



Annual performance of evacuated tubular collector integrated solar still

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ABSTRACT

Evacuated tubular collector (ETC) and solar still (SS) are two solarthermal technologies for heating and purification of water, respectively. ETC stores water at high temperature whereas SS requires heated water for increased evaporation as well as yield. In this paper, an active solar thermal system “evacuated tubular collector integrated solar still (EISS)” (ETC and SS are integrated together) has been analyzed for its annual (January–December 2008) experimental performance for the composite climatic condition of New Delhi, India. The EISS system has been designed to recover the heat loss (which occurs from the ETC’s hot water during off-sunshine hours) in the form of distilled water by evaporation–condensation process in SS. Hence, the EISS system provides both hot water as well as potable (distilled) water. The main purpose of the present analysis is to develop a thermal model of EISS, its validation with experimental results, economic analysis, and to compare the performance of EISS with the single slope SS. Results show that EISS system can produce 630 kg/m² year of distilled water, compared to the amount of 327 kg/m² year yielded from a single slope SS. The maximum overall thermal efficiency of EISS has been found to be 30.1% (16 May 2008) and the annual average, has been found to be 21.3%. An economic analysis of EISS shows the annualized cost of distilled water US \$ 0.128 per kg.

Keywords: Solar distillation; Evacuated tubular collector; Thermal efficiency; Distilled water production

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