Techno-economic evaluation of solar-based thermal energy storage systems

What is thermal energy storage?
Introduction Thermal energy storage (TES) has the potential to store energy in the form of heat over a period of time for later use. It is a promising technology that can reduce reliance on fossil fuels and help avoid penalties related to environmental regulations.

How are thermal energy storage systems sized?
Thermal energy storage (TES) systems can be sized using a few key parameters, namely, storage duration, capacity factor, solar multiple, and plant capacity. These parameters were given a base value, as shown in Table 3. The base case was selected from values commonly used in the industry.

What is sensible heat storage?
Sensible heat storage is a commercially available technology that can store thermal energy for up to 15 h using a heat transfer medium such as molten salt . Molten salts have high storage efficiencies that allow sensible heat storage to produce electricity during peak energy demand, thereby making electricity more economical .

How much does thermal storage cost?
The costs of thermal storage for parabolic troughs and central tower solar field systems were evaluated by Turchi et al. using the Solar Advisor Model (SAM) software and found to be less than 11 cents/kWh. In a similar study by Hinkley et al. ,the LCOE was evaluated for both technologies using SAM software.

What is thermochemical heat storage?
Thermochemical heat storage (S5) Fig. 5 is a process flow schematic of thermochemical energy storage. In this scenario, a stream of pure ammonia in gaseous form is the input (labelled "1"). The input ammonia is assumed to be heated to approximately 1742 °F (950 °C) and 2900 psi (20 MPa) using concentrated solar radiation.

Can thermal energy storage be optimized?
The optimization of thermal energy storageis a key aspect to competing with mature fossil fuel technologies with low LCOEs. The optimization process adopted in this paper uses correlations reported by the International Renewable Energy Agency (IRENA) .

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The described energy conversion and storage options were integrated into MRESOM model, energy systems can then be performed with technical and economic ...

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Various types of energy storage technologies have been widely-applied in off-grid hybrid renewable energy systems, integrated energy systems and electric vehicles [4].Energy storage technologies are endowed with ...

Energy storage is essential in transitioning from a fossil fuel-to a renewable energy-based energy system, especially in the context of future smart energy systems, since ...

Thermochemical energy storage (TCES) systems are a promising alternative to conventional molten salt systems for integration with solar thermal power plants.TCES ...

As a widely available, clean, harmless, and sustainable renewable energy source, the efficient development and adoption of solar energy is an efficacious and practical way to ...

The results indicate that when uncertainty is taken into account, the investment cost for thermochemical storage is clearly higher than other scenarios. This study will provide key ...

These studies help us understand technical properties, such as efficiency, energy and power densities, depth of discharge, lifetime, etc., and to determine the size of energy ...

Although the aforementioned studies are a good addition to the field, the lack of economic analysis limits the prospects of scaling up the proposed systems. To overcome this ...

Solar and wind energy are quickly becoming the cheapest and most deployed electricity generation technologies across the world. 1, 2 Additionally, electric utilities will need ...

excess energy to be stored [4]. A solar multiple of two, on the other hand, indicates that the energy produced in the solar field is twice that consumed by the turbine, leaving

A few studies have focused on one or two specific STES technologies. Schmidt et al. [12] examined the design concepts and tools, implementation criteria, and specific costs of ...

The pursuit of energy decarbonization has led to a significant focus on the development of renewable energy sources as an alternative to traditional fossil fuels such as ...

The aim of the present study is to carry out a techno-economic evaluation of PV and CSP plants under the climatic conditions of Saudi Arabia. The main contribution of the ...

This paper aims to perform a techno-economic evaluation for the sensible heat, latent heat, and combined sensible-latent heat storage systems applied in concentrated solar ...

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Techno-economic evaluation of solar-based thermal energy storage systems. Author(s) / Creator(s) Thaker, Spandan; Oni, Abayomi Olufemi; Kumar, Amit; In this paper, a data ...

Rafael Guedéz, Davide Ferruzza, Monica Arnaudo, Ivette Rodríguez, Carlos D. Perez-Segarra, Zhor Hassar, Björn Laumert; Techno-economic performance evaluation of ...

Solar energy is one of the leading potential resources in solving the energy deficit in sub-Saharan Africa, yet the entire continent accounts for less than 1% of global solar PV ...

In this paper, a data-intensive cost model was developed for sensible heat, latent heat and thermochemical storage systems. In order to evaluate the economic feasibility of storage ...

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