Title

Mean Monthly Performance of Passive Solar Water Heaters

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Abstract

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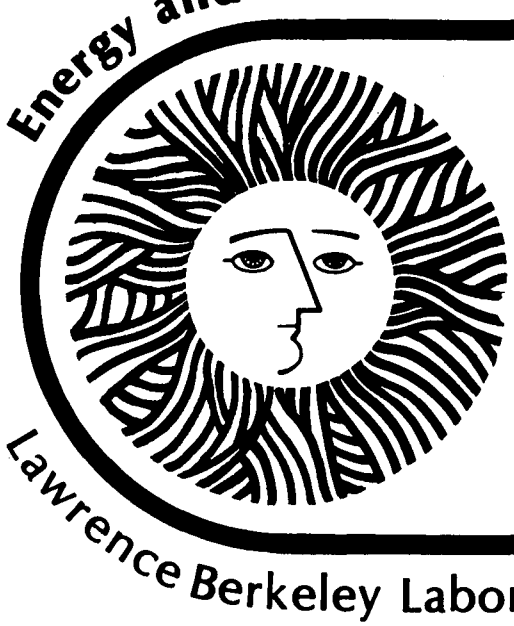

Mean Monthly Performance of Passive Solar Water Heaters

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DISCLAIMER

MEAN MONTHLY PERFORMANCE OF PASSIVE SOLAR WATER HEATERS†

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An analysis method has been developed for predicting the transient performance of passive solar water heaters. Simplified equations are defined, and exact analytical solutions obtained for the variation of the average water temperature in the solar heater during a typical day of each month. The main assumptions in the analysis are (1) the overall heat transfer coefficients are constant; (2) the ambient temperature is step-wise variable during the analysis period; (3) the solar radiation is represented as part of a sine curve during the typical day; (4) water is drawn from the solar heater at the average storage temperature; and (5) the effective absorptivity of the solar collector is constant.

The analysis has been used to compare the average monthly performance of two types of passive solar water heaters:

- a compact heater, having combined collection and storage;
- a thermosyphon heater, using convective fluid flow to transfer heat from a collector to an insulated storage tank.

Among other things, the comparisons have indicated the following important differences between the two systems:

(a) In general, the thermal performance of the thermosyphon is substantially better than the compact solar heater.

(b) The performance of the thermosyphon is less sensitive than the compact heater to the storage volume and the shape of the load profile.

(c) The freezing hazard indicates that the thermosyphon heater with non-freezing transfer fluid and heat exchanger may be most appropriate for most parts of the United States.

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