UTILIZABILITY DESIGN METHODS FOR PREDICTING THE LONG-TERM PERFORMANCE OF SOLAR WATER HEATING SYSTEMS

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ABSTRACT

Two design methods are presented to analyze solar water heating systems. Both methods combine an energy balance on the solar storage tank with the collector utilizability concept to determine the useful solar energy gain. The first method, the "utilizability design method for solar water heating systems", correlates the relationships among the monthly average temperatures for energy collection, storage, and delivery. The second method, the $\overline{\Phi}$, f-chart design method, was developed for closed-loop solar energy systems. It is shown in this paper that the $\overline{\phi}$, f-chart method can also be used to analyze open-loop systems. The two methods were compared with TRNSYS simulations in three locations: Madison, Seattle, and Albuquerque. The standard deviation of the annual solar fractions predicted by the design methods relative to the TRNSYS predictions was 1.22% for the utilizability design method for solar water heating systems and 1.34% for the $\overline{\phi}$, f-chart method.