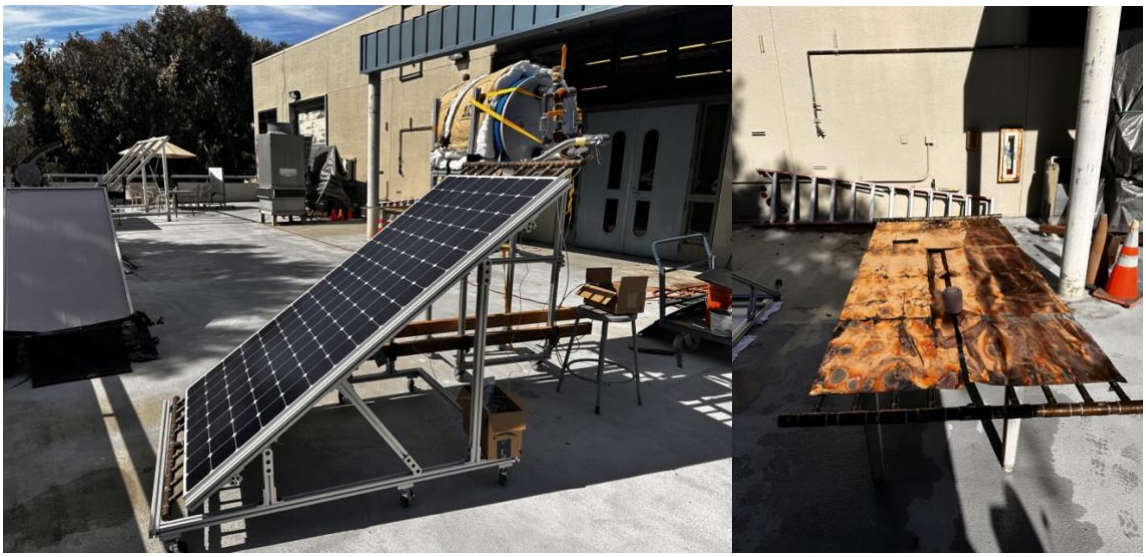
Design, Test and Comparison of a Photovoltaic Thermal Hybrid Solar Collector Utilizing a Thermosiphon and Theory and Analysis of Related Predictive Computer Model



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Design, construction and testing of a photovoltaic thermal collector, or PVT, was completed to determine efficiency improvements of this system compared to a conventional solar panel and to find the thermal energy gained through hot water storage. Flow, driven by density changes from solar radiation, creates a thermosiphon, moving water without the use of a pump and ultimately drawing heat away from the solar panel. This is done to create a more efficient solar cell as well as decreasing the damage due to high temperatures. Evaluation of electrical efficiency, thermal efficiency and flowrate allow for comparison between other PVT systems. Finally, a computer model of the constructed PVT system was also created to predict solar panel, heat exchanger manifold and plumbing temperatures as well as electricity generated by using starting temperature data and transient measures of ambient temperature and solar radiation. Multiple full day tests were conducted to find performance characteristics of this system and for a standard solar panel. Results from this thesis show little electrical efficiency gains but show a noticeable heat generation rate that was comparable to other studies. As a result, panel temperatures in the PVT are lower than a conventional solar panel. Flowrate was measured and fell between expected values. Finally, model error was minimal and predicts the behavior of the system with relative accuracy.

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