

Can energy tunnels store thermal energy?

This study indicates storage efficiencies of energy tunnels of up to about 70%. Therefore, energy tunnels have marked potential to store massive amounts of thermal energy in the shallow subsurface for subsequent reuse.

Can underground tunnels be used as heat exchangers?

This paper presents an unprecedented investigation of the thermal energy storage potential of underground tunnels used as heat exchangers, often called energy tunnels, with a focus on seasonal, medium-temperature thermal energy storage applications. The study is divided into two parts.

How do energy tunnels work?

In fact, through diverse shapes in contact with the ground (e.g., prisms with cylindrical, egg-shaped, squared, or rectangular cross-sections), energy tunnels and other underground infrastructures involve an uncharted energy performance for heat storage.

Why are energy tunnels important?

A significant feature of energy tunnels, similar to other underground infrastructures, is that they are characterized by a relatively low surface-area-to-volume ratio [,,]- a valuable attribute for the effective storage of thermal energy.

How does the inner tunnel environment affect the storage and extraction operation?

The inner tunnel environment is assumed not to influence the storage and extraction operation through perfect thermal insulation applied to the tunnel intrados, which is reproduced numerically through an adiabatic boundary condition that reads $(\mathbf{n} \cdot \nabla T) = 0$ where \mathbf{n} is the outward vector from the relevant boundary.

What types of applications can energy tunnels serve?

From this perspective, similar to more conventional ground diffusive storage systems, energy tunnels and other underground infrastructures can serve three different types of applications (Fig. 1), once thermally insulated from the internal built environment that they host (e.g., subway and train lines, subway and train stations, and car lanes).

The provision of mechanical cooling in deep mines comes with a significant energy cost as a significant amount of heat transfers from surrounding rock to the airflow. ...

To potentially reduce the cost of additional drilling and trenching, recent technological advances have integrated conventional geotechnical structures with ground heat ...

Metal coating is a prevalent strategy for enhancing surface properties. Among the numerous methods for

preparing coatings, electrodeposition stands out due to its ...

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An important contribution can be provided by energy tunnels, which make it possible to draw on a form of clean, renewable and locally accessible thermal energy for ...

Tunnel coatings face constant exposure to vehicle exhaust, humidity, temperature fluctuations, and mechanical abrasion from traffic. Independent studies show that unmodified epoxy-based ...

Meanwhile, applying energy-storage reflective coating on the sidewalls of the tunnel has a better visual performance than using light yellow ceramic tiles and cement mortar on the sidewalls. ...

Sounds like sci-fi? Well, it's already happening. Energy storage in underground tunnels is revolutionizing how we manage electricity grids, offering solutions for renewable ...

This article first categorizes energy tunnels into external and internal heat source energy tunnels, describes the characteristics of the environment inside and outside of these ...

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Applying energy-storage reflective coating on the sidewalls of the tunnel has a shorter reaction time than using light yellow ceramic tiles and cement mortar on the sidewalls.

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