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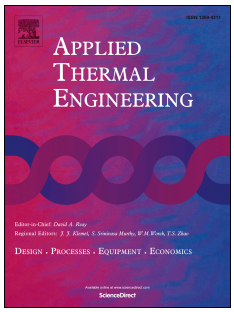

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Techno-economic analysis of Gas Turbine inlet air cooling for Combined Cycle power plant for different climatic conditions

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Abstract

This paper reports on a techno-economical parametric analysis of an inlet air cooling system applied to an aero-derivative Gas Turbine (GT) for a combined cycle power plant (CC). The system is based on a cold water thermal storage charged nighttime by mechanical chillers; chilled water is used in the hottest day hours to cool inlet air to the compressor. Three cases have been analyzed, supposing the plant operating in different sites, Phoenix (AZ - USA), New Orleans (LA - USA) and Abu Dhabi (UAE), characterized by quite different climatic conditions. Particular attention was paid to the influence of storage volume and heat exchanger sizing on both energetic and economic performances. Results have been obtained by a numerical code specifically developed to size the inlet air cooling system and to model the whole power plant behavior over the entire year on one hour basis. A 55 MWe combined cycle power plant with a GE LM6000 gas turbine was assumed as a reference case. Operational hours and power output augmentation were higher in hotter climates; wet climates required huge thermal storages, thus increasing the investment cost. The best techno-economic performance is attained for sites with high temperature combined with low relative humidity, typical of desert areas. The parametric analysis showed that the size of cooling storage is a very important parameter for the economical revenue.

Keywords: Gas turbine, inlet air cooling, thermal energy storage.

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