

## Steam, electricity and water costs evaluation of power-desalination co-generation plants

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Received 28 September 2009; Accepted 12 April 2010

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### ABSTRACT

This paper addresses the effect of the oil prices on the cost of low pressure heating steam for thermal desalination systems, electricity and desalinated water. Two methods of calculating the low pressure steam, and electricity are developed and compared with a typical power/water cogeneration plant commissioned in 2009, by the King of Saudi Arabia. The first method is based on the calculation of the monetary cost of all streams of power cycle and charging the levelized capital and operating and maintenance costs based on exergy. The cost of bleeding steam is allocated based on the steam quality. In the second method we calculate the low pressure steam of the back pressure turbine based on equivalent cost of power loss due to the steam withdrawal for desalination plant. Visual Design and Simulation Program (VDSP) previously developed by the authors is used. The effect of a wide range of the oil price (5–100 \$/bbl) is investigated. The results showed that the second method overestimates the electricity cost by 8% and underestimates the low pressure steam cost by 25% at oil price of 70 \$/bbl. The results showed also that the product water, electricity, and steam costs are significantly affected by the variation in oil price. The product water cost will be less than 1.0 \$/m<sup>3</sup>, only if oil price is subsidized to near to 20 \$/bbl. However, the water unit cost may jump to 4 \$/m<sup>3</sup> when the oil price increased to 100 \$/bbl.

*Keywords:* Desalination; Electricity; MSF; Water cost; Exergy; Cogeneration

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