PASSIVE SOLAR DESIGN

Putting Design to Work

By incorporating passive solar design early in the planning and construction process of a building you can greatly reduce your energy consumption and lessen your dependence on mechanical heating and cooling systems.

Taking into consideration the predictable seasonal path of the sun, as well as the regional environment (i.e. temperature, wind and sources of shade) homes can be designed to use the natural movement of heat and air for temperature regulation, ventilation and lighting.

Techniques and materials used in passive solar designs vary from building to building, but all share common characteristics. One of the core principals of passive solar design is to either minimize or maximize **solar gain**, which is the amount of heat generated and contained in a given space. In the summer, minimal solar gain is achieved though external shading and window placement. However winter solar gain is maximized through window technology and window placement.

How Is It Done?

Characteristics of a well designed passive solar strategy include; building orientation, overhangs and shading, windows, thermal mass and insulation.

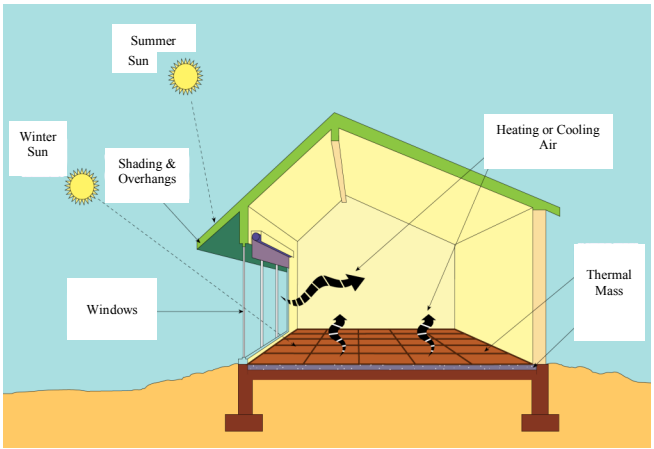

Image Credit: Department of Energy

Did you know…?

The Camp Kawartha Environment Centre orientated the building due south so as to capture as much passive solar energy as possible

1.Building Orientation

It is important to ensure that the building has a south facing orientation so that it is exposed to as much solar energy as possible. In most situations, a building oriented to approximately 30° east or west of due south will capture 90% of solar energy.

2.Overhangs & Shading

Overhangs and shading play a vital role in passive solar design, as they control how much sun hits the windows depending on the time of year. In the summer, when the sun is at its highest, overhangs prevent the sunlight from overheating the building. Conversely, in the winter, when the sun is lower in the sky, overhangs do not impede the sunlight from entering the room, thus warming the building.

Thoughtful landscaping can also compliment overhangs and help keep buildings cool throughout the summer, particularly trees and vine-covered trellises along the south, east and west walls. Deciduous trees and vines are best along these walls as they will provide shade in the summer but, in losing their leaves in the winter will allow sunlight to enter the building. Planting coniferous trees along the north-west face of a building further compliment passive solar design by shielding the structure from cold winter winds.

3.Windows

Windows are probably what come to mind first when thinking of passive solar heating, and rightly so. The placement, number and type of window are all of the upmost importance. In heating climates, such as Canada, the majority of windows should be located on the south facing wall.

By limiting the number of windows on the north, west and east walls the building will be better insulated against heat lost in the winter and overheating in the summer

When selecting windows for a passive solar building, there is lots to consider. Windows installed on north facing walls can have interior coatings to insulate against heat loss, where as windows on west facing walls can have an exterior coating to help keep the setting sun out. Many window features aim to keep the heat in and strong summer sun out. These features include multiple panes of glass, a frame made out of fiberglass or wood rather than metal, and specialty coatings that make it difficult for infrared heat to pass to the outdoors.

Did you know…?

The windows in the Environment Centre are triple glazed with low emissivity coatings and filled with krypton, an inert gas, to improve insulation

Photo Credit: Shelby Parker

4.Thermal Mass

Thermal Mass, material which absorbs, stores and releases warmth. Have you ever felt a warm brick wall in the fall after the sun has set? Then you have experienced thermal mass. Thermal mass can be many things and common materials include brick, tile or concrete.

In the winter, heat is absorbed into the thermal mass through direct sunlight. This process is reversed overnight, with the thermal mass releasing its stored heat into the surrounding environment. In the summer direct sunlight could result in overheating. Therefore thermal mass should be shaded, and instead of draw warmth from sunlight, it will take it from the surrounding air, cooling the room.

5.Insulation

The final element to a well designed passive solar building is effective insulation. For without it the building would not be able to maintain a stable temperature. Preferably every surface between the building and the exterior should be insulated; this includes attics, crawlspaces, basements and garages. Also, be sure to check for drafts around windows and doors to ensure the tightest seal possible.

Did you know…?

The Environment Centre makes use of natural materials with insulative qualities such as straw and hemp. The building also incorporates recycled and salvaged materials such as cellulose (newsprint) and factory cut offs from jean manufacturers.

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Photo Credit: Shelby Parker

For more information on passive solar construction check out these resources;

- Kachadorian, James. (1997). *The Passive Solar House, revised Edition: Using Solar Design to Heat and Cool your Home*. Vermont: Chelsea Green.
- Chiras, Daniel. (2002). *The Solar House: Passive Heating & Cooling*. Vermont: Chelsea Green.

Bibliography

- Snell, Clarke. (2004). *The Good House Book: A Common Sense Guide to Alternative Building.* New York: Lark Books.
- www.buildgreen.ca
- www.nmsea.org

THE CAMP KAWARTHA Environment Centre

The Environment Centre & Camp Kawartha Outdoor education Centre