Solar Hot Water System

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Solar hot water production is a reliable and well accepted technology. There are a variety of ways to design a solar hot water system. In North-Central Mississippi, where freezing temperatures are common, a dual loop system is necessary for winter operation. There are several types of dual loop systems. The most attractive with respect to reliability and performance is the drainback system (described below). In North-Central Mississippi, it is likely that a solar hot water system can provide all of the hot water required (if properly sized) during warmer months and 50% or more during cooler months. It is common to mate the solar system to an electrical backup heater that will provide makeup heat to meet hot water demands when solar radiation is not sufficient.

Proposed Research

Recommendations for solar hot water system size and performance in the mid-south are imprecise and anecdotal. We propose to plumb the hot water system to divert flow from the back-up tank. Once each week, the volume of all of the hot water will be measured with corresponding temperatures to calculate total capture of solar radiation. A pyranometer connected to a PC driven data acquisition system will provide total solar radiation for the site. This will provide a measure of collector and system efficiency (multiple pyranometers, temperature, humidity, and wind run sensors should be used in the sustainable house in any case). The solar hot water monitoring project will be continued for 1 complete calendar year.

Solar Hot Water Heating as a Sustainable Practice

Solar radiation is an inexhaustible energy source for the foreseeable future. It is non-polluting in operation and does not contribute to greenhouse gas production. The operating principle and mechanical operation is simple. Mechanical components are low energy and amenable to photovoltaic supply.

Requirements of a Drainback Solar Hot Water System

Drainback systems may use water as the heat transfer fluid, since the collectors drain when not in operation. Antifreeze may be added to provide an extra measure of freeze protection if drainage is blocked or sensors malfunction. A circulating pump operated by a differential control is turned on when the collector outlet is at least 11°C warmer than the tank outlet. Water or an antifreeze solution is lifted from a small reservoir tank and circulated through the collectors and back to the tank. Heat is transferred to the domestic water via a heat exchanger in the reservoir tank. The circulation loop through the collectors is a closed loop.

Design Considerations

Hot water usage in the US is typically 15 to 30 gallons per person per day for home use. In Central Mississippi, 1.5 ft2 of collector is required for each 1.5 gallon of tank capacity (55 ft2 to supply a household of 4 residents). Collectors are typically a combination of chromium and black to achieve reasonable temperature gain and low radiation losses. Collectors and associated piping must have adequate slope to completely drain when not in heating mode. The lift pump must be sized for adequate

flow rate to the topmost elevation of the system.

Cost

System Design and Detailing, and Conduction of Research for 1 year = $26,279.00