

# Potential of PCM as a thermal energy source for uninterrupted on-farm agricultural food processing

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## Project description

The current study is focused on finding the possibility to integrate “Latent heat thermal energy storage system” (LHTESS) in various suitable solar thermal processes in agricultural. The setup consists of a laying Scheffler reflector, heat receiver, PCM storage tank, heat exchanger and a thermal oil reservoir. The laying type Scheffler reflector generates high radiation flux at the bottom of receiver causing a rise in temperature of thermal oil inside the receiver. Heated thermal oil is then introduced to PCM storage tank to exchange thermal energy with PCM after which it is reintroduced to receiver to repeat the cycle. The heat exchanger is used to transfer the thermal energy from PCM to the suitable agricultural process whereas the oil tank acts as a reservoir for thermal oil.

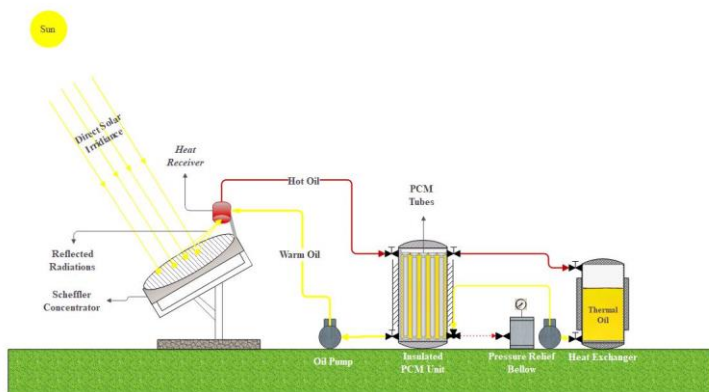


Figure 1: Experimental Setup of LHTESS at the experimental and demonstration site for irrigation and solar technology

Solid Phase	Mushy Zone	Liquid Phase
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Figure 2: Melting of PCM in Shell and Tube Tank

Initial experimentation revealed that the system during charging cycle stored 0.75 KWH of thermal energy in approximately 3 hours under average beam irradiance of  $457 \text{ W/m}^2$  resulting in overall thermal efficiency of 35%. During discharging cycle, the system released 98% of stored thermal energy and raised the thermal oil temperature in the heat exchanger from  $17^\circ\text{C}$  to  $45^\circ\text{C}$  in an hour. The results show that the system is capable to store thermal energy and can supply heat to a cold body acting as a thermal load.