

Simulation of an autonomous, two-stage solar organic Rankine cycle system for reverse osmosis desalination

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ABSTRACT

The present work concerns the simulation of an autonomous, two-stage solar organic Rankine cycle (SORC) for RO desalination. Aiming at improving the efficiency of the single-stage low temperature (operation temperature range in the order of 70–80°C) SORC for RO desalination, a high temperature (operation temperature range in the order of 140°C) stage is added. The basic principle of operation is that the heat extracted from the condensation of the high temperature stage (e.g. upper stage), evaporates the refrigerant of the low temperature stage (e.g. lower stage), thus significantly increasing the overall efficiency. In comparison with the low temperature single-stage system, the two-stage system exploits much more efficiently the heat produced by the vacuum tube solar collector array, since a higher operational temperature difference between high and low temperature reservoirs is achieved. Moreover, an analysis of the desalination unit takes place so that to estimate the annual desalinated water. The system design was implemented based on TRNSYS V16.0 and ROSA software.

Keywords: Evacuated solar collectors; Solar organic Rankine cycle; RO desalination

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