

3D Simulation for Design and Predicting Performance of a Thermal Heat Storage Facility using Sand

Authors : Nadjiba Mahfoudi, Abdelhafid Moumni , Mohammed El Ganaoui

Abstract : Thermal applications are drawing increasing attention in the solar energy research field, due to their high performance in energy storage density and energy conversion efficiency. In these applications, solar collectors and thermal energy storage systems are the two core components. This paper presents a thermal analysis of the transient behavior and storage capability of a sensible heat storage device in which sand is used as a storage media. The TES unit with embedded charging tubes is connected to a solar air collector. To investigate its storage characteristics a 3D-model using no linear coupled partial differential equations for both temperature of storage medium and heat transfer fluid (HTF), has been developed. Performances of thermal storage bed of capacity of 17 MJ (including bed temperature, charging time, energy storage rate, charging energy efficiency) have been evaluated. The effect of the number of charging tubes (3 configurations) is presented.

Keywords : design, thermal modeling, heat transfer enhancement, sand, sensible heat storage

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