



Combined water and power plant (CWPP) – a novel desalination technology

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ABSTRACT

In recent years, an enormous increase of fuel cost and greater demand for fresh water have imposed tremendous challenges for researchers to pursue a drive towards more energy-efficient desalination technology. In the search for a more energy-efficient desalination process, the next generation plants will use a combination of membrane processes with multi-stage flash (MSF)/multi-effect distillation (MED) thermal processes to harness the maximum thermal energy that would otherwise be wasted from a power plant. The novelty of this proposed combined water and power plant (CWPP) concept lies in the usage of the power plant at rated conditions most of the time, where the power plant is most efficient, and when demand falls in one area (electricity), resources can be directed to another area (i.e. desalination). A detail thermoeconomic analysis of the proposed plant under different loads has been used to quantify the benefits of the CWPP. This study includes a combined cycle (CC) power plant with stand-alone MSF, MED and RO; and CC with MSF-RO hybrid or MED-RO hybrid. The CWPP exhibits thermal efficiency of around 63% compared to conventional 44%. The specific energy consumption can be reduced by about 17% with the proposed CC+MED+RO system compared to CC+MSF+RO plants. Moreover, water can be produced from a MED/RO hybrid power plant at about US\$1.09/m³ whereas for MSF/RO, the cost increases to about US\$1.65/m³ at a fuel cost of 100 US\$/barrel.

Keywords: Combined water and power plant; MSF/RO; MED/RO; Thermal efficiency; Part load; Economics

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