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COMPUTATIONAL STUDY OF MIST SPRAY SYSTEMS FOR AIR COOLERS – AN ANALYSIS OF THERMAL PERFORMANCE IMPROVEMENTS VERSUS WATER CONSUMPTION

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FINAL ABSTRACT

To improve the environmental profile of concentrated solar power plants, the feasibility of replacing wet cooling towers by versatile air coolers equipped with mist spray systems is being investigated under the European WASCOP project[†]. In this paper, a numerical model is developed to study the adiabatic pre-cooling performance of an evaporating mist spray. Experimental validation is performed against two sets of measurements from the literature. To ensure that the air cooler thermal performance is maintained during the hottest days of the year while limiting water consumption, a numerical parametric study is performed to optimize the spray system parameters and operating point. Results on a model of a lab-scale test bench at CEA Grenoble show the superiority of counter-flow injection over parallel-flow injection. Within the range of positions studied, an increase in the distance between the nozzle and the heat exchanger is shown to be beneficial. Nozzle pressure and air speed are found to have the most influence among the parameters investigated. Correlations are generated to facilitate integration of the model predictions into a performance analysis tool capable of optimizing spray system parameters and operating points for a wide range of conditions.

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