# Solar Water Heating

If you've ever felt warm water flow from a garden hose that's been stretched across a sunny lawn, you know how solar water heating works. And if you've ever paid a fuel or electric bill, you can understand why using the sun's rays to warm water is a good idea. Up to 25 percent of a household utility bill goes to heating water for washing clothes, dishes, and ourselves. A solar hot-water system can reduce those costs by two thirds—without using any fossil fuels or causing any pollution. You don't even need to live in a sunny climate to take advantage of this infinitely renewable source of free power. Thanks to advances in solar-collector technology, these systems have become practical even in places where the sky is gray more often than blue.

The basic setup consists of a heat-trapping solar collector sitting outdoors in an open, south-facing location—usually up on the roof—and a water-storage tank inside the house. In cold climates, a pump circulates an antifreeze-laced liquid through a closed loop of pipe connecting the rooftop array and the tank. A submerged coil inside the tank transfers the heat from the sun-warmed liquid to the household water supply. (In frost-free zones, potable water can be heated directly by the collector.)

Collectors come in two main types. The most popular are the so-called flat-plate collectors: insulated glass boxes with copper pipes attached to heat-trapping “absorber sheets.” Under ideal conditions, they can produce 150-degree water, well above the 125-degree water in a typical water heater. More efficient tube-type collectors encapsulate the absorber sheets and pipes in glass vacuum tubes for maximum insulating effect ( see slide 2 at left: Collecting Heat in a Vacuum). They can heat water up to 200 degrees. And because tubes can capture heat when the sun is not directly overhead and even on cloudy days, you don't need a big array to get a lot of hot water. The downside is that they cost twice as much as flat plates.

ILLUSTRATION BY HARRY CAMPBELL

Unlike flat-plate collectors, evacuated-tube systems encase the solar absorbers in a vacuum, preventing any significant heat loss.

**Costs**

Still, no matter how well a collector performs or how perfectly it's placed, there's no getting around the fact that it relies on an energy source that only works part-time. “You can never meet the demand exactly, because you can't turn on the sun when you need it,” says Robert Waters of Viessmann, a manufacturer of solar thermal systems. In the some parts of the United States, solar panels might provide as much as 95 percent of a household's hot water in summer, but as little as 20 percent in winter. And unlike solar-generated electricity, which can be stored in batteries or sold back to the power company, hot water is a fleeting asset; even a well-insulated storage tank turns cold after a few overcast days. That's why virtually all solar hot-water systems are supplements to, rather than replacements for, conventional water heaters.

As is often the case, it costs money to save money. A typical setup for a family of four, with an 80-gallon storage tank, runs about $5,000, plus another $2,000 or so for installation. But compared with photovoltaic cells or wind generators, the payback periods are relatively quick—as little as five years, depending on local energy costs and state subsidies. (That factors in the current federal investment tax credit for 30 percent of the cost of a solar thermal system, up to $2,000.) Solar hot-water systems are also fairly easy to retrofit in existing homes. The solar-heated storage tank is simply linked to the existing hot-water tank, which switches on only when water from the collector falls below the water heater's temperature setting. In new homes, a single tank can be heated by both solar collectors and gas or electricity. Either way, you can take your hot-water savings to the bank. Or you can hop in the shower and sing a longer song.

**Solar Heating—and Cooling, too**

Some solar systems can supplement hydronic (hot-water) heating systems, but don't expect the same kind of efficiencies or payback as with solar collectors that just supply domestic hot water. That's because these systems are expensive, and the highest demand for heat comes during the darkest months of the year. The most benefit comes in the shoulder seasons, spring and fall, when solar hydronics can supply 20 percent of the total annual heating load.

A more promising application, still in development, is using solar-heated water to drive chillers, cooling systems without compressors. It's a tantalizing concept because solar output peaks at the same time as AC use. The challenge has been to design small-scale residential chillers that can run at the lower fluid temperatures that a solar array can produce.

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