

Passive Solar Design for Homes



RENEWABLE ENERGY
THE INFINITE POWER
OF TEXAS

HIGHLIGHTS

- **Direct or indirect gain, solar heating can save money**
- **House orientation and window sizing are keys to proper design**
- **Thermal storage helps control overheating of spaces**
- **Porches and trees are important elements in solar control**

SUMMARY

Sometimes when architects and builders decide where to locate a home or building on a piece of land, they try to position it so that it can make the most use of the sun's heat in the winter. At the same time, they make sure the building will not be too hot in the summer. Locating and placing a home based on the sun is called "solar orientation." Solar orientation for heating and cooling buildings is not a new idea. Builders in China and Greece were designing buildings that used the sun's heat over 2,000 years ago. Buildings in any climate can take advantage of the

sun. All that is required is an interest in using passive solar design in the building. Once this design is chosen, the building basically becomes a large solar collector.

THE SUN AND YOUR HOME

The sun is much lower in the sky during the winter than it is in the summer at most places on Earth. The only exception to this fact is when the location is near the equator. Then the sun remains directly overhead. Solar homes are designed to use the changing position of the sun to benefit the home throughout the year. This is done by allowing the sun to shine into the house in the winter, which heats the home, and by blocking out the sun during the summer, which helps keep the home cooler. To do this, architects and builders must know the exact position of the sun in the sky at various times of the year. Then they can predict the angle that the sun's rays will shine into a home. Using that information, they will know where to place windows and roof overhangs.

DIRECT-GAIN SYSTEM

The simplest way to use passive solar heating is to just let the sun shine into

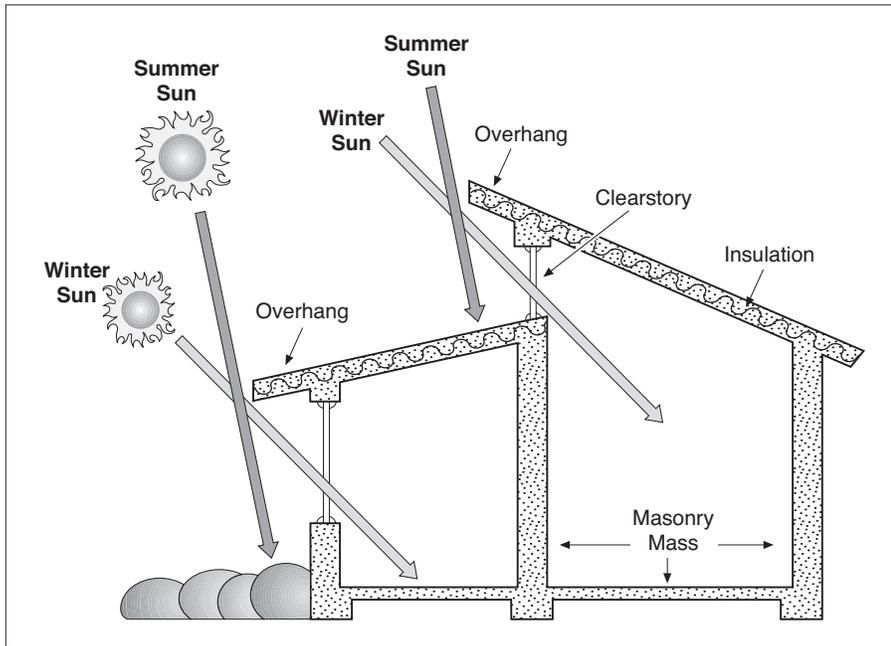


FIG. 1 SUN ANGLES This diagram shows the direct gain system.

the home. This is known as a direct gain system. During the winter, a direct gain system uses south-facing windows that allow heat from the sun to enter the home (See Fig. 1). That heat is then stored using thermal mass. Thermal mass is a dense material that gains or loses heat slowly. Examples of thermal mass include concrete, adobe, stone, brick and water. Heat that is stored in the thermal mass is eventually released into the home later when the sun is no longer high in the sky. During the summer, when the sun is higher in the sky, window overhangs block the sun. For Texans, the most important thing to consider is that the home has the right number of south-facing windows. The right number of south-facing windows depends on how big the home is, also known as the square footage of the house. Too many windows will make the home too hot, which could be worse than no windows at all.

When designed correctly, a direct-gain solar home in a Texas city like Amarillo could get 75 percent of the heat it needs from the sun.

INDIRECT-GAIN SYSTEMS

The most common type of indirect system is a greenhouse or sun porch (See Fig. 2). These rooms trap heat from the sun that can be used in other parts of the house. These structures are usually built to provide

more living space in the home or as a place to grow plants. They also contain a large amount of thermal mass to help store heat from the sun. This heat can then be used in other parts of the house by natural air movement or by a fan.

During the hot Texas summer, when we want to keep our homes as cool as possible, these structures can be covered with a curtain, shades or blinds. Or we can let the warm air out by opening windows, door or vents.

THERMAL STORAGE

Solar homes work best when they are made with dense material that absorbs and loses heat slowly. These dense materials are known as thermal mass. Examples of thermal mass include water, adobe, insulated concrete slabs, masonry or even a brick fireplace. The

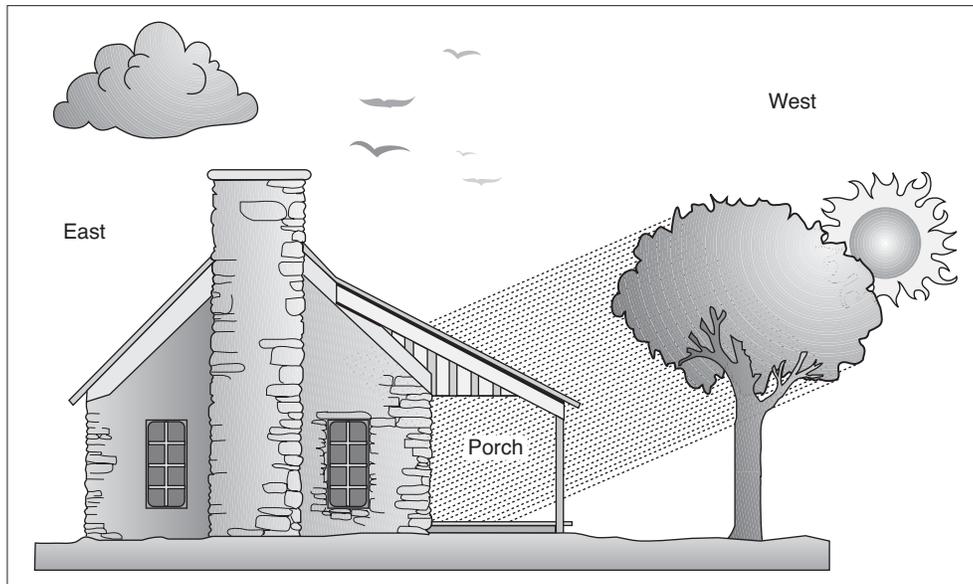


FIG. 2. LANDSCAPING CAN LOWER ENERGY COST *Using natural shading from trees and placing spaces, such as porches and garages, on the west side of the house can lower heating and cooling costs.*

thermal mass absorbs heat during the day when the sun is shining and releases it at night and when it is cloudy outside. Thermal mass also helps prevent homes from getting too hot during the day by absorbing excess heat.

Builders can use thermal mass walls on the south side of homes and cover it with glass. These types of walls have been in use for centuries. These walls are sometimes called Trombe walls named after the French architect Felix Trombe. If the walls are constructed of masonry, small vents can be added in the top and bottom so that warm air from the air space in the wall will move into the home. If the home becomes too warm, the vents can be closed.

In Texas, where cooling is usually more of a problem than heating, vents can be added to thermal walls that will move hot

air to the outside during the summer. In addition, if a roof overhang is the right size, it will prevent sunlight from hitting the wall during the hot summer months.

NATURAL SHADING AND LANDSCAPING

Deciduous trees may be considered low-tech, but they are one of the best ways to keep a home cool in the summer and warm in the winter. During the summer, the trees provide shade that blocks the sun and keeps it from making the house warm. In the winter, when the leaves have fallen, sun can shine through the branches and into the home to provide some heat. Studies have shown that when the right type of shade trees, bushes and grass are planted in the right places, energy that is used to cool and heat a home can be reduced by up to 30 percent.

ORGANIZATIONS

American Solar Energy Society

2400 Central Ave., G-1
Boulder, CO 80301
(303) 443-3130
www.ases.org

Florida Solar Energy Center

1679 Clearlake Road
Cocoa, FL 32922
(407) 638-7400
www.fsec.ucf.edu

Passive Solar Industries Council

1511 K Street, Suite 600
Washington, DC 20005
(202) 628-7400
www.sbicouncil.org

Texas Solar Energy Society

P.O. Box 1447
Austin, TX 78767-1447
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Texas Renewable Energy Industries Association

P.O. Box 16469
Austin, TX 78761
(512) 345-5446
www.treia.org

RESOURCES

FREE TEXAS RENEWABLE ENERGY INFORMATION

For more information on how you can put Texas' abundant renewable energy resources to use in your home or business, visit our website at www.InfinitePower.org or call us at 1-800-531-5441 ext 31796. Ask about our free Teacher Resource Guides and CD available to teachers and home schoolers.

ON THE WORLD WIDE WEB:

Renewables, products, sustainable living. A good place to start your search.

The U. S. Department of Energy- Energy Efficiency and Renewable Energy

This site has a comprehensive list of related web sites.
<http://www.eere.energy.gov/AB/>

Operated by the **North Carolina Solar Center**, this site offers a wealth of information, including ideas on how to decorate a passive solar home. <http://www.ncsc.ncsu.edu/>

Texas Solar Energy Society, a good place to start. www.txses.org

A source for Green and Sustainable Building covering energy, water, building materials, solid waste and other topics. A mammoth resource. www.greenbuilder.com/sourcebook

Green Building Source - <http://oikos.com/>

BOOKS:

Interior Design for Passive Solar Homes. Jill C. Breen, National Renewable Energy Laboratory, 1981.

The Passive Solar House: Using Solar Design to Heat and Cool Your Home. James Kachadorian, Chelsea Green Publishing Co., 1997.

The Passive Solar Energy Book. Edward Mazria, Rodale Press, 1979. (Often available at libraries)

Sunspace Basics. U.S. Department of Energy, to order call (800) 523-2929.



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