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Performance analysis of multi effect desalination thermal vapor compression unit assisted by solar energy

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ABSTRACT

The seas around us harbor over 97.5 % of water in the world. Yet water stress and scarcity loom large as population grows. Desalination technology has come to harness the water treasure in the seas. Desalination plants growing in number, size and efficiency are supplying more and more water with lower energy requirements, more attention to environment and lower cost. In the same time, great efforts are being made to promote water conservation by more efficient use. Desalination is a main source of fresh water in the many countries. The increase in population and limited water sources, therefore look for other sources. The companies and factories headed to buy water desalination units.

This thesis simulates and optimizes a 5000 m^3/day parallel cross feed flow multi-effect desalination plant using thermal vapor compression. This plant operates with steam flow by mazout and natural gas fuel firing. MATLAB language programming along with engineering equation solver has been utilized to create a simulation code. An analysis of the performance of the plant was conducted.

Using a new design, a solar desalination plant consisting of solar parabolic collectors, steam generator, and MED unit has been used to substitute the plant. An investigation was conducted in relation to indirect steam production via multiple thermal oils including THERMINOL VP1, THERMINOL 66, THERMINOL 59, THERMINOL SP, THERMINOL 55 and DOWTHERM A. Through the simulation, it was clear that THERMINOL VP1 had greater characteristics and produced 1.025 % more desalinated water than others. In addition, it showed that the operation cost of distillate production using mazout or natural gas is much more than using solar energy by 99.992 %.