



Green Energy Ohio

www.GreenEnergyOhio.org

Solar Thermal

An average of 3-4 kilowatt (kW) hours per square meter of solar energy falls on Ohio everyday. Considering your average utility bill, this free energy source can significantly reduce your monthly energy expenses and eventually be cash in your pocket once this energy is put to work.

But how? One of the simplest and economical ways to utilize solar energy is through solar thermal systems. This proven and economical technology has been around for decades for hot water, pool and space heating applications. Since an electric water heater accounts for one-fourth of the total energy used in a single home, many people use solar thermal systems to reduce their monthly utility bill by as much as 10-15%.

Solar Water Heaters

A solar domestic hot water system uses the sun's energy collected by a flat-plate solar collector and transfers the heat to water or another liquid flowing through tubes. The system then draws upon this reservoir when you need hot water inside your home. This system usually complements an existing electric or gas hot water system to reduce your utility bill and provide approximately 40-70% of your household's annual hot water needs.

Solar Space Heaters

A solar space heater collects the sun's energy by a solar collector and directs the energy into a "thermal mass" for storage later when the space is the coldest. A thermal mass can be a masonry wall, floor or any storage drum used specifically to absorb and store the energy. Many systems involve a distribution system and control devices to circulate the heat throughout the space and to prevent loss from the collector area. These systems may be combined with a solar hot water system and sized to accommodate both uses. Solar space heaters are more economical when it replaces a electrical heating systems.



Solar Thermal System on a home in Maumee, OH.

Solar Hot Water Technology Overview

Two basic solar systems exist to produce hot water: passive and active.

A passive solar system relies on natural sources to transfer heated water for domestic use, which is more prevalent in warmer climates with minor chance of freezing periods. The alternative, an active solar system, is better suited for the colder climate in Ohio as it uses a pump to force the liquid through the solar collector and into the home.

An active pumped system can be either an open loop where the water is directly heated by the solar collector, or closed loop where antifreeze or glycol mixture is heated before transferring its heat to the water by a heat exchanger. A popular design of the closed loop system is known as a drainback system. This freeze-proof design drains water back into a small holding tank when freezing temperatures occur.

Green Energy Ohio is a nonprofit organization dedicated to promoting environmental ly and economical ly sustainable energy policies and practices in Ohio. GEO is the Ohio Chapter of the American Solar Energy Society (ASES).

Solar Water System Basics

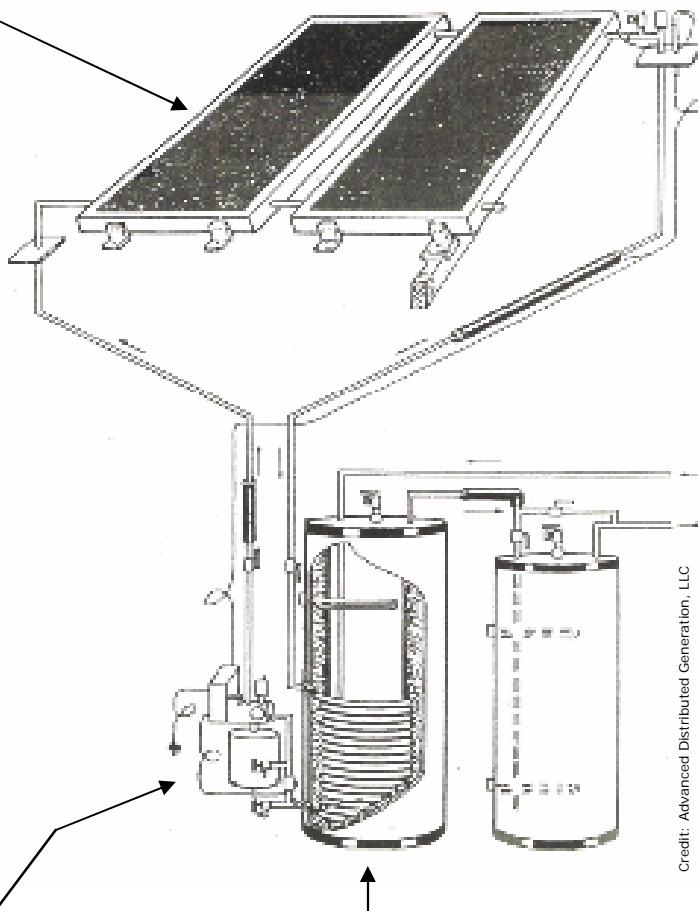
The closed loop system is better suited to Ohio's colder climates. The main components of this system are the solar collector, heat transfer liquid, circulating pump, differential temperature controller, heat exchanger and a storage tank. Basically, the sun's energy is captured by the solar collector that heats an anti-freezing liquid. The heated fluid is pumped into the home and transferred to the domestic water supply, which is held in a storage tank for later use.

Solar Collectors:

The flat-plate collector is a weatherproof rectangular box between 2–4' wide, 4–12' long and up to 8" thick. A dark absorber plate usually coated black at the surface of the collector beneath a sealed glass or plastic top absorbs the sunlight. The heat is then transferred to a series of lengthwise tubes that contains the heat transfer liquid.

The solar collectors are usually mounted on the roof facing due south and angled to the horizontal equal to the site's latitude + 15 degrees (*anywhere from 38 degrees in southern Ohio to 42 degrees latitude in northern Ohio + 15 degrees*).

Most people prefer to mount the solar collectors integrated into the roof for added strength and aesthetics, but the roof needs to be properly oriented for maximized effectiveness. A final factor in siting is to ensure the solar collector will be free from shade during the peak hours when the sun is brightest. A solar pathfinder provided through the GEO equipment lending program can help assess the sun's path during different seasons.



Circulating Pumps:

Active systems use pumps to circulate the heat transfer liquid through the solar collector and the heat is then transferred to the domestic water supply by a heat exchanger. The pumps can be powered by conventional electricity and regulated by a controller that turns the pump on and off depending on sensors to determine whether the solar collector can heat the water in the tank. A more sustainable solar thermal system may use a solar electric (photovoltaic (PV)) powered panel to supply the electricity to the pump. A controller is not needed as the PV panel supplies electricity to the system when it is capable of heating the water – whenever the sun is out!

Storage Tanks:

Beyond the solar collector, the storage tank is a major component of the solar thermal system. The tank's function is to store the heated water collected during the day. Most systems use a super insulated storage tank specifically designed for this purpose, but the solar thermal system can be connected to any existing water tank.

Heat Transfer Fluids:

Different liquids can be used within a solar collector, including tap water, distilled water and propylene glycol (an antifreeze) that is used in the colder climates because it is nontoxic and stable. A closed loop system uses the same liquid until it needs replaced in 3 to 5 years.

Cost

A system's payback is based on a variety of factors, including the size, materials used, incorporating existing structures or integrating into new construction, installation services, and current financial incentives. A solar thermal system should be included in the financing of a new building, thus taking advantage of the federal income tax deduction. Also important is to utilize energy efficient measures in the building to maximize the benefits and savings from installing the system, such as low flow shower heads, aerators on all faucets, south-facing windows, etc.

Existing buildings that add a new system can take advantage of federal and state financial assistance programs. Federal tax breaks may be available depending on current legislation, up to \$2,000 for a solar thermal unit. The State of Ohio issues periodic grants and other incentives. To receive the latest information, contact the entities on page four for updated resources.

The average cost for a system on a new residential building is \$4,500, while the average cost to install a system on an existing building is \$5,500 (*average cost for Ohio installations in 2004 dollars*).



Solar thermal collectors (top) resemble the skylights on this Ohio home.

Maintenance

Ensuring your system continues to run smoothly will depend on the care it receives over the years. The active systems used in the colder climates of Ohio will need more, but relatively easy maintenance than the passive systems used in tropical climates. Preferably completed by a trained contractor, the antifreeze heat transfer fluid will be changed every 3-5 years and some electrical components after 10 years.



Warranties

Check with the manufacturer and/or contractor to determine what warranties exist on the system you choose. Typical full system warranties, including parts and labor, may range from 1-3 years.

Renewable Energy Installers

A reputable contractor can discuss the issues involved to install a solar thermal system, such as site assessment, choosing a system, financing, warranties and maintenance. Your system should be designed & built by a trained and experienced professional to ensure your system is properly and safely installed. GEO maintains a list of Ohio renewable energy installers on the GEO website at www.GreenEnergyOhio.org.

Following questions may be helpful in choosing an appropriate installer:

- What kind of products and services are offered?
- What experience does the contractor have with solar thermal systems in design and installation?
- How much will the system cost?
- How long will the installation process take?
- What licenses does the installer have?
- Will the contractor obtain the necessary permits?
- What warranties exist?
- Will the contractor complete any future maintenance requests?
- What incentives and financing services are available?
- Can past customers provide a reference?



Organizations

Green Energy Ohio

7870 Olentangy River Road, Ste 209
Columbus, OH 43235
(866) GREEN-OH Toll Free
geo@greenenergyohio.org
www.GreenEnergyOhio.org

American Solar Energy Society

2400 Central Ave. Ste A
Boulder, CO 80301
(303) 443-3130
www.ases.org

Office of Energy Efficiency Ohio Department of Development

77 South High Street
PO Box 1001
Columbus, OH 43216-1001
(800) 848-1300

Energy Efficiency and Renewable Energy Department of Energy

www.eere.energy.gov

Florida Solar Energy Society

1679 Clearlake Road
Cocoa, FL 79968
(888) 879-2887

North American Board of Certified Energy Practitioners

Saratoga Technology + Energy Park
10 Hermes Road, Ste 400
Malta, NY 12020
(518) 889-8126
www.nabcep.org

Acknowledgement:

This publication was made possible by the generous support from the Ohio Department of Development Office of Energy Efficiency and The George Gund Foundation.

What GEO is Doing for Consumers

Workshops

Green Energy Ohio hosts several workshops every year for people interested in home renewable energy systems. These workshops provide opportunities for people to talk to professional installers from around Ohio and get answers to their specific questions.

Ohio Solar Tour

As the Ohio Chapter of the American Solar Energy Society (ASES), GEO hosts the fall annual solar tour throughout the state. This event provides the unique opportunity for Ohioans to tour homes, businesses and public places with renewable energy systems, talk to the owners and obtain educational materials on clean energy information and activities.

GEO Website

The GEO website at GreenEnergyOhio.org features information for people interested in renewable energy, including solar thermal: A list of renewable energy installers in Ohio with contact information and specialties; information on Ohio's net metering rule; current financial incentives for Ohio's residents; upcoming event information; links to government, nonprofit and business sites; and much more.

Join GEO!

Green Energy Ohio (GEO) is a 501(c)3 nonprofit organization and relies on the support from its diverse, dedicated membership. Exclusive benefits are available for current GEO members, including newsletters, volunteer opportunities, discounts off merchandise and access to member-exclusive pages on the GEO website.

Join online at www.GreenEnergyOhio.org.

Resources

Department of Energy: Energy Efficiency and Renewable Energy, *A Consumer's Guide: Heat Your Water With the Sun*. <http://www.nrel.gov/docs/fy04osti/34279.pdf>.

Midwest Renewable Energy Association (MREA), *Solar Domestic Hot Water Factsheet*. www.the-mrea.org.

Sklar & Sheinkopf. *Consumer Guide to Solar Energy*. 2002.

Florida Solar Energy Society. Solar Thermal factsheets and pamphlets. www.fsec.ucf.edu.