



## **The Resurrection of Solar Water Heating**

My friend Tom suggested the topic for this week's energy article (thanks Tom!). The "Resurrection" we'll discuss applies to resurrecting existing systems as well as resurrection of the demand for new solar water heating systems and why it's happening.

The house Tom bought in Alta Sierra came with a solar water heating system that worked fine for the first few years. But one day he called saying he was "pretty sure it's not working," asking "can it be fixed?" A quick trip out to Tom's house confirmed he had a dead pump in his "drain-back" style solar water heating system, and the cost to fix it would be a few hundred dollars.

Tom's solar system is a good example of what's possible with many of the 1980's vintage solar systems in Nevada County – they can be fixed for a fraction of the cost of a new system.

Unfortunately, most people we hear from think their system is unsalvageable. The typical caller would say "we're re-roofing and we just want the solar collectors removed". This is unfortunate because, if the collectors are made of quality materials (glass, aluminum and copper) they're probably still good, assuming they haven't burst from freeze damage. One collector we saw recently had a broken acrylic (plastic) cover and an absorber plate that had frozen, splitting open the tubing. But both were fixed and the system placed back in operation at minimal cost.

Even in the worst case scenario, with "throw-away" panels and a leaky storage tank, the home will still have the copper piping installed between the collector and the storage tank, making the installation of a new system easier than trying to retrofit a brand new system into a home that's never been plumbed for solar.

What typically fails is just a pump, sensor or controller, all of which are relatively inexpensive parts to replace. If the solar storage tank has failed it's quite a bit more costly to fix, but still far less cost than a new system. It turns out that any one of these items, other than the collector and piping, is likely to last 15 years, but some may last as long as 20 or 25 years! So why do so many people elect to junk their old solar system rather than spend a few hundred dollars to get it back in operation?

Many of the systems installed during the 1980's used low-quality or unreliable components and suffered from poor installation practices. California had developed a solar tax credit at the time, so everyone and their brother were out selling and installing solar water heating systems! Because of the tax credit, many of these systems were "oversold" in terms of the benefits they would provide, and many were oversold with regard to the price tag as well. Many of the systems were poorly installed, leading to reliability problems. The industry got something of a "black eye" during this period and, after the expiration of the credits, never completely recovered. This is slowly beginning to change.

Homeowners we speak to these days are keenly interested in solar electricity generating systems but many are still leery of solar water heating. This is a shame because solar water heating reliability issues are now very well understood, they're far less costly to install than solar electric systems, and they typically provide a more attractive return on investment than solar electric systems do. Slowly but surely we're seeing a "resurrection" of interest in solar water heating. Let's take a look at why this is happening.

Just how cost-effective is a solar water heating system? The answer is, of course, "it depends." If you're a single person household and your home is surrounded by 200 foot pine trees it doesn't make sense. On the other hand, if you're a family of three or more people with a sunny roof it's probably going to make good sense. Solar water heating is most cost-effective if you have electric water heating, followed by propane and natural gas. If you have a super-efficient gas backup heater it will be less cost effective than if you have an average or mid-efficiency backup heater. Let's look at two examples to illustrate just how cost effective these systems can be.

Both examples are based on borrowing money over 30 years at a 7% (fixed) rate and a \$1,000 down payment. The cash flow charts show the net cash flow for each individual year as well as the cumulative net cash flow (the sum of all previous year cash flows). The cash flow in any given year is the sum of the annual loan cost, annual loan savings (mortgage interest deduction), annual energy savings (assuming energy costs rise 5%/year), maintenance costs, replacement costs and, at the end of the first year of operation, a \$2,000 federal tax credit. A solar rebate will be available in California soon as well, but it's not included here. In each example the annual savings are greater than the annual costs (with the exception of year 18 in the Anti-freeze System).

The first system uses antifreeze for freeze protection and has an electric backup heater. The installed cost is \$7,260 and it saves \$366 per year, giving it a "simple payback" of 19.8 years. The maintenance costs are \$260 every ten years for a glycol change, and replacement costs are assumed to be \$400 in year 15 for a new pump and \$1,615 in year 18 for a new storage tank.

From the cash flow chart (see "Antifreeze System" below) we see that, with financing, the system's cumulative savings are greater than the costs from the first year forward, and we've saved a total of \$4,000 after 17 years of operation and \$11,173 after 30 years.

In the second system, the water in the collector drains back into an insulated storage tank for freeze protection and it has an (average efficiency) propane backup heater. The installed cost is \$7,789 and it saves \$367 per year, giving it a "simple payback" of 21.2 years. There are no maintenance costs and replacement costs are assumed to be \$400 in year 15 for a new pump. The solar storage tank has a lifetime warranty and, should it leak, it can be repaired rather than discarded.

From the cash flow chart (see "Drainback System" below) we see that, with financing, the system's savings are greater than the costs from the first year forward, we've saved a total of \$4,032 after 10 years of operation and \$26,470 after 30 years.

### Cash Flow - Solar Water Heating (Electric Backup) Antifreeze System



### Cash Flow - Solar Water Heating (Propane Backup) Drainback System



These two examples are useful for pointing out that, if we had chosen the antifreeze-based system solely on the basis of simple payback we would have chosen the wrong system! This is because simple payback didn't account for the impact of financing, fuel cost inflation, maintenance costs or replacement costs. This is why simple payback is inadequate for decision-making when it comes to competing economic investments.

We also calculated the return on investment (Internal Rate of Return or "IRR") for each system. The antifreeze system has an IRR=18% and the drain-back system has an IRR=35%. This is why we prefer

to use the drain-back system whenever possible. We'll only use the antifreeze system in applications where the drain-back doesn't work (usually when the collector must be lower than storage or there isn't space for the drain-back tank).

Either system is cost effective, however, when you consider the average return on investment from the stock market over the past thirty years has been roughly 11% gross (less than 8% net, after taxes)! The economic benefits, aided by the trend to "go green", helps explain why we're seeing a "resurrection" of interest in solar water heating today. There are quite a few solar installers serving Nevada County – check the phone book under "Solar Products" and start saving money today!



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](mailto:RayDarby@SustainableEnergyGroup.com), or visit their web site at [www.SustainableEnergyGroup.com](http://www.SustainableEnergyGroup.com).