An Innovative Design of Enhanced-Performance Solar Panels Using Heat Pipe and Thermoelectric Generator

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Solar power is a main source of energy and is expected to play a vital role in fulfilling the future global demand for electricity. A major obstacle hindering useful photovoltaic (PV) utilization is the deterioration of solar cell efficiency with temperature. In this work, an innovative, efficient and cost-effective design was developed to enhance solar energy efficiency, through a specific design using a micro flat heat pipe (HP) with a Thermoelectric Generator (TEG). This design contains eight micro flat heat pipes used to alleviate solar panel temperature, each of these pipes attached with TEGs. The condensation section of the HP is innovatively cooled by utilising the condensed water inside the evaporator of an air conditioner. This has been tested by using a chiller to simulate condensed water on two different types of silicon panels: monocrystalline and polycrystalline solar panels. The results showed a 25% reduction in average temperature on the polycrystalline solar panel. In addition, power was calculated by measuring voltage and current and a significant increase of 45% was gained when it was cooled by the HP. An additional two Watts was produced by TEGs when incorporated into the panel and the HP, raising the total power produced in the proposed system by 63.5%. Finally, a feasibility study of the proposed hybrid system was developed. A sample house in Saudi Arabia was considered to conduct the analysis. If four million houses in Saudi Arabia were included, an extra 32 billion dollars in 20 years can be obtained by installing the proposed design versus the conventional solar panel system.

Awards Won:
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