Using salvaged materials to build a thermosiphon solar hot water system

By Dave Duffy

Getting hot water free from the heat of the sun is always a pleasure, but building your solar hot water system out of materials salvaged from storage yards and dumpsters is the height of delight.

This summer I built a thermosiphon solar hot water system at my remote Oregon home out of 90% salvaged materials. The two banged-up but serviceable solar panels came from the storage yard of Scholfield Solar in Ventura, CA, which had salvaged them from a convalescent home in Ojai, CA. The leaking 84-gallon solar hot water storage tank came from Scholfield's dumpster.

The knowledge to build the system came out of various small books and pamphlets I had accumulated or borrowed. None were particularly significant for their technique, as a solar thermosiphon system is fairly low-tech.

Thermosiphon effect

A thermosiphon hot water system is one of the most basic solar hot water systems. It requires no electricity, but relies instead on the physical law that says hot water, because it is less dense than cold water, will rise while cold water will sink.

In a thermosiphon system, the solar panel is installed below the hot water storage tank. Two pipes connect the tank to the panel: a cold water pipe leaves the bottom of the storage tank and connects to the bottom of the solar panel, and a hot water pipe leaves the top of the panel and enters the top of the storage tank.

The sun heats the water in the panel and causes it to rise to the storage tank above it; the cooler water in the tank drops down to the panel through the pipe leaving its bottom, The continuous loop circulates the water as long as the sun shines.

Storage tank

The storage tank I retrieved from Scholfield's dumpster leaked. To find the leak, I used a Skil saw to cut away the metal jacket, then tore off all the insulation inside the jacket. I then pressurized the tank by filling it with water with a hose attached to city pressure.

Ilene wraps the plastic pipe so the sun won't degrade it.

The leak was at a stripped bolt. It seems that the tank had been salvaged once before. It had previously been an electric hot water tank, and someone had taken out the two electric heating elements and welded brackets over the holes so they could screw on metal plates with rubber gaskets to seal them. Four lag bolts held on each !metal plate, but one of the bolts holding the lower plate had stripped threads. I discarded that bolt- and replaced it with a bolt that took a nut . Bingo! End of leak.

Solar panels

The two 4x8-foot solar panels I got from Scholfield's storage yard had previously been two of about 20 panels that sat on the roof of an Ojai, CA, convalescent home. They had been installed incorrectly in the 1970s by a fly-by-night solar outfit sucking up the available federal tax dollars of the day.

Allen Carrozza, owner of Scholfield Solar, said the panels had been installed partially in the shade of a big oak tree and were situated so that one panel shaded the next. They never worked properly, he said, and helped contribute to the bad name solar got in the eyes of many people back then. The panels were allowed to fall into disrepair; finally, Allen salvaged them and tested them to determine which ones were still serviceable.

Installation

I leaned the two solar panels against the south-facing wall of my ~house. South because that's where the sun is most of the time as it makes its East to West arc across the sky. The panels must be free of shading for most of the sunny part of the day, or their efficiency will be cut down considerably.

I installed the tank on the second floor of the house, almost directly above the panels. It was a big effort that involved tying a chain around the tank and hoisting it to the second floor with the aid of a comealong.

The pipe that was inside the panels was 1½" copper diameter, so I soldered on threaded nipples that reduced the diameter down to ¾" as it left the panels. That allowed me to use relatively inexpensive ¾" diameter CPVC plastic pipe to connect the panels to the hot water storage tank.

Be sure you use CPVC plastic pipe and not PVC. Solar panels will heat water to a good 140 degrees and that kind of temperature will melt PVC

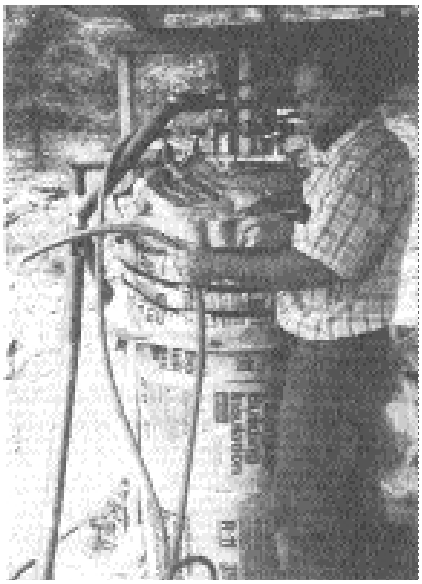
pipe. Use the PVC pipe for your cold water plumbing system.

I connected the panels together with radiator hose and clamps. Be sure to use radiator hose that is flat inside, not the corrugated ones with springs inside. The latter will leak and make you very angry, as it did me.

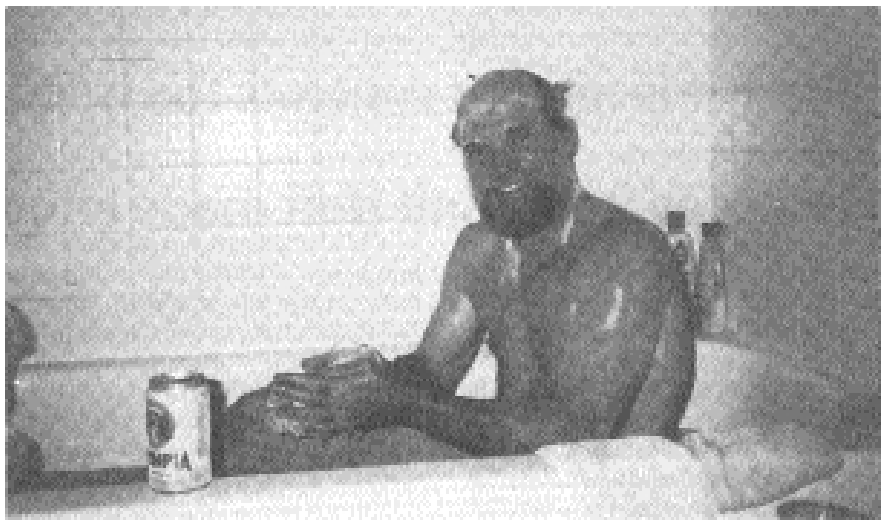
Salvaged water heater

My salvaged water storage tank was originally designed for solar, so there were four pipes going into it from the top. Two of them were for the regular hot and cold water connections, and the other two were for the solar panel connections.

If you aren't lucky enough to salvage such a tank, but instead salvage a regular hot water heater, you can use that too. The hot water **FROM** the solar panel will still go into the hot water connection on top of the tank, but the cold water **TO** the panels will come out of the tank's drain near the bottom. There are a number of books on the various piping arrangements you can use with a hot water tank; the arrangements can get pretty creative, I recommend a book called *Blazing Showers*, printed in 1984.



Me draining off trapped air with a hose connected to hose bibs installed at the highest points of the pipes leading to and from the panels.



Enjoying the free hot water in a kerosene lantern-lit bath.

Air in the pipes

Even a small amount of trapped air in the pipes will completely shut down the thermosiphon effect. After I finished installing my system, then connected it to the hot water pipe in my house, I waited a day for the sun to do its work. But only cold water came out.

My neighbors, Jerry and Doug, happened over and advised me that I probably had air trapped in one or both of the pipes, probably at their highest points. They advised me to install hose bibs at the highest point of each pipe and bleed off the air with a garden hose. I did and the next day I had enough hot water for four people to take a bath or shower.

Don't forget the woodstove

Now the sun won't always shine enough to keep you in solar-heated hot water, so while you are installing this system I recommend you make allowances to shut down the solar panels and re-route those two pipes to a heat exchanger in your woodstove for colder seasons.

The shut-down is accomplished easily enough by installing shutoff valves in the solar panel pipes near the storage tank. (Also be sure to put a drain at the bottom of your solar panels so you can drain them so they won't freeze in winter.)

Leave a plugged-up "T" in the two solar panel pipes as they leave the storage tank. You can run pipes from them later when you install a simple system (very similar to a solar panel system) that will let your woodstove heat your hot water in the winter. I'll describe that system in a later issue, after I install one in my home for this winter.

Pointers

A few pointers to remember:

- CPVC pipe is slightly brittle compared to PVC pipe, so be careful how much pressure you exert when you screw on fittings.
- You will be cementing together most of the CPVC pipe you will use, so be sure to use CPVC cement, not PVC cement.
- If the plastic pipe is to be exposed to sunlight for very long before you have a chance to insulate it, wrap it with cloth or something else as the sun will degrade it and make it brittle.
- Insulate the pipes and the hot water storage tank. This is important for an ordinary hot water storage tank, but it is a **MUST** for a solar storage tank.
- Don't get mad when something goes wrong, as I do. Δ