

System-Level Analysis of Thermocline Energy Storage (CSP-5)



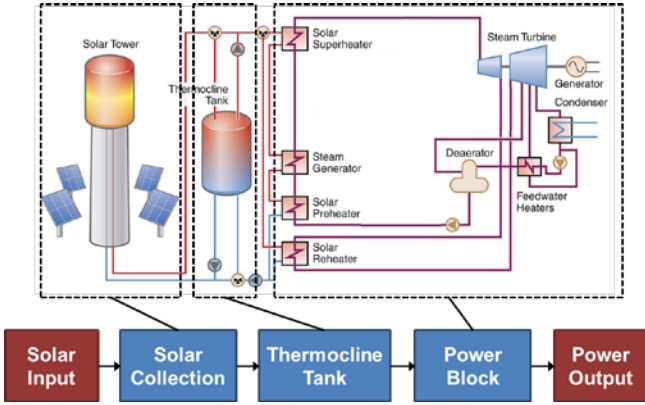
A joint India-U.S. research consortium funded under the Joint Clean Energy Research & Development Center (JCERDC)

Scientific Achievement:

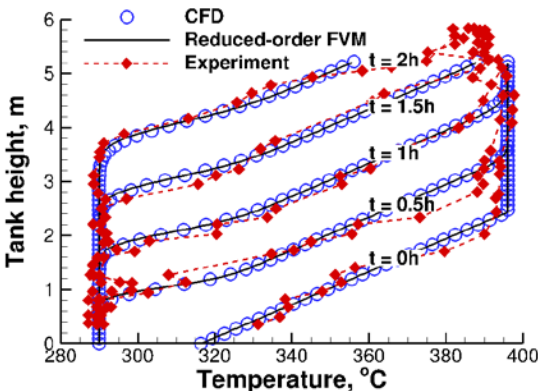
Thermocline tanks are a potential low-cost storage concept for next-generation CSP plants. We developed a new model for thermocline energy storage that is 100X faster than conventional CFD models. Low computing cost enables an advanced system-level simulation of a CSP plant with thermocline storage.

Significance and Impact:

System model provides new insights on thermocline tank response to realistic solar collection and power production processes. Verified that thermal stratification inside tank is sustained over long-term plant operation.



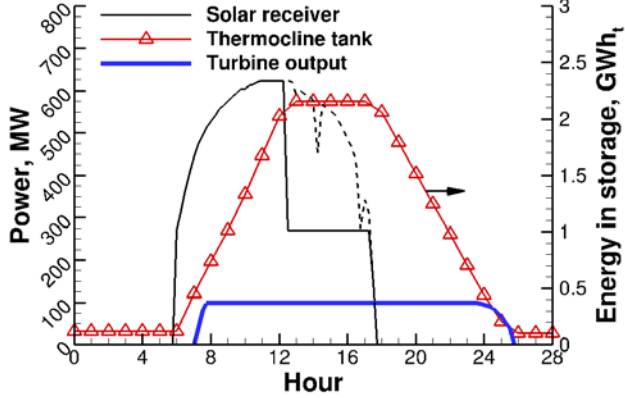
System-level model of a molten-salt power tower plant (Electric Power Research Institute)



Model validation for tank discharge process

Research Details:

- Simulation is performed with a user-generated finite-volume numerical approach; model validated against experiment thermocline performance data reported in the literature.
- The thermocline model is integrated into a system model of a 100 MW molten-salt power tower plant to investigate storage under realistic and long-term operating conditions.
- Solar collection is simulated with DELSOL and SOLERGY; power production is simulated with a Rankine cycle model.



Simulated plant operation near summer solstice

Publication(s): S. M. Flueckiger, B. D. Iverson, and S. V. Garimella, "Economic Optimization of a Concentrating Solar Power Plant with Molten-Salt Thermocline Storage," *ASME Journal of Solar Energy Engineering*, Vol. 136, 011016, 2014.



Contact(s): Suresh V. Garimella (sureshg@purdue.edu)