



# E<sup>3</sup>A: 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

### Costs

Based on information compiled by the National Renewable Energy Laboratory and RS Means in Green Building Cost Data, small solar water heating systems, such as those used for homes, can cost between \$187 and \$199 per square foot of collector area. Larger, centralized systems that could be used for agricultural purposes can average about \$60 per square foot of collector area. For example:

$$52 \text{ square feet of collector area} \times \$187 = \$9,724 \text{ for complete system}$$

This is just an estimate, and any available rebates or tax incentives would reduce the final cost.

Once you know the system option that will work best for you, determine the purchase and installation costs of several systems you are considering. Take into account the costs of backup system fuel, operation and maintenance. After calculating yearly operating costs for each system, you can make a complete cost comparison.

### Calculating yearly operating costs

To estimate the yearly operating cost, first collect the following information:

- The solar hot water system's Solar Energy Factor (SEF)
- The cost of fuel to be used for the backup system

### Gas backup

For a gas backup, determine the cost of the fuel in therms or British thermal units (Btu). Utility bills might show gas prices in units of therms (1 therm = 100,000 Btu) or dekatherms (1 dekatherm = 10 therms). Use this formula to estimate yearly cost of operation:

$$365 \times (0.4105 \div \text{SEF}) \times \text{fuel cost per therm} \\ = \text{estimated yearly cost of operation}$$

Example for a **gas** backup:

$$365 \times (0.4105 \div 2) \times \$0.98 \\ = \$73.42$$

Notes:

365 = days in a year

0.4105 = formula constant for therms (use 41,045 for Btus)

2 = Solar Energy Factor

\$ 0.98 = cost per therm

### Electric backup

For an electric backup, determine how much you pay for a kWh of electricity, then use this formula to estimate the yearly cost of operation:

$$365 \times (12.03 \div \text{SEF}) \times \text{electricity cost per kWh} \\ = \text{estimated yearly cost of operation}$$

Backup system costs and maintenance costs contribute to yearly operational costs. Solar hot water system maintenance costs typically run \$25 to \$30 every three to five years.

Once you know the solar hot water system's purchase and installation costs and have calculated yearly operating costs for each, you can compare and determine simple payback.

The additional purchase price of the more efficient (higher SEF) System B is \$500 (\$10,000 - \$9,500 = \$500), but the yearly operating cost of System B is \$50 less per year (\$170-\$120 = \$50). For any comparison, simple payback is calculated by dividing the

Example for an **electric** backup:

$$365 \times (12.03 \div 3) \times \$0.10 \\ = \$146.37$$

Notes:

365 = days in a year

12.03 = formula constant

3 = Solar Energy Factor

\$0.10 = cost per kWh

**Table 1. Yearly operating cost comparisons.**

	Purchase and installation cost	SEF	Estimated yearly operating cost
System A	\$9,500	2	\$170
System B	\$10,000	3	\$120

system price difference by the yearly operating savings:

$$\$500 \div \$50 = 10\text{-year simple payback}$$

The more efficient solar hot water system will pay for itself in 10 years or less.

*Note:* Payback periods decrease when fuel costs increase. Also, government and utility rebates and tax incentives can significantly reduce your final system cost and payback period.

### **Other cost considerations**

When an installer visits your home or building, they will look at how solar hot water system components will integrate into your home's structure and existing hot water system. Installation costs can vary based on where collectors are located and the piping distance to the storage tanks.

### **Incentives that lower costs**

There are several federal, state and local government and utility incentives for energy efficiency and renewable energy. These incentives vary by state and availability. The Department of Energy's Database of State Incentives for Renewables and Efficiency (DSIRE) tracks tax credits, rebates

and other incentives at their website, <http://dsireusa.org/>.

Final cost with current incentives, using the \$9,724 residential system example:

Federal Income Tax Credit (expires Dec. 31, 2016) is 30 percent of the system cost (after any utility rebates):

$$\$9,724 \times 0.30 = \$2,917 \text{ tax credit}$$

*Note:* To qualify for this federal tax credit, according to DSIRE, "solar water heating property must be certified by SRCC or a comparable entity endorsed by the state where the system is installed. At least half of the energy used to heat the dwelling's water must be from solar."

### **References**

U.S. Department of Energy. (2010, October). *Estimating a Solar Water Heating System's Cost*. Retrieved January 19, 2011, from: [http://www.energysavers.gov/your\\_home/water\\_heating/index.cfm/mytopic=12910](http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12910)

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