

***A Two-Phase System for Solar Domestic Water Heating***

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ABSTRACT:

The goal of the research is to develop a solar hot water system to maximize the efficiency and effectiveness of renewable energy usage, which can (1) reduce non-renewable energy usage for hot water heating; (2) perform more cost-effectively than traditional solar water heaters in regions where freezing occurs; and (3) reduce the total cost for equipment/installation/maintenance.

This research aims to develop a new technology for harvesting solar energy using a boiling-condensing cycle in a domestic hot water system. Buildings dominate energy consumption in the U.S. They consume 40% of primary energy and 70% of electric energy. The U.S. Department of Energy has adapted Zero-Net Energy Buildings as a strategic goal in their efforts aimed at energy efficiency and sustainability. Besides achieving energy use reduction and system efficiency improvement, the success of this goal very much relies on offsetting part of the energy usage through on-site renewable energy generation. Solar domestic water heating systems are generally efficient and cost-effective in climates where freeze protection is not required. In regions where freezing occurs, the system becomes more complex and expensive. Maximized heat transfer in the solar collectors can be achieved by forced convection boiling in two-phase flow. This system has the advantages of easy freeze protection, and no pumping or control system requirements.