# Green Home Tech Sheet: Solar Hot Water

> Featuring technologies and innovations to help create healthy, high-performance homes



The high-strength glass tubes are designed to withstand hail and wind-blown branches.

Photo: Jon Alexander

The distintive look of evacuated tube systems can be harnessed to great design effect.

Photo: www.pugetsoundsolar.com

Solar hot water and photovoltaic (solar electric) systems are readily combined to offer a diverse renewable energy strategy.

Photo: www.pugetsoundsolar.com

# In brief:

One-fifth of a typical Seattle home's energy budget is spent heating water. Solar hot water systems can help save money on water heating costs, while lessening your home's impact on the environment through reductions in carbon dioxide emissions related to energy use.

Federal tax incentives and recent state sales tax exemptions help shorten the already-quick (often less than ten years) payback on solar hot water systems.

In the Pacific Northwest, evacuated tube or vacuum tube solar collectors for water heating systems are a good choice, since they efficiently heat water even on cloudy days—a common occurrence here in Seattle.

Many people assume solar technologies and our cloudy Pacific Northwest climate are mutually exclusive. But it turns out that right at the time that water to power our hydroelectric plants is lowest (summer and early fall), solar systems are at their most productive. This complementary arrangement can help us stay local with our energy production and reduce the need to buy costly electricity on the open market.

Most people think of photovoltaic (solar electric) systems when they hear the word solar. Solar hot water systems are another promising technology that can reduce our need for electric- or natural gasheated water, or even supplement space heating in homes with hot water based heat.

## Energy down the drain

According to Seattle City Light, water heating consumes about 20 percent of the energy used in a typical home. As our homes become more efficient in terms of insulation and space heating, the proportion of energy going to heat water will continue to increase. High-efficiency water heaters, water saving fixtures and appliances, and efficient plumbing configurations can help reduce demand for hot water in the home. But an increasingly viable option for reducing conventional energy use for heating water is the solar hot water system.

#### How it works

Residential solar hot water systems come in a variety of configurations and levels of sophistication. *Batch or integral collector-storage systems* are the simplest, basically consisting of water-filled tanks or tubes painted black in an insulated box with a transparent top. The system preheats an existing hot water heater's input water. While relatively low cost, these systems are bulky and often unattractive, can freeze in cold weather, and often require structural reinforcement since they impose heavy loads on the roof.

Flat plate collectors are the most common form used in solar hot water systems. They too feature an insulated box with a translucent top. But they "up the technological ante" by including a heat-absorbing plate with liquid-containing tubes in or on the plate. These collectors are more efficient than the batch systems at gathering heat, but work best in direct sunlight—something we don't get a lot of in Seattle.

The latest development in solar hot water technology is the *evacuated tube* or *vacuum tube* solar collector. These high-tech systems consist of a series of long glass tubes, each housing a pipe and a finned absorber plate. The pipe contains a water-based heat transfer fluid. The air within the tube is removed (creating a vacuum), to lower the boiling point of the transfer fluid and to

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Collectors can be mounted vertically or horizontally, although the goal is to maximize the unit's exposure to the sun.

Photo: www.pugetsoundsolar.com

Hot water storage, a circulation system, and supplemental heating are also key parts of a system.

Photo: www.pugetsoundsolar.com

If roof mounting isn't available or desirable, solar hot water collectors can be mounted wherever sufficient sun exposure permits.

Photo: www.pugetsoundsolar.com

Find out more:

US Department of Energy
Office of Energy Efficiency & Renewable Energy
<eere.energy.gov>

(click on *Solar* under the *Renewable Energy* section). Technical information on solar energy and solar hot water systems.

### Solar Washington

<solarwashington.org>

Information on solar-related trainings and events in Washington, and a list of members, including contractors and solar energy specialists.

### **Energy Star**

<energystar.gov>

Provides a good synopsis of current tax credits for energy efficiency and solar hot water systems.

reduce heat loss. As the sun strikes the finned absorber plate, heat is transfered to the liquid in the pipe. The heated liquid travels up the pipe to a heat exchanger, where the heat is again transfered, this time to the water supply. The result is a high-efficiency system that can produce heated water even on cloudy days.

The high-tech look of evacuated tube solar collectors is a draw to some, and a drawback to others. The systems maintain a relatively low profile on a roof, meaning they can be unobtrusive if that's the intent. Alternatively, they can be used as a design element and focal point for those that want to show off their green ways..

The collectors are just part of a solar hot water system. Systems also consist of a storage tank to hold the hot water until needed, a circulation system to move the fluid from the collectors to the storage tank, an overall controller for the system, and a backup heat source.

#### Tax incentives

The Federal Energy Policy Act of 2005 includes incentives for installing solar hot water systems. Homeowners can receive a tax credit worth 30% of the installed cost of a solar hot water system, up to \$2000. Note this is a tax *credit*. dollars subtracted directly from tax dollars owed, rather than deducting the amount from earned income.

The credit is available for systems "placed in service" in 2006 or 2007. See sidebar for links to additional information. Additionally,

Washington State recently added solar hot water systems to its list of solar products exempt from state sales tax, further reducing the cost of systems to homeowners.

### Cost

Solar technologies tend to have a high up-front cost, but a long life (often twenty years or more) and very low operating cost. The sticker shock can be addressed by rolling the cost of a system into your mortgage through a home improvement loan. Renewable energy experts also recommend reducing the up-front cost by identifying conservation strategies that minimize demand for hot water, allowing the installation of a smaller system. High-efficiency showerheads and aerators on fixtures, and water- and energy-efficient dishwashers and clothes washers will help minimize hot water demand. These efficiency upgrades usually cost much less than additional solar panels. Look to <savingwater.org> for help with reducing water use.

Sizing, designing and installing a solar hot water system is a technically complex job best left to a professional. Look for contractors with applied experience in this specialty field. One source is the Northwest EcoBuilding Guild's online "Green Pages." See <ecobuilding.org> to search its database of members. Also, look for experts by searching the membership of Solar Washington (see sidebar).