Performance of a Solar Heating System with Photovoltaic Thermal Hybrid Collectors and Heat Pump

The energy consumption in buildings accounts for a large part of the World's CO2 emissions. Much energy is used for appliances, domestic hot water preparation and space heating. In solar heating systems, heat is captured by solar collectors when the sun is shining and used for heating purposes. When the solar collectors are unable to supply the heat demand an auxiliary heat source is used. Heat pumps can generate this heat. Liquid/water heat pumps have better performance than air/water heat pumps in cold climates but requires installation of a tubing system for the cold side of the heat pump. The tubes are typically placed in the ground, requires a significant land area and increase the installation cost.

A new system design of a solar heating system with two storage tanks and a liquid/water heat pump is presented. The system consists of PVT collectors that generate both heat and electricity. Heat from the collectors is transferred to a domestic hot water storage tank or to a cold storage tank, which is used as the source for the heat pump. When the heat pump charges the warm storage tank, heat is extracted from the cold storage tank, which then can be reheated by the PVT collectors. In this system, it is possible to have the high performance of the liquid/water heat pump but without the need to install tubes in the ground. The performance of the system with automated energy discharge over several months is evaluated.

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