Solar Energy | Water | Environment Nexus IN NEVADA

Computational Analysis and Design of Air Cooled Condensers

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Air-cooled heat exchangers (ACHE), are devices used to reject heat from a working fluid using ambient air in place of water. A system coupling analysis is introduced to better account for the combined heat transfer effects of the internal multi-phase flow and external air domain. A fully three-dimensional CFD model has been developed for the air-side region and the heat transfer at the interface surface is coupled to an analytical steam condensation model. While the heat transfer associated with the forced convection on the exterior of the heat exchanger tubes has a larger role in the overall performance of the condenser system, the internal phase change flow becomes a dominating factor in the heat transfer characteristics as the axial distance from the inlet becomes large. Experimental data is used to validate the model and to investigate the impact of fan speed, flow distribution and inlet conditions on the overall heat and mass transfer. A comprehensive system model can assist in design and optimization of ACHE condensers, improving the viability of solar power generation in arid climates by significantly reducing water consumption.

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