

# Aquifer thermal energy storage heat pump

The concept of aquifer thermal energy storage (ATES) has evolved from theory to the point ... &lt; 30 &#176;C (ATES) 70 - 90% heat pump &gt; 1.300 systems in the Netherlands 30 - 60 &#176;C (MT-ATES) 60 - 80% ...

Keywords: Aquifer thermal energy storage systems, Thermal imbalance, Heating and cooling systems, Ground-source heat pumps ABSTRACT Aquifers can be used to store thermal energy, either produced as waste heat or captured during cooling in summer. This thermal energy can be used for heating in the winter via a heat pump system.

3 days ago&#0183; These costs can be further reduced by using a thermal energy storage system (TES), which serves to balance out the fluctuating generation of renewable energy. ... Thermal ...

Aquifer Thermal Energy Storage is a sustainable energy supply in which heat and cold are stored via a heat exchanger (counter-current device, TSA) in a water-carrying sand package 90 meters deep in the ground. ... The heat pump then extracts the warmth and cools the water from the building installation back to about 5 degrees. The heat pump ...

Aquifer thermal energy storage (ATES) is an energy efficient technique to provide heating and cooling to buildings by storage of warm and cold water in aquifers. In regions with large demand for ATES, ATES adoption has ...

The aquifer thermal energy storage (ATES) system is an efficient method to overcome the gap between energy supply and demand over time and space. ... Performance analysis and parametric study of thermal energy storage in an aquifer coupled with a heat pump and solar collectors, for a residential complex in Tehran, Iran. Appl. Therm. Eng., 62 (1 ...

Aquifer thermal energy storage can use groundwater to heat and cool buildings--decarbonizing homes and businesses in the process. ... Combined with a heat pump, this process extracts heat from ...

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 ...

A novel approach to high-temperature aquifer thermal energy storage (ATES) ... The heat storage temperature is maintained at 90 &#176;C, and during heat extraction, the CO 2 is cooled to 25 &#176;C by the heat pump. The duration of the heat storage cycle for the system spans 1 year, with a target safe operating period of 20 years.

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Performance analysis and parametric study of thermal energy storage in an aquifer coupled with a heat pump and solar collectors, for a residential complex in Tehran, Iran ...

Water-based systems include tank thermal energy storage (TTES), pit thermal energy storage (PTES), and aquifer thermal energy storage (ATES) systems. A TTES system employs a stainless steel or reinforced concrete water tank as the storage medium, transferring heat to and from the tank by circulating a heat transfer fluid through a HE.

Aquifer thermal energy storage with heat pump (ATES-HP) A combination of aquifer thermal energy storage and heat pump is shown in Fig. 7. Paksoy et al. [75] found a 60% increase in COP of the ATES-HP, when compared to a COP of a conventional HP using ambient air. In ATES-HP, depending on the required temperature level, it is optional to ...

Aquifer Thermal Energy Storage (ATES) is a type of UTES that stores warmed or cooled groundwater in naturally porous, permeable underground rocks and uses this to provide low ...

Aquifer thermal energy storage (ATES) systems with groundwater heat pumps (GWHP) provide a promising and effective technology to match the renewable energy supply and demand between seasons ...

The objective of the present study is to analyse the economic and environmental performance of ATES for a new building complex of the municipal hospital in Karlsruhe, Germany. The studied ATES has a cooling capacity of 3.0 MW and a heating capacity of 1.8 MW. To meet the heating and cooling demand of the studied building, an overall pumping rate of 963 m<sup>3</sup>/h is ...

Such storage systems can be combined perfectly with heat networks and heat pumps. Near-surface low-temperature aquifer thermal energy storage systems (LT-ATES) have proved to be particularly efficient. As the water temperature is not much higher than the temperature of the environment, little heat is lost during storage.

Aquifer thermal energy storage systems can largely contribute to climate-friendly heating and cooling of buildings: Heated water is stored in the underground and pumped up, if needed. Researchers ...

Aquifer thermal energy storage (ATES) Description of the technology In an aquifer thermal energy storage (ATES), excess heat is stored in subsurface aquifers in order to recover the heat at a later stage. The thermal energy is stored as warm groundwater. The groundwater is also used as a carrier to transport the heat to and from the subsurface.

Aquifer thermal energy storage (ATES) is used for seasonal storage of large quantities of thermal energy. Due to the increasing demand for sustainable energy, the number of ATES systems has increased rapidly, which

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has raised questions on the effect of ATES systems on their surroundings as well as their thermal performance. Furthermore, the increasing ...

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Being a heat source or sink, aquifers have been used to store large quantities of thermal energy to match cooling and heating supply and demand on both a short-term and long-term basis. The current technical, economic, and environmental status of aquifer thermal energy storage (ATES) is promising. General information on the basic operation principles, design, and construction of ...

Aquifer Thermal Energy Storage (ATES) is considered to bridge the gap between periods of highest energy demand and highest energy supply. The objective of this study ...

Aquifer thermal energy storage (ATES) is a seasonal storage technology that is experiencing renewed interest as building owners strive for net zero and reduced bills. Well established in the Netherlands and Belgium, ATES is an open-loop system that stores coolth and heat in two aquifers at up to 250 metres underground.

The overall aim of the program is research, development and innovation in refrigeration and heat pump systems as well as cooling and heating bearings contribute to society and the outside world's transition to a more resource-efficient and sustainable energy use and the reduction of environmentally harmful substances in thermal storage and heat ...

Aquifer Thermal Energy Storage (ATES) systems are a proven technology for reducing fuel consumption for heating and cooling purposes. Thermal energy storages are available at different temperature levels and a general classification is done accordingly. ... applications with direct use of the stored heat without interconnected heat pumps. Kranz ...

The working principle of the ATES system is shown in Fig. 1 and requires an underground saturated confined aquifer as the thermal storage site; therefore, the flow process in the reservoir conforms to Darcy's law and follows the mass conservation equation [20].The heat transfer process in the reservoir includes three parts: heat conduction, heat convection, and ...

Abstract: Aquifer thermal energy storage (ATES) combined with ground-source heat pumps (GSHP) o er an attractive technology to match supply and demand by e ciently recycling ...

Underground aquifer thermal energy storage systems are accessed by boreholes and used to store heat from solarthermal plants or waste heat from industrial facilities. If required, the heat can be pumped up again. Such storage systems ...

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Others investigated at hot water tank storage with heat pump (HWTS-HP) [105,106], water gravel pit storage with heat pump (WGPS-HP) [26], borehole thermal energy storage with heat pump (BTES-HP) ...

High-temperature aquifer thermal energy storage (HT-ATES) is a cost-effective and suitable technology to store large amounts of energy. ... Second, operating at higher temperatures could eliminate the need for the heat pump that raises the temperature of the fluid before it enters district heating networks, thereby reducing investment costs ...

The storage of heat in aquifers, also referred to as Aquifer Thermal Energy Storage (ATES), bears a high potential to bridge the seasonal gap between periods of highest thermal energy demand and supply. ... Current status of ground source heat pumps and underground thermal energy storage in Europe. *Geothermics*, 32 (2003), pp. 579-588, 10.1016 ...

An experimental investigation of an aquifer thermal energy storage system was conducted in Belgium [23], in which a low temperature ATES system was coupled with heat pumps for heating and cooling of a hospital over a three-year period. Gao et al. investigated the well position for improving the efficiency of thermal energy storage systems [24].

3 days ago; Abstract page for arXiv paper 2411.02211: Stochastic Optimal Control of an Industrial Power-to-Heat System with High-Temperature Heat Pump and Thermal Energy Storage The ...

Sustainable and climate-friendly space heating and cooling is of great importance for the energy transition. Compared to conventional energy sources, Aquifer Thermal Energy Storage (ATES) systems can significantly reduce greenhouse gas emissions from space heating and cooling. Hence, the objective of this study is to quantify the technical potential of shallow ...

**Aquifer Thermal Energy Storage 4.1 Definition** In general, groundwater temperatures remain relatively stable at temperatures typically 1-2 C higher than local mean annual temperatures between depths of ... typically in combination with a heat pump. The majority of open-loop systems

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