# EFFECT OF CRYSTAL TUNNELING ON ENERGY STORAGE PERFORMANCE

How does convection affect thermal energy storage performance of tunnels? Convection effects on the thermal energy storage performance of tunnels are unraveled. Groundwater flows and airflows severely affect the storage efficiency of tunnels. Thermal insulation layers deployed on the intrados of tunnels can enhance performance. Storage efficiencies of tunnels can drop from 60 % to less than 10 %due to convection.

Do energy tunnels have a thermal energy storage potential? A framework to assess the heat storage potential of energy geostructures is proposed. The thermal energy storage potential of energy tunnels is numerically explored. Storage efficiencies of up to about 70% characterize energy tunnels. Performance mostly varies for different charging-discharging profiles and temperature changes.

How efficient are energy tunnels for energy storage? The rationale behind this work is that Rotta Loria recently highlighted promising storage efficiencies of up to 70%for energy tunnels characterized by favourable subsurface conditions for storage applications (i.e.,lacking convection heat transfer).

Can energy tunnels be used as heat exchangers? Energy tunnels can serve single buildings and city districts as thermal energy storage means. 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.

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.

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Does subsurface temperature affect thermal energy storage performance of underground tunnels? The findings indicate a positive influenceof subsurface temperature rises on the thermal energy storage performance of underground tunnels. Meanwhile,the findings indicate a generally detrimental role played by convection heat transfer for the performance of such systems.

The lighting design of a road tunnel focuses on the setting of pavement luminance. As for the tunnel sidewall luminance, it simply follows the principle of no less than 60% of the pavement luminance. In fact, the sidewall ???

Depending on the different sodium content in the molecular formula, transition metal oxide cathode materials can be classified into two categories: tunnel oxides (Na x TMO 2, x ??? ???


Different from most of the studies on dielectric energy storage thin films, which mainly talk about domain engineering or interface engineering, our work revealed the effect of ???


Where P is the polarization, E is the exerted electric field, P m and P r represent the maximum polarization and remnant polarization, respectively. The equations demonstrate that ???

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Three distinct parametric studies investigate the influence of: (1) groundwater velocity, (2) air convection heat transfer coefficient and temperature, and (3) thickness and thermal conductivity


The ferroelectricity was first discovered in Rochelle salt (sodium potassium tartrate tetrahydrate) in 1920 by Valasek [1], who also confirmed the single polarization hysteresis loop ???


Graphene, known to be the basic building block of other carbon nanomaterials, is a single-atom thick planar sheet of graphite with a perfect two-dimensional (2D) crystal structure ???

Moreover, an increase in underground temperatures, which may result from subsurface heat islands, has a positive impact on the storage performance of tunnels. Higher average tunnel ???