UNIVERSITI TEKNOLOGI MARA

THE ESTABLISHMENT OF SALINITY GRADIENT SOLAR POND FOR ENERGY STORAGE AND THE DESIGN OF THERMO ELECTRIC GENERATOR HEAT EXCHANGER FOR POWER GENERATION OF LOW GRADE HEAT

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ABSTRACT

The use of renewable energy becomes crucial nowadays to avoid pollutions and global warming, which is caused by fossil fuels. Use of renewable energy provides a sustainable future for our next generations. In this work, solar pond was established with salinity gradient establishment. The solar pond performance was monitored by analysing the temperature, density and pH value at each level of the solar pond from time to time. The temperature difference between the upper convective zone and the lower convective zone of a salinity gradient solar pond can be in the range of 40 ^{o}C–60 ^{o}C. The temperature at the bottom of the pond can reach up to 90 ^{o}C. High temperature of 62.1^{o}C was reached within a few weeks at the bottom of the solar pond. The efficiency of the solar pond is 20.8 %. Low-grade heat (<100 °C) from solar ponds is currently converted into electricity by organic Rankine cycle engines. Thermoelectric generators can operate at very low temperature differences and can be a good candidate to replace organic Rankine cycle engines for power generation from salinity gradient solar ponds. The temperature difference in a solar pond can be used to power thermoelectric generators for electricity production. This paper presents an experimental investigation of a thermoelectric generators heat exchanger system designed to be powered by the hot water from the lower convective zone of a solar pond, and cold water from the upper convective zone of a solar pond. The results obtained have indicated significant prospects of such a system to generate power from low-grade heat for remote area power supply systems. The thermoelectric heat exchanger was tested in lab within the range of low grade heat produced similar to solar pond. The thermoelectric generator power generation was tested with and without electrical load. The maximum power, short circuit current and voltage of open circuit were 0.98 W, 0.49 A and 8.51 V respectively, was obtained from the investigation. The efficiency of the system was recorded at 1.9 %.

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