



E³A: Solar Hot Water Applications for the Home, Farm or Ranch

Steps in the Solar Hot Water Series

Building and Site Assessment

Conservation and Efficiency

System Options

System Sizing

Costs

Installation

Operation and Maintenance

Solar Hot Water Collector Sizing Worksheet

System sizing

One of the most important steps in buying a solar hot water system is sizing it according to your hot water needs. If the system is too large, you waste money on a system that makes more hot water than you need. If it's too small, your backup heater powered by natural gas, electricity or propane does more work, which adds to your utility bill. Choosing the size and number of collectors, storage tank size and overall system type best suited to your hot water needs will result in a smaller, more resource-efficient and cost-effective system.

Collector sizing and roof space

Flat-plate collectors range in size from 20 to 48 square feet and can weigh 80 to 150 pounds. Dimensions range from 3 by 6 feet to 4 by 10 feet with a 3-inch thickness.

Evacuated tube collectors are heavier than flat-plate collectors, and their size depends on the number of tubes used. A 20-tube collector — about 6 by 7 feet — would provide enough hot water for one to three people.

For a quick residential system estimate, the first two people in your home require a minimum of 20 square feet of collector area on a south-facing roof. For each additional person using hot water, add 12 to 14 square feet. Using these guidelines, 52 square feet of south-facing roof or other surface area is needed for collectors to provide 100 percent of the hot water for three people.

Conserving water and installing efficient fixtures and appliances can reduce the overall system size needed. For an assessment specific to your hot water use, complete the *Solar Hot Water Collector Sizing Worksheet*.

3-person household example:

two people =	40 square feet
third person =	+12 square feet
	<hr/> 52 square feet

Solar storage tank sizing

Some companies sell one-tank solar hot water systems, in which the tank stores solar-heated water and serves as a backup, but most building owners keep the existing hot water heater as a backup and purchase a new storage tank for solar-heated water.

Storage tank size is based on an average of 20 gallons of hot water per person per day. For active systems, a more accurate estimate uses the guideline that 1½ gallons of storage tank capacity is needed per square foot of collector area. This helps prevent system overheating when hot water demand is low. For example, 52 square feet of collector area × 1.5 = 78 gallons of storage tank volume needed, so an 80-gallon tank would be used.

Number of people	Storage tank volume (gal.)
1–3	30–60
3–4	80
4–6	120

System efficiency

Efficiency is as important as the type and size of a solar hot water system. The more efficient the system, the sooner it pays for itself. You should be aware of two measurements of efficiency:

- Solar Energy Factor (SEF): This number ranges from 1.0 to 11; the higher the number, the more efficient the system. SEF is determined by the amount of energy delivered to the system, divided by

3-person household example:

3 people × 20 gallons water per day = 60-gallon storage tank

the electrical or gas energy put into the system.

- Solar Fraction (SF): This number ranges from 0 to 1.0 and is the fraction of your water heating energy requirement provided by solar energy. A higher SF number means a more efficient system and more of the sun's energy contributing to your water heating, which reduces the energy used by a backup heater.

The Solar Rating and Certification Corporation's (SRCC) website compares complete systems under the OG 300 directory, so you can compare SEF and SF ratings at www.solar-rating.org. System ratings are for all components of a system: collector, tank, pumps, motors, valves, piping, etc. SRCC system ratings are only for residential-scale systems, and the OG 100 directory provides only individual collector rating information.

The sizing worksheet provides a general idea of collector and storage tank sizes, but solar hot water system companies and installers can conduct a more precise assessment.

Additional information

If you have access to a computer, Solar Estimate allows you to enter your information to get an idea of system size and cost online at www.solar-estimate.org.

References

- National Renewable Energy Laboratory (produced) for the U.S. Department of Energy. (2003, December). *A Consumer's Guide: Heat Your Water with the Sun*. DOE/GO-102003-1824. (1996, March). *Solar Water Heating*. DOE/GO-10096-050.
- U.S. Department of Energy. (2010, October). *Sizing a Solar Water Heating System*. Retrieved January 19, 2011, from: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12880
- (2010, October). *Solar Water Heater Energy Efficiency*. Retrieved February 8, 2011, from: http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12900

Original work created by Montana State University Extension and the University of Wyoming.
Adapted with permission by University of Missouri Extension.