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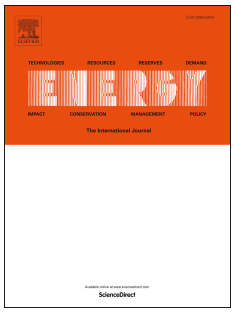

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Energy recovery in cooling water system by hydro turbines

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Abstract: A cooling water system requires a large amount of power to send water to coolers installed at high platform. In spite of pressure drop, most power is not consumed, but turns to potential energy. The potential energy will turn back to pressure once cooling water goes down from high, but the pressure is wasted in current cooling water system. In this work, hydro turbines are used to recover surplus pressure. In comparison with Main-Auxiliary pump structure that is used to reduce pressure head of main pump, a new superstructure contains Main-Auxiliary pump structure and Main-Branch hydro turbine structure is proposed. The hydro turbines can be installed on the main pipeline to recover surplus pressure turned from potential energy, or on branch pipeline to recover surplus pressure provided by auxiliary pump, and to balance pressure between parallel branches. MINLP algorithm is employed to optimize pump network and hydro turbine network simultaneously. The results show that hydro turbine has greater energy saving potential than auxiliary pump. Structure with Main-Auxiliary pump and Main-Branch hydro turbine is the most energy saving and cost saving configuration. Two case studies demonstrated that the optimal structures save up to 28.2% and 31.7% of the total annual cost, and save 36.8% and 39.1% of the total energy consumption.

Key words: energy recover, cooling water system, pump network, hydro turbine, MINLP.

1. Introduction

Cooling water systems are widely used to dissipate low-grade heat of chemical and petrochemical process industries, electric-power generating stations, refrigeration, and air conditioning plants[1]. In the last few years, many optimization models have been