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Numerical Modeling of a Molten Salt Power Tower Configuration Adaptable for Harsh Winter Climate

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Abstract : This paper proposes a novel configuration which introduces a natural draft dry cooling tower system in a molten salt power tower. A three-dimensional numerical modeling was developed based on the novel configuration. A plan of building 20 new concentrating solar power plants has been announced by Chinese government in September 2016, and among these 20 new plants, most of them are located in regions with long winter and harsh winter climate. The innovative configuration proposed includes an external receiver concrete tower at the center, a natural draft dry cooling tower which is surrounding the external receiver concrete tower and whose shell is fixed on the external receiver concrete tower, and a power block (including a steam generation system, a steam turbine system and hot/cold molten salt tanks, and water treatment systems) is covered by the roof of the natural draft dry cooling tower. Heat exchanger bundles are vertically installed at the furthest edge of the power block. In such a way, all power block equipment operates under suitable environmental conditions through whole year operation. The monthly performance of the novel configuration is simulated as compared to a standard one. The results show that the novel configuration is much more efficient in each separate month in a typical meteorological year. Moreover, all systems inside the power block have less thermal losses at low ambient temperatures, especially in harsh winter climate. It is also worthwhile mentioning that a photovoltaic power plant can be installed on the roof of the cooling tower to reduce the parasites of the molten salt power tower.

Keywords : molten salt power tower, natural draft dry cooling, commercial scale, power block, harsh winter climate
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