

How much solar energy can a 10 m-long energy pile store?

Under the specific thermal boundary conditions adopted, the maximum daily average rate of solar energy storage reached 150 W/m for the 10 m-long energy pile. It decreased to about 35 W/m as the pile length increased to 50 m.

Can energy piles be used for underground energy exchange?

Energy piles, which are combinations of BHEs with pile foundations, could be used for underground energy exchange without the need for drilling holes [.,]. Energy piles have been combined with ground source heat pump (GSHP) systems for building heating or cooling for years [33].

Can a full-scale energy pile provide thermal injection performance?

A field test was performed to investigate the thermal injection performance of a full-scale energy pile for USES. A bridge deck embedded with heat exchange tubes was employed for solar energy collection, which can provide thermal energy to the energy pile.

How does pile size affect solar energy storage?

As the pile diameter increases, there is a relatively larger volume of concrete for solar energy storage, leading to a lower pile temperature. As a result of its lower temperature, a higher rate of solar energy storage is observed for cases with larger pile diameters.

How does underground thermal energy storage work?

The conventional practice of underground thermal energy storage is burying heat exchange pipes into pre-drilled vertical holes, referred to as the borehole thermal energy storage. Heat transfer occurs by circulating heat carrier fluid through the pipes. However, the cost of drilling deep holes can cause a breakdown of a project.

How is solar energy collected?

A bridge deck embedded with heat exchange tubes was employed for solar energy collection, which can provide thermal energy to the energy pile. A full-scale pile foundation with a spiral-shaped tube in the pile shaft was employed for storing the collected solar energy underground.

Thus, it is important to include the group pile effect for design and analysis of the energy storage pile foundation. Analytical model of (a) group piles and (b) 2D plane strain model.

Information is available regarding the impact of thermal processes on the structural performance of energy piles. In the present work, the geo-energy research group has analysed the thermo-hydro-mechanical behaviour of an energy pile installed in pyroclastic soils and rocks, as an element of a sheet pile wall. The

developed model,

Underground Gravity Energy Storage: A Solution for Long-Term Energy Storage. January 2023; Energies 16(2):825; ... Download full-text PDF Read full-text. Download full-text PDF. Read full-text.

There are two main different features of the energy pile-solar collector coupled system compared to the traditional borehole system for underground thermal energy storage. First, the concrete pile material and the larger pile diameter help to improve the thermal performance of energy piles. Nevertheless, the energy piles are relatively shorter ...

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Abstract Phase change materials which absorb large amounts of heat can be used as backfill material around heat transfer piles to improve the heat transfer efficiency and reduce the underground space required by the heat transfer piles. This paper describes a scale model test of a 0.2 m diameter and 1.5 m long concrete phase-change energy storage pile.

The application ascertains the potential of the building foundation to be part of a comprehensive renewable energy system. Zhang et al. [2012] suggested the idea that air is compressed using an ...

"The HOT Energy Group has substantially assisted RAG in planning almost all of our underground gas storage (UGS) facilities. The quality of their subsurface models has proved outstanding and has helped us to develop more than 50% of our gas fields into successful UGS operations and to become one of Europe's leading gas storage operators."

Download scientific diagram | Energy pile application in building energy efficiency. (a) Schematic drawing of geothermal piles system [14]; (b) Heating/cooling operation of energy piles during ...

Compared with the traditional single energy pile, there is a special characteristic of the energy pile in underground row piles: piles are linked as a whole by the top beam at the top of the row pile. Field tests on the thermal response and thermo-mechanical characteristics of the energy pile in underground row piles were performed.

A new pile foundation system is being developed for renewable energy storage through a multi-disciplinary research project. This system utilizes the compressed air technology to store renewable ...

By injecting thermal energy in summer and extracting it in winter, the ground in the area of a building's piles

can be used for seasonal energy storage, as long as the underground water flow in ...

Downloadable (with restrictions)! Energy storage needs to account for the intermittence of solar radiation if solar energy is to be used to answer the heat demands of buildings. Energy piles, which embed thermal loops into the pile body, have been used as heat exchangers in ground source heat pump systems to replace traditional boreholes.

Underground thermal energy storage (UTES) is a form of STES useful for long-term purposes owing to its high storage capacity and low cost (IEA I. E. A., 2018).UTES effectively stores the thermal energy of hot and cold seasons, solar energy, or waste heat of industrial processes for a relatively long time and seasonally (Lee, 2012) cause of high thermal inertia, the ...

Energy piles, which embed thermal loops into the pile body, have been used as heat exchangers in ground source heat pump systems to replace traditional boreholes. Therefore, it is proposed ...

Further, other geotechnical applications involving elevated temperatures include earthen structure-atmospheric interaction under a changing climate, storage of nuclear waste, energy piles, soil ...

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