A Solar-Based Thermal Energy Storage System for Water and Space Heating

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Researchers studied alternative solutions to replace energy from fossil fuels with clean energy for domestic water and space heating. Despite the available technologies that utilize solar energy for this purpose, the main challenge remains in the reliability and intermittency of solar-based systems. Thermal energy storage (TES) is being considered worldwide as a solution for the reliability and intermittency of renewable energy sources. The main objective of the proposed research study is to investigate the potential use of packed-bed thermal storage tanks with heat transfer pipes coupled with solar concentrators (ex. Fresnel-based solar energy source) to provide clean energy for domestic hot water use and space heating in individual households. The goal is to develop a practical cost-effective solar-based thermal energy system that could be deployed in buildings as a replacement for fossil fuel-based systems for heating applications. As such, we are proposing to model, design, construct, and test a medium scale low-cost thermal storage tank that is charged by an HTF from a system of Fresnel lenses. The optimal design of the Fresnel-TES system will be facilitated and informed by a comprehensive experimental and theoretical program. Results from the experimental and numerical study will allow for a better understanding of the mechanisms involved in the performance of Solar/TES systems and will allow for optimizing the design of these systems to meet a target heating demand.