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Economic Analysis of Co-Production Plants for Electricity and Potable Water

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ABSTRACT

This paper describes the detailed analyses of power and water costs for 1800 MWt Pressurised light water reactor (PWR), 330 MWt, System-Integrated Modular Advanced Reactor (SMART) and 1200 MWt gas turbine combined cycle (GTCC) power plant operating in a cogeneration mode and coupled to various desalination processes. In this study, four different desalination processes including multiple effect distillation (MED), Multi-Stage flush distillation (MSF), reverse osmosis (RO) and hybrid MED + RO are considered and compared with each other in terms of energy consumption, electricity and water costs. Detailed economic analyses of energy and water production costs for a 100,000 m³/d desalination plant were carried out. The obtained results concluded that the water production cost (at 5% discount rate) with the GTCC power plant and nuclear reactors coupled with RO desalination plant is 0.86 \$/m³ and 0.79 \$/m³, respectively. In case of MED and MSF desalination processes coupled with GTCC, the water costs are 1.23 \$/m³ and 1.83 \$/m³, respectively. Lower water costs were obtained when nuclear reactors coupled to MED and MSF desalination plants and found to be 1.06 \$/m³ and 1.53 \$/m³, respectively. Results concluded that coupling nuclear reactor to desalination plants is an attractive solution for energy demand and fresh water supply.

Keywords: Nuclear Desalination. Co-production, Reverse Osmosis, Multi-Effect Distillation, Water Cost.