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Parametric analysis and optimization of combined gas turbine and reverse osmosis system using refrigeration cycle

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ABSTRACT

This study proposes a systematic approach to analyzing and optimizing combined gas turbine (GT) and reverse osmosis (RO) systems. Two systems combining RO to produce freshwater and a GT power plant to generate the required power for the RO system were modeled. In the first system, the coupling between the RO and the power plant was only mechanical; while in the second system, the coupling was both mechanical and thermal, using a refrigeration cycle. The effects of seawater temperature and intake air temperature on the freshwater production of the systems were investigated and their optimal values were calculated. Economic modeling was applied in order to calculate the unit product cost of freshwater. The second system, with two RO units under optimal operation conditions, can increase freshwater production by 26% and save 21% in the production cost of 1 m^3 of freshwater as compared to the first system as a base system.

Keywords: Reverse osmosis; Gas turbine; Mathematical modeling; Economic costs; Optimization

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