Special Issue

Advanced Underground Energy Storage Technologies

Message from the Guest Editors

Underground energy storage technologies utilize deep underground spaces to store energy or strategic resources—such as oil, natural gas, hydrogen, compressed air, and carbon dioxide—within underground rock formations. These technologies provide significant advantages, including large storage capacity, extended duration, and minimal environmental impact, offering sustainable solutions for energy systems. They are vital for supporting energy reserves, stabilizing renewable energy supply, and optimizing hydrogen utilization, addressing key challenges such as energy intermittency and storage. Major forms of underground energy storage include compressed air energy storage (CAES), underground thermal energy storage (UTES), and salt cavern storage, each suited to specific geological conditions. Despite their potential, challenges remain, including selecting suitable storage media, ensuring safety and stability, improving energy transfer efficiency, and achieving economic viability for large-scale deployment and integration with renewables. Additionally, environmental impacts and sustainability must be carefully evaluated.

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Energies is an international, open access journal in energy engineering and research. The journal publishes original papers, review articles, technical notes, and letters. Authors are encouraged to submit manuscripts which bridge the gaps between research, development and implementation. The journal provides a forum for information on research, innovation, and demonstration in the areas of energy conversion and conservation, the optimal use of energy resources, optimization of energy processes, mitigation of environmental pollutants, and sustainable energy systems.

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