Improving the Harnessing of Solar Energy Using a Hybrid Photovoltaic Thermal System

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Solar photovoltaic panels are becoming increasingly competitive sources of household energy due to their continually decreasing costs. As photovoltaic panels, they are currently limited to an efficiency of 13-20%, as solar energy is only converted to electrical energy. This project aimed to increase the energy efficiency of solar panels by extracting the thermal energy that would otherwise be dissipated as waste heat. This heat also has an adverse impact on the solar panel's electrical performance and lifespan. Using readily available materials, small scale (10W electrical rating) prototypes of modified solar panels were constructed, with front and back water cooling. When operated without improved coolant circulation timing there was an increase in total energy efficiency, with the front cooled panel showing a doubling (>28%) in efficiency whilst the back cooled panel more than tripled (>42%) it's overall efficiency. Using an improved coolant circulation timing algorithm, which balanced the heat loss from the panel and the coolant pump energy consumption, further increased the overall efficiency of the front cooled and back cooled panels to (>54.1%) and (>65.9%) respectively. The back cooled panel also had an increase in electrical efficiency from 13.7% to greater than 20.3%. As the cost of modification was less than that of the photovoltaic panels the benefit of energy savings would exceed the cost of modifications making it economically viable as a household energy source. The project has achieved the engineering goals of improving the efficiency of solar panels in a practical and cost-effective manner

Awards Won:

U.S. Agency for International Development: USAID Science for Development Second Place Award of $3,000.