

SOLAR THERMAL

a cost-effective renewable energy

By Milton Geiger

When people envision solar panels, generally photovoltaic systems come to mind.

Although converting the sun's energy to electricity is a useful and exciting technology, there is a more direct, and often cost-effective, method for home and business owners to utilize this resource: solar thermal.

Heating hot water is often the second largest use of energy in Wyoming households, and solar thermal can have an immediate impact on energy use.

If you have ever sat in a car with the windows up, even in the depth of winter, you know the sun provides substantial heat. Solar thermal energy systems harness and make available this resource for water heating.

Solar thermal, also called solar heaters or solar hot water, is an old technology being rediscovered with rising energy costs and interest in renewable energy. Solar thermal has come a long way from the often unsightly structures built in the late 1970s and early 1980s. Improved technology allows Wyoming residents to utilize our excellent solar resource (see Figure 1).

Who Should Consider a Solar Hot Water System?

Solar thermal makes sense for many reasons. It is a clean and cost-effective technology for Wyoming residents that provides a sense of independence to many. Residences, businesses, and community buildings can all utilize this cost-effective technology.

Several questions help identify those best-suited for solar thermal:

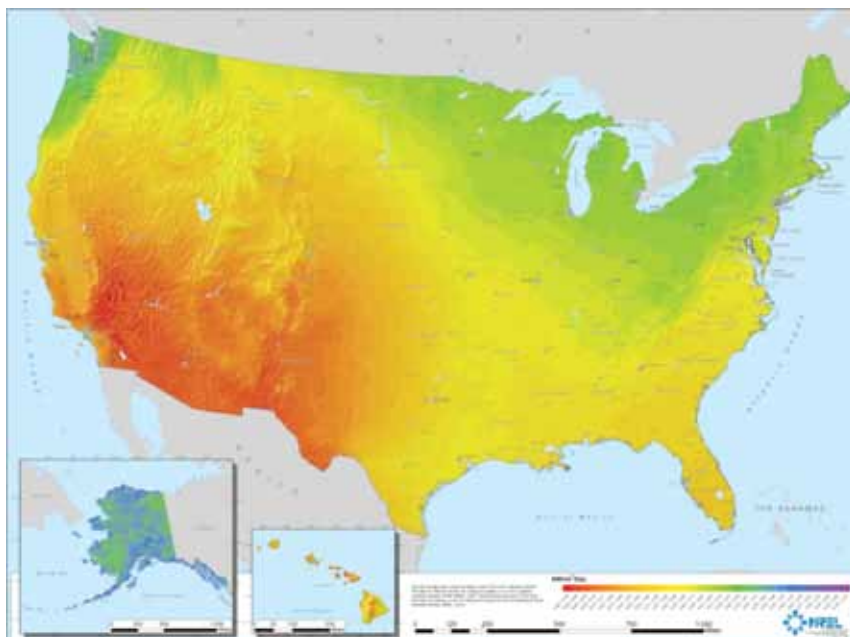


Figure 1: United States solar resource for flat plate collectors tilted for latitude – red is the best resource, green the least.

Wyoming's resource ranges from ~4.75-5.75 kWh/m²/day

Source: National Renewable Energy Laboratory

1. Do you need to replace a hot water heater in the near future?
2. Do you heat water with propane or electricity?
3. Are you interested in renewable energy, such as wind or solar electricity, for environmental reasons, including reducing your carbon footprint?
4. Do you own a business in a rural area that uses a significant amount (150+ gallons per day) of hot water?

If you answered yes to any of these questions, then solar thermal may be for you! If you did not stand up and yell "yes," keep reading – solar thermal could still be a good bet for you.

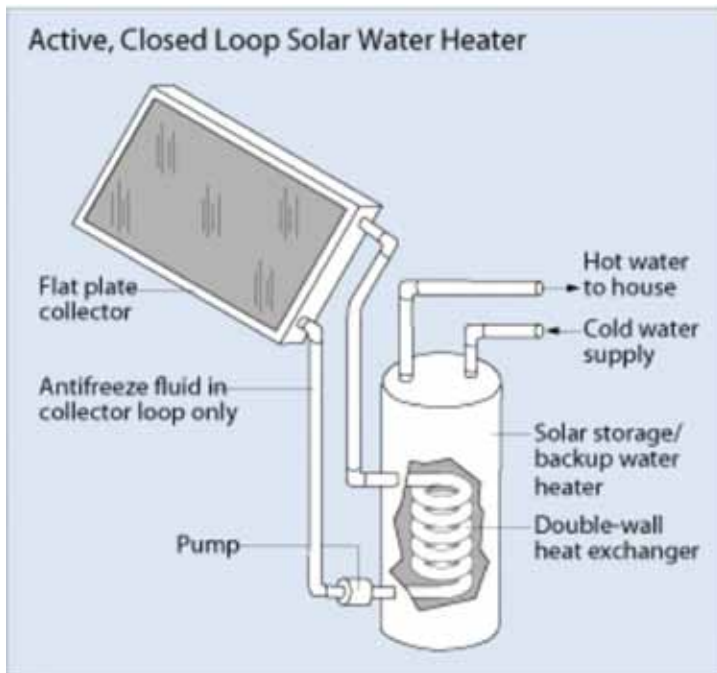


Figure 2 – A typical solar thermal design for Wyoming.
Source: Department of Energy/Energy Efficiency and Renewable Energy



Figure 3 – An indirect circulation flat plate collector system.



Figure 4 – An example of an evacuated tube collector system.

Heating Your Water ... Intelligently

For most residences and businesses, solar thermal will most effectively be utilized to heat water with additional options to provide space heating.

Although many types of solar thermal systems exist, the most common systems for Wyoming are indirect circulation flat plate collector systems (see Figures 2 and 3) and evacuated tube collector systems (see Figure 4). The flat plate collectors are much sleeker and aesthetically pleasing than older systems; they often appear to be no more than a black skylight to a roadside viewer.

The indirect circulation component recognizes the cold climate of Wyoming where freezing would certainly be a problem! An indirect circulation system uses non-toxic antifreeze in a closed loop. The loops are coupled to a heat exchanger in the storage/backup water heating tank (see Figure 5). This also means potable water never enters the solar thermal system. Collectors are generally connected to larger storage tanks than standard water heaters, which allows for more solar energy to be stored for use at night and cloudy days.

There is no free lunch with any energy source. First, unless you are willing to take a cold shower on a cloudy February day, nearly all solar hot water installations will require backup systems, such as an existing hot water heater. Second, the systems can be initially expensive to install – the average four-to-five person (80 gallon) system can cost \$6,000-\$8,000. Finally, a clear southern exposure is required and a willingness to place a system on your roof or nearby vacant ground.

A Cost-effective System

Solar thermal systems can offer an attractive return for Wyomingites. Homes and businesses that use more expensive resources for water heating, such as electricity and propane, generally offer the shortest payback period.

For example, a typical Wyoming home using 120 gallons of hot water per day (enough for four to six people) heated with propane at a cost of \$2.50/gallon, would generally have a four-to-six year simple payback and a 15-year levelized energy cost of \$1.10-1.30/gallon of propane equivalent. This assumes the water heating system costs \$8,500 installed and the homeowner is able to utilize the 30 percent federal tax credit.

Cooperative Extension Service Web site – In the near future, the Web site <http://ces.uwyo.edu/> will contain information on energy efficiency and renewable energy and provides links to the Department of Energy resources, Wyoming-specific publications, and a list of installers.

Solar Thermal for Electricity – Utilities can also use solar thermal energy to create electricity. This requires the sun's energy to be concentrated through precisely aligned mirrors or other reflectors creating enough focused heat to boil a fluid to drive a turbine. Solar thermal electricity systems are currently installed in the Southwest.

The solar thermal system also reduces exposure to fuel price fluctuations (remember when propane was \$3.25/gallon?). In addition, a solar thermal system should enhance the value of a home. It is similar to installing any other home improvement, such as a new deck; part of your investment should be recovered if you sell your home. Remember, no two examples are alike, but solar thermal energy can pay!

Take Action!

Solar thermal energy can save money, increase your personal energy independence, and reduce your environmental footprint, so, what do you do next?

First, determine if a solar thermal system will fit your situation. After you establish your need, find a reputable installer. An ever-growing list of Wyoming-based installers is available from the UW CES. Ask the installer if his/her systems are reviewed by the U.S. Department of Energy-supported Solar Rating and Certification System Corporation (www.solar-rating.org). This certification ensures validated performance and reliability.

As you consider a system, collect all available incentives, particularly the 30-percent tax credit available to both homeowners and businesses. Businesses will also want to utilize accelerated depreciation and USDA Rural Development's Renewable Energy Development Assistant (REAP) program (25-percent grants).

Once a modern solar thermal system is installed, you should be on your way to years of cost-effective, environmentally responsible hot water!

For additional information

See "How to determine if that renewable energy project makes economic sense" Summer 2010 *Barnyards & Backyards* magazine.



Figure 5 – Non-toxic antifreeze in a closed loop is circulated through a heat exchanger in a backup water heating tank.

Solar Space Heating – Solar thermal space heating can also be a cost-effective solution in Wyoming, and it can be a logical extension of a solar hot water system. The same type of system used to heat hot water can help support a hydronic or forced air heating system. The systems can be coupled with a geothermal heat pump. Obviously, more collectors are required to support space conditioning, often leading to excess summer capacity. Passive solar is another simple, and often most cost-effective, strategy. Passive solar involves orienting windows and thermal mass to take advantage of winter sun. More can be learned about both passive and active solar heating at the UW CES Web site.

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