

Application of aquifer energy storage technology

What is aquifer thermal energy storage?

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 therefore is to review the global application status of ATES underpinned by operational statistics from existing projects.

How is a aquifer used to transfer thermal energy?

Groundwater is used to transfer the thermal energy into and out of an aquifer in ATES systems. ATES systems utilize aquifers for the storage of low-grade thermal energy such as solar heat or waste heat during off-peak periods. The low-grade energy is used to heat or chill water which is injected into an aquifer for storage.

What is sensible aquifer thermal energy storage (ATES)?

In open-loop systems, also referred to as Aquifer Thermal Energy Storage (ATES), sensible heat and cold is temporarily stored in the subsurface through injection and withdrawal of groundwater ... Fig. 1. Seasonal sensible UTES techniques.

How does a aquifer system work?

ATES systems utilize aquifers for the storage of low-grade thermal energy such as solar heat or waste heat during off-peak periods. The low-grade energy is used to heat or chill water which is injected into an aquifer for storage. Later, the water is withdrawn for space heating or cooling during a period of high demand.

Is high-temperature aquifer thermal energy storage sustainable?

A review within ECES Annex 12 of the International Energy Agency IEA. Giessener Geologische Schriften 67; 1999. Drijver B, van Aarssen M, Zwart B. de. High-temperature aquifer thermal energy storage (HT-ATES): sustainable and multi-usable. Innostock. In: Proceedings of the 12th international conference on energy storage, Lleida, Spain.

What are aquifers used for?

Being necessary for the implementation of ATES, aquifers are underground, water-yielding geological formations, either unconsolidated or consolidated. Two hydraulically-coupled wells are normally used to separate water supply from storage. Aquifers can be discharged effectively through production wells to meet large cooling and heating demands.

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 ...

3 IF Technology BV by EDF and KIT - current global practical experience ... High-Temperature Aquifer Thermal Energy Storage (HT-ATES) ... P., Godschalk, B., Stober, I., Blum, P. (2019): Worldwide application

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of aquifer thermal energy storage -A review. Renew Sustain. Energy Rev. 94, 861-876 (2018). doi: 10.1016/j.rser.2018.06.057

(DOI: 10.1016/J.RSER.2018.06.057) To meet the global climate change mitigation targets, more attention has to be paid to the decarbonization of the heating and cooling sector. 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 therefore is ...

Worldwide application of aquifer thermal energy storage - A review. P. Fleuchaus B. Godschalk I. Stober P. Blum. Environmental Science, Engineering. ... (Aquifer Thermal Energy Storage) technology for the seasonal storage of heat and cold in shallow aquifers in ... Expand. PDF. Save.

The global potential evaluation results display where the aquifer thermal energy storage technology is likely to be, or has potential to apply. ... are expected to promote the application of ...

In order to achieve global carbon neutrality in the middle of the 21st century, efficient utilization of fossil fuels is highly desired in diverse energy utilization sectors such as industry, transportation, building as well as life science. In the energy utilization infrastructure, about 75% of the fossil fuel consumption is used to provide and maintain heat, leading to more ...

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Aquifer thermal energy storage (ATES) represents a promising solution for heating and cooling, offering lower greenhouse gas emissions and primary energy consumption than conventional technologies. Despite these benefits and the widespread availability of suitable aquifers, ATES has yet to see widespread utilisation, with uptake highly concentrated in select ...

Schematic diagram of aquifer thermal energy storage system. During the summer, groundwater from cold well is extracted for cooling purposes and residual warm water is injected back into the hot well for recharging the warm storage. ... The first application of combined heating and cooling ATES was started at the Scarborough Centre building of ...

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The objective of the current study is to assess the technical performance of Aquifer Thermal Energy Storage (ATES) based on the monitoring data from 73 Dutch ATES systems. With a total abstraction of 30.4 GWh heat and 31.8 GWh cold per year, the average annual amount of supplied thermal energy was measured as 932.8 MWh. The data analysis ...

Acta Horti 2008;801:819-26. [250] Turgut B, Dasgan HY, Abak K, Paksoy H, Evliya H, Bozdog S. Aquifer thermal energy storage application in greenhouse climatization. Acta Horti 2009;807:143-8. [251] Wong B, McClung L, Snijders A, McClenahan D, Thornton J. The application of Aquifer Thermal Energy Storage in the Canadian greenhouse industry.

Aquifer Thermal Energy Storage (ATES) is a building technology used to seasonally store thermal energy in the subsurface, which can reduce the energy use of larger buildings by more than half.

LARGE-SCALE ANNUAL-CYCLE THERMAL ENERGY STORAGE IN AQUIFERS. C.F. Meyer, in Energy Storage, 1980 CONCLUSIONS. Aquifer thermal energy storage is a technology whose time has come. It inherently is most suitable for large-scale application, because the loss per unit of heat stored depends on the ratio of the surface area of the hot water to its volume.

As carbon dioxide emissions and resource depletion become increasingly severe, the technology of aquifer thermal energy storage (ATES) has become a hotspot and urgent topic and the determination of technological potential on a global scale is the basis for effective technology application. ... Such a new potential evaluation paradigm and its ...

storage system is equivalent to the amount of energy injected into an aquifer (e.g., energy injected to the aquifer while cooling a building) divided by the amount of energy taken from an aquifer (e.g., energy rejected from the aquifer using a fluid cooler to passively refrigerate the aquifer during cold spells). It should be calcu-

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