

Solar Hot Water Technology

DOE has helped to develop reliable and durable solar hot water systems

Every home, commercial building, and industrial facility requires hot water. An enormous amount of energy is consumed in the United States producing and maintaining our supply of on-demand hot water; the residential and commercial sectors combined use 3 quads (quadrillion Btus) of energy per year, roughly 3% of the total U.S. energy consumption.

As of 1998, 1.2 million systems have been installed on homes in the United States, with 6000 currently being added each year. Yet the potential for growth is huge, as solar hot water systems are supplying less than 2% of the nation's hot water.

For industrial applications, the growth potential lies in large-scale systems, using flat-plate and trough-type collectors which are being installed in increasing numbers in schools, hospitals, prisons, and commercial and industrial facilities across the country. As in residential applications, industrial-scale solar hot water systems are integrated with conventional hot water heaters, which ensures hot water will be available at all times. Solar

systems typically meet between 40% and 75% of a facility's total hot water load.

Solar hot water technology has made great strides, thanks partly to U.S. Department of Energy (DOE)-sponsored research. For example, researchers have developed a low-cost method for draining back the water in solar collectors at night to prevent freezing during cold weather, a method many commercial collectors now use in their designs. Researchers also helped develop new collector designs that eliminate expensive hardware and increase reliability, such as a thermosyphon design that eliminates pumps. Research also established that collector orientation was only weakly related to performance, which allowed industry

The Office of Power Technologies is part of the Office of Energy Efficiency and Renewable Energy

Highlights

- **System payback periods range from 5 to 10 years when displacing electric water heating.**
- **As of 1998, 1.2 million solar hot water systems have been sold. However, the potential for new systems is much larger.**
- **A mature solar industry produces systems to meet typical residential and commercial needs.**
- **Solar hot water systems are expected to avoid 0.9 million tons of carbon emissions by the year 2000.**



NREL/PIX 05978

Flat-plate collectors are commonly used in residential hot water systems and can be integrated into the architectural design of the building. On this building in Tucson, Arizona, the system looks much like a skylight.

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engineers to eliminate metal supports, reducing costs, and allowing integration of collectors into the roofs of buildings. Scientists at a DOE national laboratory developed new materials with improved performance, such as a nickel-based "Black Crystal" coating, now offered commercially by Energy Laboratories, Inc., of Jacksonville, Florida. This coating has solar absorptance and thermal emittance properties that can be tailored to solar applications, yet it costs less than other coatings with similar properties.

Today, DOE, through the Office of Power Technologies, continues to contribute to the progress of solar hot water technology. For

example, researchers are developing new collectors made from inexpensive polymers instead of metal and glass. The technical expertise resident in both Sandia National Laboratories and the National Renewable Energy Laboratory is also put at the disposal of the solar industry, helping improve system designs and reduce manufacturing costs.

All of these technical advances are enhancing solar hot water system performance while cutting costs. By incorporating these advances, manufacturers have been able to expand the market for solar hot water systems. But to achieve market penetration, consumers must have confidence in the products. To this end, DOE helped develop an objective, uniform method to certify the performance of solar collectors. This is now handled commercially by the Solar Rating and Certification Corporation of Cape Canaveral, Florida.

DOE has also formed partnerships with utilities, energy supply companies, and builders to include solar in the portfolios of services they provide. These combined efforts will help solar hot water heaters achieve their potential to meet our country's hot water needs.



NREL/PIX 04244

Installed in 1997, the hot water system at the Jefferson County Jail in Golden, Colorado, uses trough collectors and produces 50% of the hot water used annually in the facility.

For More Information:

Visit DOE's Solar Buildings Program Web site at:

www.eren.doe.gov/solarbuildings

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