Domestic Hot Water Experience

By Bob Laitsch

Two years ago my wife and I decided to use our tax return to install DHW. I researched on the web and met with several installers. The first decision was between tube type collectors and flat plate. I chose flat plate for several reasons. Flat plates are a bit better for indirect solar. Also, there is a frost factor. Both flat plate and tube collectors frost up during the winter. The efficiency of tube collectors keeps the frost from melting off. A frost-covered collector is only a roof ornament. A study in Germany indicated this problem. They supposed the efficiency of tube collectors would be a benefit in the winter, but the opposite was true. Orientation of your panels can take this into effect. Your panels will only collect efficiently across a 6 -hour period. If your panels are slow to melt off, they can be aimed a bit southwest of solar noon to take advantage of 6 frost -free hours.

A note on efficiency, a solar panel's efficiency changes with the difference between the fluid temperature and the outside air temperature. This is not a linear relationship. Most panels are efficient during the summer when the air temperature (85 degrees) and the hot water temperature (140 degrees) are close. This 55-60 degree difference may give results of 70% efficiency. If we were warming a swimming pool to 80 degrees on an 85-degree day our efficiency may be in the upper 90%. In the winter, however, an 8 degree day with the same target temperature of 140 degrees may be anywhere from unattainable to 50%

These %'s are from memory, Efficiency tables are available on the web, (try the Florida site) as part of their certification process. Pay attention to the breaking point in the curve. This can be quite dramatic and indicate a limit beyond which a panel may be useless.

If you're using your panels for heat and DHW, the lower target temperature for radiant floor heat will increase the efficiency of the system. When my storage tank reaches 120 degrees, any excess heat goes to my floor. The 120-degree DHW water is topped -off by the gas hot water heater to 140 degrees before use. The difference between 140 and 120-degree water allows me to use my panels to their highest efficiency during the winter. I still use fossil fuel, but this scheme uses the least.

The biggest problem I face during the summer is too much hot water. If we don't use it my system will overheat on the second day and boil the tank and potentially the system dry. This is not good. The stagnation temperature, the maximum temperature a panel will reach in full sun when empty of fluid, on my panel is 367 degrees. These two panels will easily heat from 80 to 120 gallons of water from 65 degrees to 180 degrees any sunny day.

My background in construction allowed me to do all of the work my self. If you can replace a gas hot water heater, you can probably install your own solar. Some advice I got along the way was to consider installing the panels at ground level. My roof was already pitched for solar so I choose to install on the roof. If I did it over again, I might

well choose to do a ground mount. The dust here can quickly form a fine layer over the panels and needs to be washed off to preserve efficiency. Even during the summer a dirty panel can lower my final water temperature by more than 10 degrees. Also, A ground mount keeps you from the danger of working on a roof and, it keeps you from having to remove your panels when you re roof. My panels were small enough that two people could place them on the roof. If you choose larger panels you will need a crane. This can be another reason for a ground placement. .

The high temperatures possible in a solar system requires copper pipe. Pex tubing can't withstand the temperature spikes.

Make sure your pipe insulation is rated for your solar temperature range. The split black pipe insulation commonly used for frost protection will melt when your panel spikes due to stagnation. I bought my insulation at Home Depot. It needs to be protected from U.V. rays. I used 3-inch aluminum tape. It has an adhesive peel off backing. There are several qualities available. Your installation should be good for thirty years, use the best.

Designing a system that does DHW and heating took a great deal of time. I made mine too complex. After completion I left parts of the system disconnected. The over design cost an extra $200.00. The explanations would need to be prefaced with my original system design, and is too much to go into in this article.

I built a pump loop between my eighty-gallon hot water storage tank and my forty-gallon gas hot water heater. We have used this feature a bit but I don't think it's worth the money or effort. The arrangement in my system is to feed the cold water into my solar storage tank. Then, the hot outlet from the storage tank is fed into the cold-water inlet on the hot water heater. If the solar water is hot enough, the gas heater never fires. (I've had the gas hot water heater go out for six weeks and never knew it.) If the water is below the thermostat temperature on the hot water heater, the solar storage acts as a pre heater. This is the condition I have through the winter heating season when I bleed off all heat over 120 degrees into my radiant floor.

Time wise, I spent three months researching DHW systems and components. I have pages of designs that 2 different solar installers and I designed. I paid them hourly for their services. In the end I used my own design. It functioned from day one,

My economics were based on revue of 6 years of natural gas usage. I converted these to BTU's. This allowed me to determine how to best use my finance resources. I assumed my summer gas bill was primarily hot water. (We have a gas range and gas clothes drier to take into account,) Based on this assumption, we spent more money each year on hot water than we did on heat. The cost of the system was easily justified with a 3-year payback excluding my labor. Our monthly summer gas bill dropped from $45.00 gas usage to $4.00.

The additional panels to provide our winter heating load are harder to justify. Even if it were minimal, I have yet to come up with a cost effective solution for my house for the huge amount of waste heat generated during the summer. Winter heat requires some form of heat sink for the cloudy days. In Germany a system was built using a large

buried insulated storage tank that stored heat during the summer for use in winter.

The actual installation time for my system was a week. If I were only using DHW I probably could have done this in three or four days.