Shallow groundwater energy storage

Is a shallow geothermal system a seasonal energy storage system?
However,a shallow geothermal system is not designated for seasonal energy storage. The system uses the steady earth temperature closer to the surface for daily cooling and heating . Therefore,this system's collector area is relatively equivalent to the building's cooling or heating load.

Where is shallow geothermal energy stored?
Shallow geothermal energy is stored in the Earth's uppermost layers,up to a few hundred meters deep,and can be extracted using a geothermal heat exchanger or ground source heat pump (GSHP). The heat exchanger paced 1 to 2 m below the surface from the shallow geothermal energy.

Are underground thermal energy storage systems sustainable?
The study aims to explore the potential of Underground Thermal Energy Storage (UTES) systems, including Aquifer Thermal Energy Storage (ATES) and Borehole Thermal Energy Storage (BTES), as sustainable solutions for managing energy supply and demand.

What is shallow groundwater?
Shallow groundwater is defined here as groundwater within the near-surface critical zone where annual aquifer temperature is highly variable (within approximately 6 m from land surface), and this variability is transferred to streams through groundwater discharge zones causing annual temperature signal mixing with characteristic outcomes.

Can shallow groundwater storage buffer plant water stress?
We show that as warming shifts the balance between water supply and demand,shallow groundwater storage can buffer plant water stress; but only where shallow groundwater connections are present,and not indefinitely. As warming persists,storage can be depleted and connections lost.

What are the standards for shallow geothermal energy?
There are national,local and industry standards (DB37/T 4308-20212021) and specifications (DZ/T 225-2009 2009) about the investigation and evaluation of shallow geothermal energy that provide calculation and assessment methods based on general geological and hydrogeological conditions.

A small number of studies have been conducted to investigate the potential for deep borehole thermal energy storage (BTES) and an overview of storage efficiency metrics is provided herein to bring consistency to the reporting of thermal energy storage performance of such systems. ... (T>35^{circ }hbox {C})), on shallow groundwater resources ...

Underground thermal energy storage (UTES) systems are well known applications around the world, due to their relation to heating ventilation and air conditioning (HVAC) applications. There are six kinds of UTES

systems, they are tank, pit, aquifer, cavern, tubes, and borehole. Apart from the tank, all other kinds are site condition dependent (hydro ...

The shallow groundwater drought indicator is based on terrestrial water storage observations derived from GRACE satellite data and integrated with other observations, using a numerical model of land surface water and energy processes. The drought indicators describe current wet or dry conditions, expressed as a percentile showing the ...

Impacts of Shallow Geothermal Energy on Groundwater Quality : A Hydrochemical and geomicrobial study of the effects of ground source heat pumps and aquifer thermal energy storage @inproceedings{Bonte2013ImpactsOS, title={Impacts of Shallow Geothermal Energy on Groundwater Quality : A Hydrochemical and geomicrobial study of the ...

to install the thermal storage system. Underground thermal energy storage (UTES) systems, including aquifer systems, are well known in Europe and in the USA where groundwater is relatively deep. They are used mainly in heating applications (in winter) [12-14]. In spite of collected knowledge about these systems, they have

Comparison of the shallow groundwater storage change estimated by a distributed hydrological model and GRACE satellite gravimetry in a well-irrigated plain of the Haihe River basin, China ... Simulating and assessing the effects of seasonal fallow schemes on the water-food-energy nexus in a shallow groundwater-fed plain of the Haihe River basin ...

With the rapid growth of shallow or ambient geothermal energy systems (GES) for heating, cooling, and underground thermal energy storage (UTES), groundwater flow and heat transport modeling have become ...

Groundwater Storage (GWS) resources are an essential part of global water cycle system and one of the most critical issues concerning to the country"s economic and social development 1,2,3.The ...

Abstract The use of shallow geothermal energy increasingly receives attention as a suitable alternative to fossil fuel-based space heating and cooling, warm water provision, as well as for ...

DHC systems are a well-established option for space heating and cooling in high-demand density areas because they are more efficient than individual systems and are recognized as a critical technology for the energy transition [[1], [2]].These criteria make them suited for places with high heating demand, which explains why they have been installed mostly in Central and Northern ...

Geothermal energy plays an increasingly important role as a renewable energy source. However, it induces temperature changes in natural thermally static groundwater ecosystems. Temperature impacts can considerably alter the groundwater chemical composition and quality, the metabolism of organisms, and, consequently, biogeochemical processes and ...

Groundwater storage in the Indo-Gangetic Basin increased by ~420 km 3 during the 20th century before large-scale groundwater withdrawal began in the late 1990s and early 2000s . Leakage from surface water irrigation increased groundwater storage by ~20 km 3 in the Columbia Plateau in the northwestern United States between ~1940 and ~1970 .

water Article Site Selection of Aquifer Thermal Energy Storage Systems in Shallow Groundwater Conditions Qais Al-Madhlom 1,2, Nadhir Al-Ansari 1, *, Jan Laue 1, Bo Nordell 1 Hussain Musa Hussain 3 1 2 3 * and Department of Civil, Environmental and Natural Resources Engineering, Lulea University of Technology, 97187 Luleå, Sweden College of ...

Thermal use of the shallow subsurface for heat generation, cooling, and thermal energy storage is increasingly gaining importance in reconsideration of future energy supplies. ...

a-e, Increases in surface air and ground surface temperatures (a) drive increases in groundwater temperatures (b) that, in turn, impact the geothermal potential for shallow geothermal energy ...

Injection of CO2 into the deep subsurface will affect physical and chemical conditions in the storage environment. Hence, geological CO2 storage can have potential impacts on groundwater resources. Shallow freshwater can only be affected if leakage pathways facilitate the ascent of CO2 or saline formation water. Leakage associated with CO2 storage cannot be ...

With the rapid growth of shallow or ambient geothermal energy systems (GES) for heating, cooling, and underground thermal energy storage (UTES), groundwater flow and heat transport modeling have become essential tools for the planning, design, and implementation of GES. The development of more advanced assessment and management tools has been ...

The depletion of shallow groundwater has seriously affected the sustainable development of water resources in the North China Plain (NCP). Based on 556 well monitoring observations over a period of 13 years, we quantitatively evaluated the shallow groundwater sustainability in the NCP via various indices (e.g., the reliability, resilience, vulnerability, and ...

The use of shallow geothermal energy increasingly receives attention as a suitable alternative to fossil fuel-based space heating and cooling, warm water provision, as well as for seasonal heat storage throughout ...

At smaller scales, groundwater flow can present challenges to the proper design of geo-exchange systems and can limit the success of aquifer thermal energy storage (ATES) and borehole thermal ...

The use of shallow geothermal energy increasingly receives attention as a suitable alternative to fossil fuel-based space heating and cooling, warm water provision, as well as for seasonal heat storage throughout Europe. With the advent of shallow geothermal energy use on large scales, a vivid discussion of potential

ecological and economic impacts has ...

Currently, shallow geothermal energy home use for heating (cooling) could account for 19% of commercial buildings, and for 30% of the new construction. By the joint action of gravity potential, temperature gradient and moisture gradient, groundwater heat storage and transfer is an important part of the hydrological cycle.

Groundwater warming in shallow aquifers is closely associated with increasing average land surface temperatures and has already reached + 1 K compared to pe-industrial times. ... Hijnen W (2011) Effects of aquifer thermal energy storage on groundwater quality and the consequences for drinking water production: a case study from the Netherlands ...

Sustainable water resources and energy supply are two of the main challenges in today"s society (e.g. Gleeson et al 2012, Gleeson et al 2016, Jaramillo and Destouni 2015), (Potocnik 2007, Kammen and Sunter 2016). Shallow groundwater temperatures play a crucial role in both of these challenges.

Groundwater discharge generates streamflow and influences stream thermal regimes. However, the water quality and thermal buffering capacity of groundwater depends on the aquifer source-depth. Here ...

The importance of considering ground water and surface water as a single resource has become increasingly evident. Issues related to water supply, water quality, and degradation of aquatic environments are reported on frequently. The interaction of ground water and surface water has been shown to be a significant concern in many of these issues.

Mean decline rate of shallow groundwater level slowed by approximately 1 m a -1 during the entire future period (2041-2100) under three SSPs with a greater reduction for SSP5-8.5. The average contribution rate of future climate toward the balance of shallow groundwater pumping and replenishment was 62.9%.

The data show that the groundwater circulation by the ATES system can impact chemical groundwater quality by introducing shallow groundwater with a different chemical composition at greater depth, but the observed concentration changes are sufficiently small to keep groundwater suitable for drinking water production. We used data from an aquifer ...

The use of shallow geothermal energy (SGE) systems to acclimatize buildings has increased exponentially in the Netherlands and worldwide. In certain areas, SGE systems are constructed in aquifers ...

Aquifer thermal energy storage (ATES) ... Shallow (<400 m) geothermal installations" legal status is diverse among countries. [14] ... The presence of ATES and chlorinated ethenes offers the potential for of integration of sustainable energy technology and sustainable groundwater management. [18]

Impacts of Shallow Geothermal Energy on Groundwater Quality provides a hydrochemical and geomicrobial overview of the effects of ground source heat pumps and aquifer thermal energy ...

Shallow groundwater energy storage

Low temperature thermal energy storage has already been shown to affect ... systems is the physical mixing of deep and shallow groundwater of different quality distorting the natural water quality ...

Thermal use of the shallow subsurface for heat generation, cooling, and thermal energy storage is increasingly gaining importance in reconsideration of future energy supplies. Shallow geothermal energy use is often promoted as being of little or no costs during operation, while simultaneously being environmentally friendly.

It is demonstrated that aquifer thermal energy discharge can affect aquifer bacteria and fauna, while at the same time controlling only a minor part of the total seasonal and spatial variability and therefore posing no likely threat to ecosystem functioning and drinking water protection in uncontaminated, shallow aquifers. The use of groundwater as a carrier of thermal ...