

The Power of the Sun: The Use of Passive Solar Energy

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Solar Energy:

2 classifications

- **Active:** The use of add-on features to utilize mechanical means to distribute captured solar energy.
ex. a solar hot water heater
- **Passive:** The use of integral building components to capture the sun's energy.
ex. south facing windows

Passive Solar Energy:

Benefits

Designing the buildings we live in to capture the ambient energy of the sun through passive solar features, . . .

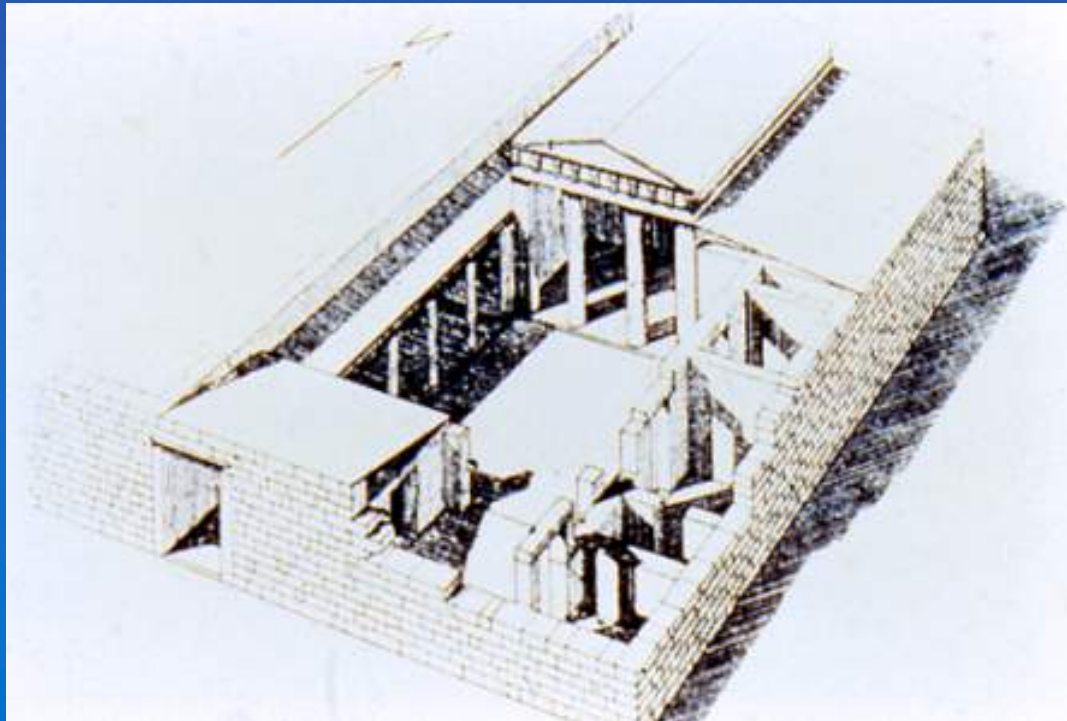
- is one of the least expensive and most environmentally friendly methods of providing our energy needs.
- makes use of the steady supply of solar energy by means of building elements such as walls, windows, floors and roofs, in addition to exterior building elements and landscaping.
- gives off no air or water emissions and therefore does not contribute to any of the environmental problems such as acid rain and global warming.

Passive Solar Energy:

History

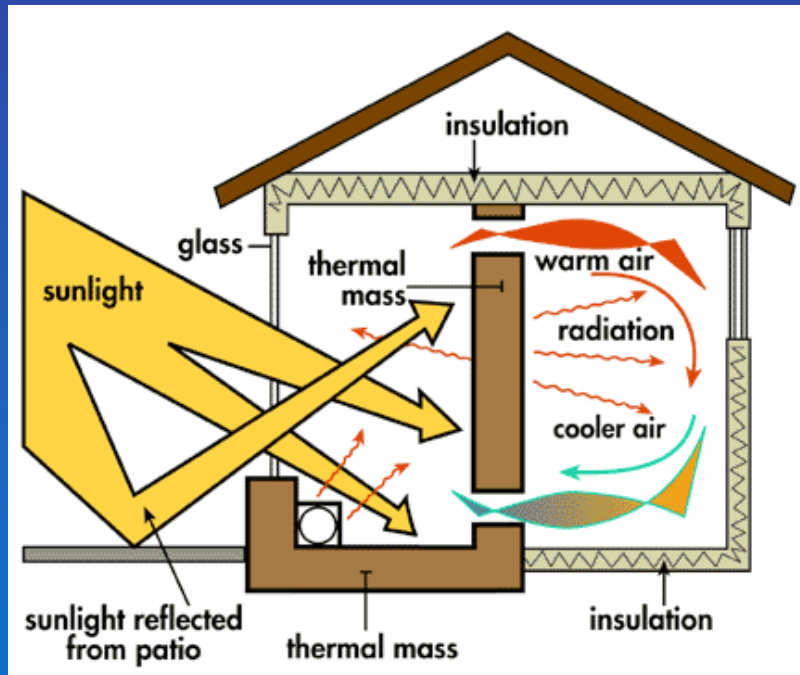
There is nothing new about using the sun's energy to heat our living spaces, humankind has used these techniques for thousands of years.

ex. More than 2500 years ago in Ancient Greece, entire cities were built to take advantage of the sun and climate.



Passive Solar Energy:

Direct-Gain

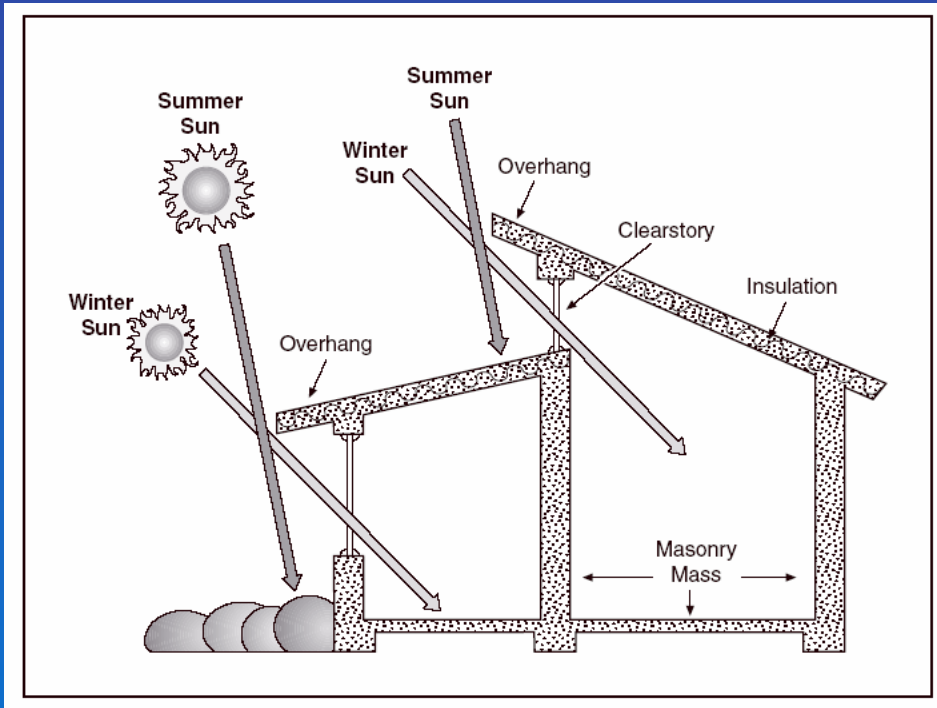


- Use of south facing windows allows for the most heat to be brought into the home.
- That heat is absorbed into a thermal mass that provides radiant heat during the night.

Passive Solar Energy:

Angling for Maximum Efficiency

- Solar homes are designed to take advantage of the changing position of the sun to allow sunlight to shine into the house in the winter and to block it during the summer.



Passive Solar Energy:

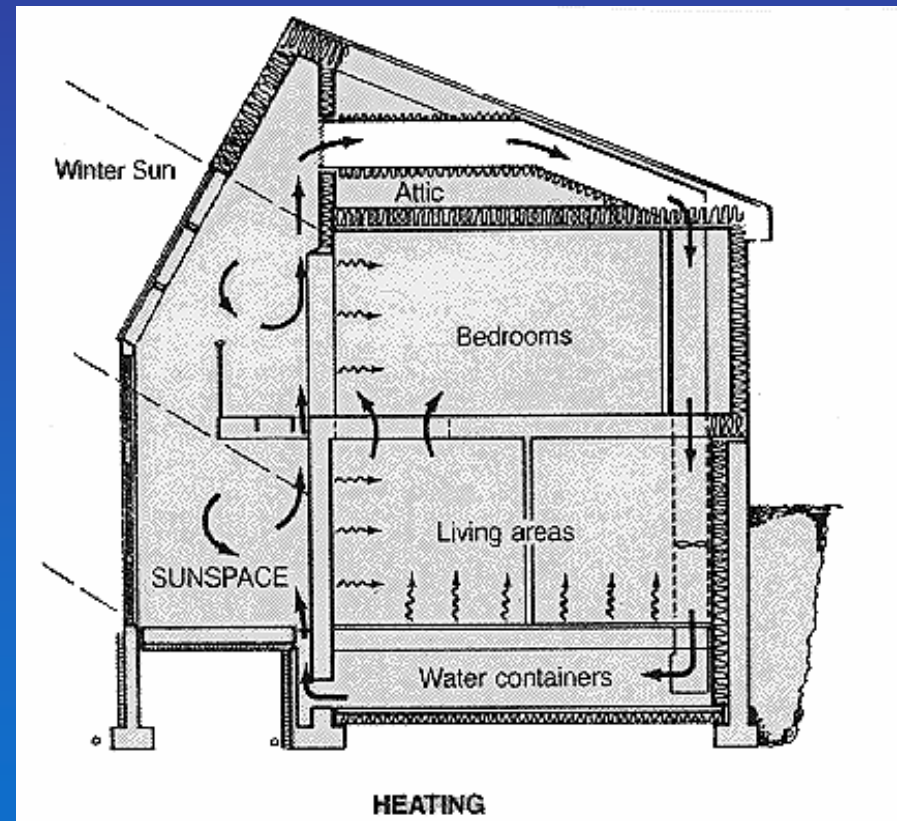
Thermal Mass

- Solar homes function best when they are constructed with dense material that gains and loses heat slowly.
 - These materials include water, adobe, insulated concrete and masonry.
 - The thermal mass absorbs heat during the day when the sun is shining and releases it at night.

Passive Solar Energy:

Heating

- Key elements:
 - Orientation - it is best to situate buildings on an east-west axis.
 - Thermal Mass - should allow for radiant heating.
 - Insulation - helps to maintain temperatures.



Passive Solar Energy:

Free Heat from the Sun

- When designed properly, a direct-gain solar home in Amarillo, TX could get up to 75% of its annual heating from the sun.

**RELATIONSHIP BETWEEN DIRECT-GAIN GLAZING
AND HEAT CONTRIBUTED BY SUNLIGHT**
(Single-Story House)

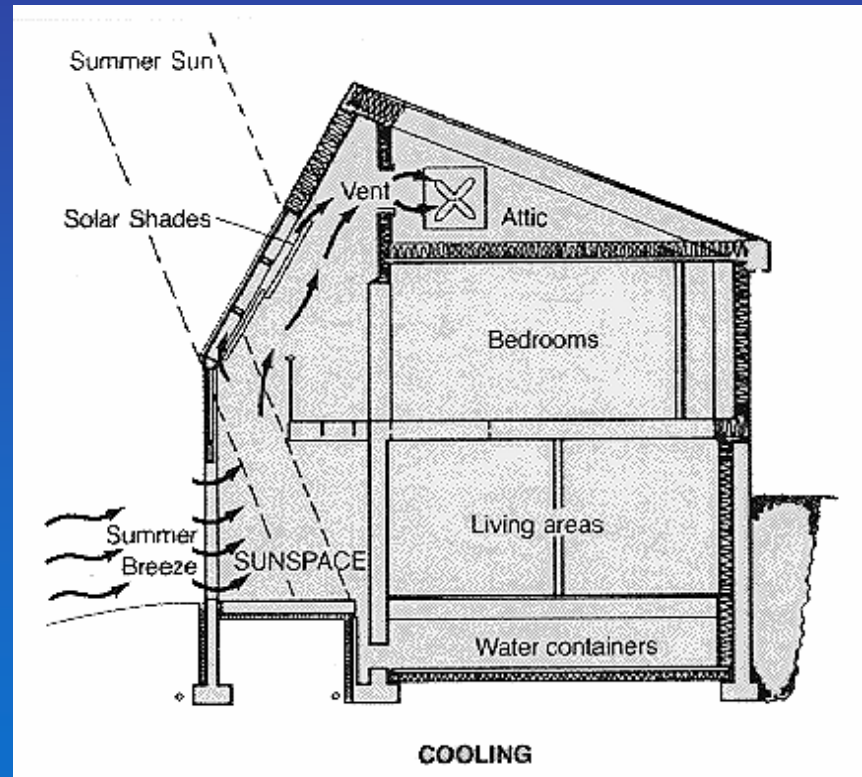
| City | Percent South-facing Glazing Necessary (Compared to floor area) | Percent Annual Heating from Solar Contribution* |
|----------------|---|---|
| Abilene | 8 to 15 | 44 to 69 |
| Amarillo | 12 to 19 | 54 to 75 |
| Austin | 6 to 12 | 36 to 63 |
| Brownsville | 3 to 7 | 33 to 60 |
| Corpus Christi | 4 to 9 | 35 to 62 |
| Dallas | 6 to 13 | 35 to 63 |
| Del Rio | 6 to 11 | 38 to 64 |
| El Paso | 10 to 16 | 58 to 77 |
| Fort Worth | 6 to 13 | 35 to 63 |
| Houston | 4 to 10 | 28 to 58 |
| Laredo | 4 to 8 | 33 to 60 |
| Lubbock | 11 to 18 | 56 to 76 |
| Lufkin | 6 to 12 | 34 to 62 |
| Midland-Odessa | 10 to 15 | 55 to 75 |
| Port Arthur | 5 to 11 | 32 to 61 |
| San Angelo | 8 to 14 | 44 to 69 |
| San Antonio | 6 to 11 | 36 to 64 |
| Sherman | 7 to 14 | 34 to 62 |
| Waco | 6 to 12 | 35 to 63 |
| Wichita Falls | 8 to 15 | 40 to 66 |

* Assuming heavy masonry mass 3 to 4 inches thick with a surface area at least three times as great as the area of south facing glass (with six times preferred).

Passive Solar Energy:

Cooling

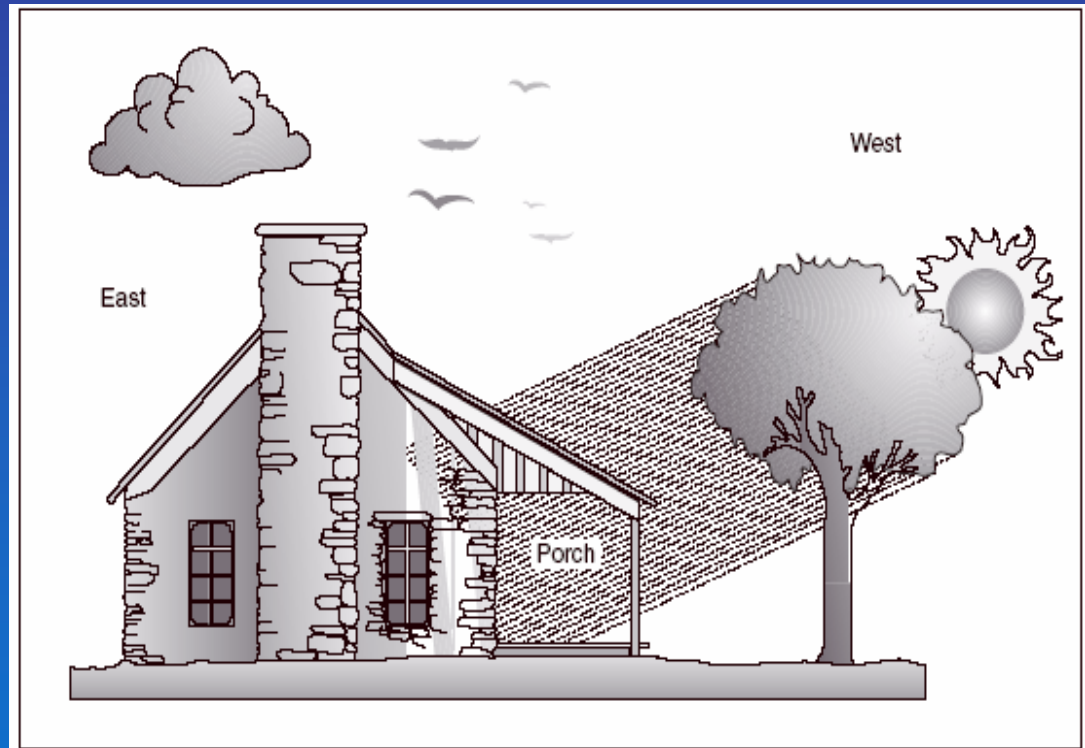
- The use of curtains, shades & blinds, especially on the south facing windows, keep the thermal mass cool, and in turn keep the house at a comfortable temperature.



Passive Solar Energy:

Cooling

- Additionally, proper landscaping can reduce energy costs by using natural shading.
- Placing trees and ‘buffer spaces’ like porches and garages on the west façade.



Passive Solar Energy:

Pros & Cons

Pros

- Very inexpensive, (for new construction) because it does not involve machinery.
- Almost no effect on the environment

Cons

- Although retrofitting a building is possible it is often fairly expensive.
- Requires a lot of planning and organization.

Passive Solar Energy:

Conclusions

- Passive solar energy has the potential to supply a large portion of the energy needs for a properly designed building.
- Passive solar energy, while often seen as “low-technology”, represents in many cases, the cleanest, and least expensive possible source of useful energy for buildings.
- Recent advances in technology and building materials have greatly expanded the tools for architects to work with, and thus the potential for passive solar energy.