

# Characteristics of solar energy cross-seasonal heat storage





## Overview

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Can solar thermal energy be used for cross-seasonal heating?

The increase in the tank temperature at the end of the heating period was beneficial for shortening the duration of the heat storage period for the following year. The feasibility of utilizing solar thermal energy and cascaded phase change heat storage for cross-seasonal heating has been demonstrated in this study.

What are heat storage methods for solar-driven cross-seasonal heating?

Heat storage methods for solar-driven cross-seasonal heating include tank thermal energy storage (TTES), pit thermal energy storage (PTES), borehole thermal energy storage (BTES), and aquifer thermal energy storage (ATES) 14, 15, 16. As heat storage volume increases, hot water preparation costs and heat loss per unit volume decrease.

Why is cross-seasonal heat storage important?

The mismatch between solar radiation resources and building heating demand on a seasonal scale makes cross-seasonal heat storage a crucial technology, especially for plateau areas. Utilizing phase change materials with high energy density and stable heat output effectively improves energy storage efficiency.

What is seasonal/long-term heat storage?

The concept of seasonal/long-term heat storage presents great opportunities for making the utmost use of solar energy. Stored “excess” heat can compensate for the heat shortage when necessary. Seasonal storage offers the possibility that solar energy can cover all the heating loads without an extra heating system.

Can a seasonal solar thermal energy storage system cover winter heating demand?

While the system aims to cover winter heating demand, its success depends



on practical operating conditions and fluctuating ambient temperatures. Ma et al. assessed the viability of a seasonal solar thermal energy storage (SSTES) system utilizing ammonia-based chemisorption for residential use in the UK.

Can thermochemical thermal energy storage be used in solar-powered buildings?

This study examines different thermochemical thermal energy storage (TES) technologies, particularly adsorbent materials used for seasonal heat storage in solar-powered building systems. This evaluation is confined to thermochemical energy storage devices with charging temperatures less than 140 °C.



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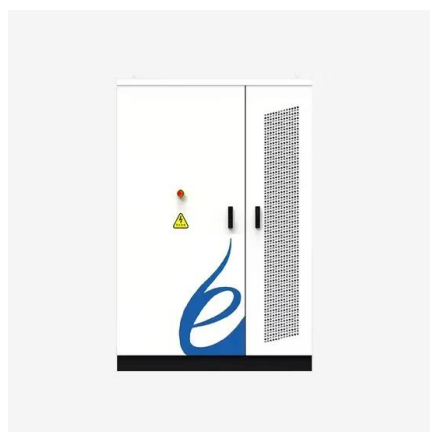


### Large scale underground seasonal thermal energy storage in ...

The heating price of typical large-scale solar energy seasonal thermal storage projects is \$0.015 per megajoule (the heating price of coal-fired heating in China is \$0.007 per ...

### Study on Operation Strategy of Cross-Season Solar Thermal ...

Based on the cross-season solar thermal storage heating system (CSTSHS) in a typical Alpine town in the west of China, this paper analyzes and compares the electric ...

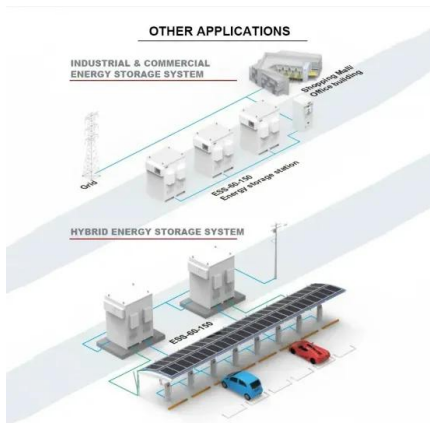


### Research Progress on Solar Seasonal Thermal Energy Storage

Research Progress on Solar Seasonal Thermal Energy Storage: ZHAO Xuan 1, ZHAO Yan-jie 2, WANG Jing-gang 1, BAO Ling-ling 1: 1. Hebei University of Engineering, Handan 056038, ...

### Performance investigation of a solar-driven cascaded phase ...

Heat storage methods for solar-driven cross-seasonal heating include tank thermal energy storage (TTES), pit thermal energy storage (PTES), borehole thermal energy



### Application Analysis of Phase Change Heat Storage in a Solar Heating

2.2 Characteristics of Solar Energy Phase Change Heat Storage. Solar energy is the main source of all energy on the earth. It is an inexhaustible and pollution-free clean ...

### The Characteristics of Solar Thermal Collector and Storage System

For observing the stratification performance of the STES, nine temperature sensors are placed at the center of STES with 1 m different heights above the floor of the STES. M. Kim / SWC 2017 ...



### A review of thermal energy storage technologies for seasonal ...

Characteristics Preventive Measures; Physical clogging: Suspended solids, bubbles, compaction for a temperature difference of 80 °C within the tank the cross ...



### Study on the Performance of a Solar Heating System ...

A novel solar heating system with seasonal and cascade thermal-energy storage based on zeolite water is proposed in this study. The system's efficiency is improved through cascade storage and the release of ...



### Simple Modeling of the Solar Seasonal Thermal Storage Behavior ...

where  $k \cdot S = 0.12 \text{ MW/K}$  was considered the thermal characteristic of the heated buildings (compatible with [1]) and  $\Delta t = 1 \text{ h}$  is the time step considered in the ...

### The role of seasonal energy storage in decarbonizing the energy ...

Energy storage is required to reliably and sustainably integrate renewable energy into the energy system. Diverse storage technology options are necessary to deal with ...



### Performance investigation of a solar-driven cascaded phase change heat ...

solar-driven cross-seasonal heating include tank thermal energy storage (TTES), pit thermal energy storage (PTES), borehole thermal energy storage (BTES), and aquifer thermal energy ...



Seasonal Thermal Energy Storage

Research progress of seasonal thermal energy storage technology based on supercooled phase change materials. Weisan Hua, Jiahao Zhu, in Journal of Energy Storage, 2023. 2 Types of ...



**Selection of cross-seasonal heat collection/storage media for ...**

In order to break through the limitations of wood solar drying and its application in the tropics, the core part of a wood solar drying system (collection/storage media) should be ...



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Renewable energy sources, such as solar energy, have the characteristics of intermittence and instability that lead to their temporal, spatial, and intensity mismatch and seasonal ...



**Application of graded phase change materials for solar energy ...**

Abstract In this paper, firstly, the heat transfer characteristics of the stepped phase change accumulator are studied, and the location of the solid-liquid phase interface is ...





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Renewable energy sources, such as solar energy, have the characteristics of intermittence and instability that lead to their temporal, spatial, and intensity mismatch and seasonal characteristics. The seasonal thermal storage ...



**The value of seasonal energy storage technologies ...**

Energy storage at all timescales, including the seasonal scale, plays a pivotal role in enabling increased penetration levels of wind and solar photovoltaic energy sources in power systems. Grid-integrated seasonal energy storage can ...

**A Review on CFD Applications in Seasonal Pit Thermal Energy Storage**

In winter, when heating is needed, heat is extracted from it. There are four common methods for cross season energy storage technology, namely buried borehole ...



**Dynamic characteristics and energy efficiency evaluation of a ...**

Seasonal thermal energy storage (STES) systems are used to store excess solar energy in summer to supply domestic hot water and space heating in winter, effectively ...



### Study on the Performance of a Solar Heating System with Seasonal ...

The energy storage density is improved through the deep coupling of daily energy storage and cross-seasonal energy storage. A mathematical model of the system ...



### Operational characteristics of solar-gas combined heating water ...

The combined heating system is designed based on a hot water station in Daqing Oilfield, featuring an existing hot water tank (HWT) with 200 m<sup>3</sup> volume. Moreover, the hot ...

### Storage and release characteristics of seasonal composite thermal ...

Renewable energy sources, such as solar energy, have the characteristics of intermittence and instability that lead to their temporal, spatial, and intensity mismatch and seasonal ...



### Seasonal thermal energy storage employing solar heat: A case ...

Seasonal thermal energy storage (STES) offers an attractive option for decarbonizing heating in the built environment to promote renewable energy and reduce CO<sub>2</sub> ...



### Thermodynamic analysis of a novel concentrated solar power ...

The surface of the central receiver is coated with a high-absorptivity material to collect solar energy. The main characteristics of the solar field are the following: a heliostat ...



### Supercooled erythritol for high-performance seasonal thermal energy storage

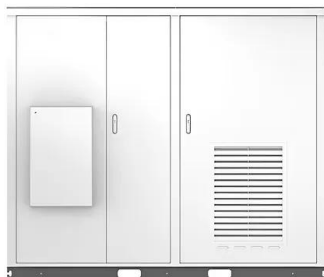
Seasonal storage of solar thermal energy through supercooled phase change materials (PCM) offers a promising solution for decarbonizing space and water heating in ...

### Operation strategy of cross-season solar heat storage heating ...

The flow heat transfer and stress distribution of the shell and tube superheater of the steam generation system in a 50 MW molten salt tank solar thermal power station are ...



Solar



### Experimental and numerical investigations of the energy ...

(2) For the field experimental conditions, during single thermal storage operation mode, the seasonal heat storage of surrounding rock can be achieved by raising the inlet temperature. At ...



### **Characteristic analysis and parameter optimization of seasonal solar**

In this study, the seasonal solar thermal storage and heating system in the Jilin region of China is considered, and a system model is established by using the TRNSYS ...



### **A review of thermal energy storage technologies for seasonal ...**

The mismatch between solar radiation resources and building heating demand on a seasonal scale makes cross-seasonal heat storage a crucial technology, especially for plateau areas.

### **A review of available technologies for seasonal thermal energy ...**

This paper reviews all three available technologies for seasonal heat storage: sensible heat storage, latent heat storage and chemical storage. Sensible heat storage is a ...



### **The Characteristics of Solar Thermal Collector and Storage ...**

A techno-economic analysis of a hybrid renewable energy system, consisting of a solar thermal system, seasonal thermal energy storage (STES), heat pump systems, and ...



### Seasonal thermal energy storage

A number of examples of the use of solar thermal storage from across the world include: Suffolk One a college in East Anglia, England, that uses a thermal collector of pipe buried in the bus ...



### **Selection of cross-seasonal heat collection/storage media for ...**

Abstract In order to break through the limitations of wood solar drying and its application in the tropics, the core part of a wood solar drying system (collection/storage ...

### **Operational characteristics of solar-gas combined heating water ...**

Hesaraki et al. [16] conducted a feasibility analysis of a solar collector integrated with a heat pump and cross-seasonal heat storage system for a residential building in Sweden ...



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