and are an important component for realizing renewable energy systems. In this paper,the use of sediment voids in highly impure rock salt formations for CAES is proposed.

How much energy can a cavern store?
Thus,over a 24 h period,we can store about 2000 W per meter drift. However,note that our analysis is focused on air tightness and energy balance of the underground cavern,whereas additional energy transfer will also occur during the compression and cooling of the air at the ground surface facility.

What is compressed air energy storage (CAES)?
Compressed air energy storage (CAES) is a large-scale energy storage techniquethat has become more popular in recent years.

What is a good compressive strength for a rock cavern?
Previous studies indicate that ~30 m thick rock formations,with a compressive strength of 69-138 MPaand a conductivity of less than 2.0 × 10 -8 m/s at a depth of 395-579 m,are desirable for rock caverns . Temperature changes are also expected during the compression and decompression cycle.

Can underground caverns reduce air leakage during decompression?
We carried out coupled thermodynamic,multiphase fluid flow and heat transport analysis. ? Coupled behavior associated with underground lined caverns for CAES was investigated. ? Air leakage could be reducedby controlling the permeability of concrete lining. ? Heat loss during compression would be gained back at subsequent decompression phase.

Abstract Compressed air energy storage (CAES) is a kind of large-scale energy storage technology that is expected to be commercialized. As an underground gas storage ...

By making use of geography like salt caves, former mining sites, and depleted gas wells, compressed air energy storage can be an effective understudy when wind or solar aren"t available. What"s better is that it has the potential to offer longer-duration storage that other technologies can"t for a lower capital investment and an out-of ...

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PDF | On Jul 19, 2023, Mingzhong Wan and others published Compressed air energy storage in salt caverns in China: Development and outlook | Find, read and cite all the research you need on ...

Exploring the material response of rock salt subjected to the variable thermo-mechanical loading is essential for engineering design of compressed air energy storage (CAES) caverns. Accurate design of salt ...

According to operational data from compressed air storage power plants in hard rock artificial excavation lined caverns similar to those tested and studied in this paper, the combined efficiency can reach up to 70% (close to 75% for pumped-hydro storage and behind 80% for electrochemical storage). However, compressed air energy storage has no ...

Compressed Air Energy Storage. In the first project of its kind, the Bonneville Power Administration teamed with the Pacific Northwest National Laboratory and a full complement of industrial and utility partners to evaluate the technical and ...

Current applications of LRCs also include liquid hydrocarbon storage [36-38], natural gas storage [39-41], and compressed air energy storage (CAES) [42-44]. Lined rock caverns have yet to be adopted for storage of hydrogen, with the exception of a pilot facility being developed by HYBRIT in Sweden [45, 46]. The key technical challenges ...

To evaluate the stability of a lined rock cavern (LRC) for compressed air energy storage (CAES) containing a weak interlayer during blasting in the adjacent cavern, a newly ...

With the widespread recognition of underground salt cavern compressed air storage at home and abroad, how to choose and evaluate salt cavern resources has become a key issue in the construction of gas storage. ...

The lower reaches of the Yangtze River is one of the most developed regions in China. It is desirable to build compressed air energy storage (CAES) power plants in this area to ensure the safety, stability, and economic operation of the power network. Geotechnical feasibility analysis was carried out for CAES in impure bedded salt formations in Huai"an City, China, ...

fracture propagation in compressed air energy storage ... framework to investigate the overall strength of pillars. Jiang et al. [11] developed a random field for large karst cave rock masses ...

Compressed air energy storage (CAES) provides an economic and technical viable solution to this problem by utilizing subsurface rock cavern to store the electricity generated by renewable energy in the form of compressed air. Though CAES has been used for over three decades, it is only restricted to salt rock or aquifers for air tightness reason.

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Alternatives are natural gas storage and compressed hydrogen energy storage (CHES). For single energy storage systems of 100 GWh or more, only these two chemical energy storage-based techniques presently have technological capability (Fig. 1) [4], [5], [6]. Due to the harm fossil fuel usage has done to the environment, the demand for clean and ...

Due to the rheology, low permeability, and damage recovery of rock salts, the salt caverns have been widely used for natural gas and compressed air energy storage (Yang et al. 1999).The salt caverns have been used for gas storage for several decades in Europe and America (Bauer et al. 2013; Brown et al. 2014; Dethlefsen et al. 2014).Gas storage in ...

One of the major challenges is ensuring the air tightness and pressure resistance performance of lined-rock caverns (LRCs). To address this, we reviewed research on several key aspects, ...

Compressed air energy storage (CAES) is considered as a promising energy storage solution to balance the energy load leveling. The previous engineering practice usually ...

Compressed air energy storage (CAES) is a promising technology solution that can store energy generated at one time for use at another time using compressed air. The ...

(compressed air energy storage), CAES,?,,,GW?, ...

The flow of compressed air in the wellbore affects the thermodynamic performance in the salt compressed air energy storage (CAES) cavern and this effect is still uncharted. In this study, a coupled explicit finite difference model considering the wellbore flow is proposed to obtain thermodynamic performance of the compressed air in the cavern.

Air tightness and mechanical characteristics of polymeric seals in lined rock caverns(LRCs) for compressed air energy storage(CAES)#br# ZHOU Yu1,2,XIA Caichu1,3 ...

Rock salt formation has the favourable properties to serve as long-term and large-scale energy storage [1], such as underground natural gas storage or compressed air energy storage (CAES) due to its extremely low permeability, creep behaviour, and relatively high thermal conductivity pared with other types of gas storage cavern, more gas injection-and ...

Renewable energy becomes more and more important to sustainable development in energy industry [1].Renewable energy has intermittent nature and thus requires large-scale energy storage as an energy buffer bank [2] pressed air energy storage (CAES) is one of large-scale energy storage technologies, which can provide a buffer bank between the usage ...

Liu et al. (2022) assessed the technical capabilities of existing salt cavern gas storage. He et al. (2021)

analyzed the technical economy of large-scale compressed air energy storage. Yuan et al. (2021) discussed the stability of compressed air energy storage in underground salt caverns. However, few scholars have studied the risk aspect.

Compressed air energy storage (CAES) is a promising energy storage technology, mainly proposed for large-scale applications, that uses compressed air as an energy vector.

Hydrogen has the highest gravimetric energy density of all known substances (120 kJ g -1), but the lowest atomic mass of any substance (1.00784 u) and as such has a relatively low volumetric energy density (NIST 2022; ...

The development of new energy storage has progressed rapidly, with over 30 GW of installed capacity currently in operation [14].The cumulative installed capacity for new energy storage projects in China reached 31.39 GW/66.87 GWh by the end of 2023, with an average energy storage duration of 2.1 h [15] g. 1 shows the distribution characteristics and relevant ...

Abstract: Compressed air energy storage (CAES) in underground lined rock caverns (LRC), with its advantages of long power generation time, large scale, short construction period, flexible ...

Therefore, salt caverns are widely utilized for energy storage space, such as oil/gas storage [8], compressed air energy storage [9], [10] and even hydrogen storage [11]. China also has abundant salt mines [1], [12], such as Jintan Salt Mine in Jiangsu Province, Pingdingshan Salt Mine in Henan Province, Yunying Salt Mine in Hubei Province ...

The first hard rock shallow-lined underground CAES cavern in China has been excavated to conduct a thermodynamic process and heat exchange system for practice. The thermodynamic equations for the solid and ...

Research results indicate that the uplift failure function f (x) of CAES caverns is a typical power function,which is mainly related to the rock uniaxial compressive strength,Hoek-Brown ...

Past studies have analyzed the stability of LRCs in relation to mechanical response caused by temperature and air pressure during operation. For example, a TOUGH-FLAC coupled approach was used to examine the thermodynamic and geo-mechanical performance of underground compressed air energy storage (CAES) in concrete-lined rock caverns [60, 64].

Liu et al. [30] and Sepideh et al. [31] studied Hot Dry Rock Compressed Air Energy Storage (HDR-CAES) system and Cased-Wellbore Compressed Air Energy Storage (CW-CAES) system, respectively. Their results also show that the round-trip efficiency of these systems is considerably higher than that of the traditional A-CAES system.

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