

The volume of thermocline energy storage system using water as storage material is evaluated by assuming a temperature difference of 37 K and assuming a total energy to be stored as 0.6 MJ (generated in metal hydride reactor) using Eq. (33). The volume of thermocline energy storage system assuming these parameters is evaluated as 0.00357 m³ ...

Xu et al. (2012b) presented a two-dimensional, two-phase model for heat transfer and fluid dynamics within the thermocline storage system. The authors used the model to evaluate different correlations for the interstitial heat transfer coefficient, effective thermal conductivity and the effect of the thermal conductivity of solid fillers. ...

Presents optimum design of the thermal energy storage system. article info Article history: Received 17 May 2013 Received in revised form 2 August 2013 Accepted 19 August 2013 Keywords: Thermal energy storage Thermocline system Latent thermal energy storage Encapsulated phase change materials Concentrating solar power abstract

The single-medium thermocline TES system has been investigated by several numerical and experimental studies. Gajbhiye et al. [9] conducted an experimental analysis of a direct single-medium thermocline tank equipped with a flow distributor, using water as a working fluid. The flow distributor used in the experiment was an annular vertical porous type with ...

Sensible and latent heat TES systems have both advantages and limitations. Sensible heat TES systems are easily available well developed technology and use low cost cheap naturally occurring filler materials like concrete, rocks etc. [9]. However, it exhibits the limitations of low storage capacity per unit volume and quick temperature drops at the end of ...

A thermocline tank was used in the Solar One pilot plant, and the stored energy was reported to be 170 MWh T [28], [31]. The thermal energy storage system operated from 1982 to 1986. It supplied 8 hours of additional electrical production to the power plant and showed a very thin thermocline layer.

The general layout of a thermocline storage system is presented in Fig. 1, and is similar to that used by others (Xu et al., 2012, Yang and Garimella, 2010). The storage volume, with height L, consists of a cylindrical tank packed with small solid particles, called the filler material. A heat transfer fluid, referred to as fluid herein, enters ...

heat capacity and reducing the storage volume, and ultimately reducing the cost of heat-transfer fluid (HTF).²⁵ Owing to the potentiality of thermocline TES system in terms of high energy storage density and relative low costs, numerous studies have been presented in literature for investigating the feasibility and

reliability of such sys-

One such thermal storage system, a thermocline, uses a single tank containing a fluid with a thermal gradient running vertically through the tank, where hotter fluid (lower density) is at the top ...

Thermal performance analysis of thermocline combined sensible-latent heat storage system using cascaded-layered PCM designs for medium temperature applications N Ahmed, KE Elfeky, L Lu, QW Wang Renewable Energy 152, 684-697, 2020

Thermal storage is a viable option to enhance the dispatchability of the solar energy and an economically feasible option is a thermocline storage system with a low-cost filler material. Utilization of thermocline storage facilities have been studied in the past and this paper hopes to expand upon that knowledge.

Thermal performance of the thermocline tank system has been predicted numerically by using several different models. Ismail et al. [33] numerically investigated the dynamic performance of the thermocline storage tank with PCM(s) particles as filler material by using the (D-C) approach. The marching technique has been applied to check the ...

Abstract The solar thermal-based hot water system has established itself as one of the prominent options to achieve sustainable energy systems. Optimization of the solar water-heating system focuses mainly on two major decision variables, the solar collector area and the storage tank volume, and leads to a significant reduction in the capital investment. In ...

This work presents an optimized thermal energy storage (TES) system based on thermocline technology. A prototype of a single-medium (molten salt) thermocline storage system was built and tested at the ENEA Casaccia Research Center, which consists of a single tank equipped with an internal vertical channel to drive the salt motion by natural convection.

An overall idea of the potential cost reduction can be highlighted by combining the facts that the conventional two-tank molten salt storage system [4] accounts for approximately 10-20% of the total investment of a CSP plant and that the thermocline TES is estimated to cost approximately 35% less [5].The expected cost reduction is achieved from ...

Hence, to understand the stability of the thermocline, it is pertinent to prudently design a thermal energy storage system. The thin thermocline is desirable for thermal energy storage systems concluded (Gil et al., 2010, Medrano et al., 2010). For a clear understanding, this novel study discusses the size and stability of the thermocline along ...

The energy storage in the thermal energy storage system is qualitatively determined in the form of "Thermocline". The term "Thermocline" refers to a zone which is created between the hot and cold region in the tank due to buoyancy force (Reddy et al., 2017).

Ireland thermocline storage system

This study aims at solving the flow maldistribution problem in the single-tank thermocline storage system by appropriately structuring the inlet/outlet manifolds. The technical solution is based ...

The model developed to study latent thermocline energy storage system in the previous section can be used to analyze sensible thermocline energy storage system by setting the nondimensional PCM melt temperature, T_m , to a value greater than 1 and the inverse Stefan number of the filler material, S , to 0.

A molten salt thermocline system has been developed that is lower cost than a two-tank molten salt system. Isothermal and thermal cycling tests showed that silica sand and quartzite rock as well as taconite were compatible with nitrate salts. The feasibility of a molten-salt thermocline system was proven on a pilot scale 2.3 MWh storage ...

