Assessment of Thermocline Tank Energy Storage with Phase-Change Materials (CSP -5)

Scientific Achievement:
An efficient reduced-order numerical model of thermocline energy storage with phase-change materials (PCMs) is integrated to system-level model of a concentrating solar power plant. A cascaded distribution of PCMs with different melting temperatures can yield to significant improvement in plant performance.

Significance and Impact:
Thermocline tanks with latent heat inclusion have potential for increased energy density, but require careful consideration of the PCM properties and distribution to avoid adverse performance. The parametric study evaluates this alternative and establishes criteria for thermocline tank design.

Research Details:
• One-dimensional user-generated numerical model of thermocline tank with latent heat integrated to system model for year-long simulations.
• Parametric study with different melting temperatures and heats of fusion.
• Conventional thermocline tank with quartzite rock is used as benchmark.
• Performance is assessed in terms of power tower plant annual indicators (e.g., capacity factor).


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