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Solar Water Heating Choices

I've covered solar water heating briefly in past articles but today we'll get a little more in-depth with regard to the different types of systems available. Over the past 30 years I've had the opportunity to delve deeply into every system type available so I need to warn the reader that, as a result of my experiences, you'll find I'm highly biased, but for good reasons!

I designed my first solar water heating system in 1978, about the time I finished my Environmental Engineering coursework at Cal Poly. I designed many more after that, at least until the tax credits expired. Between 1994 and 1997 I served as Chairman for the national Solar Rating and Certification Corporation's (SRCC) Standards Committee and, during that time, partnered the California Energy Commission with SMUD and Sacramento State University to build and operate a solar test facility. We tested four of the most common system types for a year, side by side, under the same weather, the same (hot water) draw schedule, etc.

I sent the test facility data to the National Renewable Energy Lab (NREL) hoping the results would be factored into the SRCC ratings (they did not properly reflect the differences between these systems). Unfortunately, due to budget cuts for renewables, the data is still sitting on an NREL shelf gathering dust. But it was that experience, and subsequent experience with the installation and servicing of systems with Sustainable Energy Group, that my bias continued to strengthen towards "active drain-back" systems. Our testing proved the drain-back system out-performed the other three systems, and by a significant margin! But before we get into that, let's review the different types of systems available. The two main categories of solar water heating systems are "passive" and active".

Passive Systems

A passive system is one that uses no electricity. I prefer these systems, in principle, because of their

low first cost and simplicity, however we don't install many in the foothills for reasons I'll explain below. Within the passive category are those that use water and those that use antifreeze. I've revisited all of the passive system types I did from the 1980s and found they last, on average, about 20 years before requiring major repairs or replacement. The best of the "just plain water" bunch, the "CopperHeart" units by SunEarth, are still serving homes in the Central Valley after 28 years, but most of the units in the foothills failed from freeze damage (even though the sales people and marketing literature said they wouldn't). Most water-based solar systems in our area must be drained down in winter to prevent freezing.

The antifreeze-based units, such as the Solahart, require periodic fluid changes just like the antifreeze in your car's radiator, but most people don't have them serviced. As a result, the antifreeze gets corrosive, "eats away" at the seals, the fluid leaks out onto the roof, and the mild steel heat absorber plate in the collector is gone within a few days. I've tried to fix them but found it's not worth the trouble. The SunSiphon from SunEarth uses a higher quality absorber plate but still requires the antifreeze be changed periodically. Factoring in these service costs over time tends to make antifreeze-based units much less cost-effective than they appear at first blush.

Active Systems

An active system has a pump and an electronic control that operates the pump. Within the active system category there are two primary subcategories, those that use antifreeze and those that use plain water.

Antifreeze-Based Active Systems

We don't generally recommend (or install) these systems because of the maintenance required. The only exceptions are cases where there is no space inside for a solar tank or the collector(s) must be located below the solar tank.

Water-Based Active Systems

Systems that use just water - and no antifreeze (glycol) for freeze protection – are called "drain-back" or "drain-down". The methods they use to prevent freezing are similar to what their names imply. With a drain-down system, the water in the collectors drains down onto the ground when the water in the collector approaches freezing. Just about every drain-down system installed in Nevada County

during the late seventies and early eighties had its absorber plate freeze and burst because the drain-down valves failed. While Sustainable Energy Group has repaired absorbers with freeze damage, saving our customer's the high cost of a new collector, it's a job we'd prefer not to do.

With a drain-back system the water in the collectors drains back into the solar storage tank whenever the collector isn't hot enough to heat the tank, providing "fool proof" freeze protection. Because plain water has a higher heat capacity (ability to hold solar heat) than a water-antifreeze mix, plain water systems are more efficient. Another problem with having antifreeze in the collectors at all times is that the antifreeze gets very cold at night and must be heated back up when the sun comes out. In contrast, a drain-back system holds the water in an insulated tank until the absorber warms up enough to justify circulating water up through the collector and back down into the tank.

The largest cost you're likely to incur over the life of a solar water heating system is replacing the tank when it fails. Glass-lined steel tanks are the most common and they last between 10 and 20 years. Stainless steel tanks last longer but are much more expensive. We prefer drain-back tanks made of a special type of polypropylene because they rarely (if ever) fail and, even if they do, they can be repaired instead of discarded. Our preferred manufacturer – Morley Manufacturing right here in Grass Valley - even provides a lifetime warranty on their smaller tanks!

The drain-back system I have on my home was installed in 1983 and, other than a pump and sensor replacement, it's still performing as well today - 25 years later - as it did back in 1983. The only maintenance, around once a year, involves checking the water level in the "sight tube" on the outside of the storage tank; if the water level is low, I'll open up a valve for a second or two to raise the water to the proper level.

A system like mine starts at around $7,600 (installed and operating). The Federal Tax Credit drops that cost to $5,500 (systems must be certified by the SRCC to qualify for the credit). In general, solar thermal (heating) systems have a more attractive economic return on investment than solar electric systems, yet my company's still sees greater demand for solar electric systems. Maybe it's because most people still think of solar water heating as problematic, unreliable or high maintenance? A survey of the marketplace shows they're right – solar retailers predominantly sell systems I would not recommend, simply because they are cheaper and more profitable. My hope is that this will turn

around because, after all, one of the best (if not THE best) systems on the market today is made locally!

Ray Darby is President of Sustainable Energy Group Inc., a Grass Valley company offering energy efficiency and solar services for residential and commercial buildings, from comparing the alternatives through installation and servicing of energy systems of all types. You can reach him at 530-273-4422, via email RayDarby@SustainableEnergyGroup.com, or visit their web site at www.SustainableEnergyGroup.com.