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PASSIVE SOLAR BUILDING DESIGN
(AN ENERGY SAVING ECO-FRIENDLY CONSTRUCTION OF BUILDING)

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ABSTRACT

Passive solar energy is an excellent idea to heat, cool and lighting the home based on the structure of our buildings. It is use to distribute heat or cool through wise selection of building material, passive solar energy design will provide inexpensive sustainable alternatives for heating and cooling of homes.

A major constraints in meeting this demand is the spiraling cost of energy and other changes in climate. Passive solar buildings aim to maintain interior thermal comfort throughout the sun's daily and annual cycles whilst reducing the requirement of active heating and cooling system Passive solar building design is one part of green building design, the scientific basis for passive solar building design has been developed from a combination of climatology, thermodynamics (particularly heat transfer), and human thermal comfort (for buildings to be inhabited by humans). Specific attention is directed to the site and location of the dwelling, the prevailing climate, design and construction, solar orientation, placement of glazing-and-shading elements, and incorporation of thermal mass. While these considerations may be directed to any buildings ,achieving an ideal solution requires integration of these principles. And this paper intends to discuss demand for passive solar building design, interior thermal comfort, energy saving in the future by following passive building design, orientation of building according to solar parts, passive solar heating strategies and relative design methods, environment-friendly, energy efficient technology.

Key words: *Solar energy, Orientation, Demand and Design,Wide Range , Availability*

INTRODUCTION:

New construction offers the greatest opportunity for incorporating passive solar design, passive solar system make use of natural energy flow as the primary means of harvesting solar energy, passive solar system can provide space heating, cooling load avoidance, natural ventilation and day lighting.

Passive solar design refers to the use of the sun energy for the heating and cooling living spaces. In this approach, the building itself or some element of it takes advantage of natural energy characteristics in materials and air created by explosure to the sun. passive system are simple, have few moving parts and require minimum maintances and require no mechanical system.

Sun light can provide ample heat, light and shed and induce summer time ventilation into the well design homes. Passive solar design can reduce heating and cooling energy bills, increase spatilvetalityand improve comfort. Homes constructed as passive design use the natural movement of heat and air to maintain comfortable temperature operating with little or no mechanical assistance.Its called passive solar because the design of the home maximizes the benefits it receives from the sun with standard construction features. Passive solar takes advantage of local breeze and land scape features such as shade trees and wind brakes and uses a simple system to collect and store solar energy with no switches or controls.

Why passive?

Passive energy design meets the minimum requirements of non convectional energy resources. Rather than active which produces the green house gases such as carbon di oxide.Its eco-friendly and causes no harm. Passive solar design is much cheaper than active solar energy design as it is expensive and need more mechanical equipment are need for installation..

OBJECTIVES

The objective of this paper is to design a passive solar building that is energy effective and uses the solar energy efficiently. Perfect utilization of energy that is to be carried out while designing. The appropriate use of solar energy as it explains us the concept of passive heating and passive cooling and relatively day lightning and also the various renewables and non-renewables sources of energy that is to be preserved.

WHAT ARE PASSIVE SOLAR BUILDING DESIGN AND HOW IT WORKS:

In passive solar building design , windows, wall , and floors are made to collect, store ,and distribute solar energy in the form of heat in the summer. This is called solar passive design because unlike solar

heating systems , it does not involve the use of mechanical and electrical devices.

The key to design solar passive building is to best take advantage of local climate performing an accurate site analysis .elements to be considered include window placement and size, and glazing tile, thermal insulation, thermal mass, and shading. Passive solar design techniques can be applied most easily to new buildings, but existing buildings can be adapted or "retrofitted.

Working Principle:

Passive solar building are designed to let the heat into the building during the winter months, and block out the sun during hot summer days. This can be achieved by passive solar design elements such as shading implementing large north facing windows and building material that absorbs and slowly release the sun's heat.

CONCEPT OF SOLAR PASSIVE BUILDING:

The rate of increasing population growth with increasing innovations in the field of industries and technologies have all together resulted in the increasing energy consumption enormously. This high consumption is a concern for sustainability. This has a negative impact on the environment and energy conservation.

So, an innovation in building construction, that would perform with the existing energy, without exploiting any additional mechanical or electrical sources is called passive solar building design concept. These buildings take the advantage of the climate, where it must be constructed. A proper site analysis would judge the performance of the building.

The main concept of passive solar buildings is that its building elements i.e. the windows, walls and the floors are made able to collect solar energy and store them. This energy is then used in the winter for warmth and used to reject the heat during the summer seasons.

PRINCIPLE OF SOLAR PASSIVE DESIGN:

Solar passive design is concerned with 10 basic principle that is to be achieved

1.Site Selection – Select a site protected from afternoon sun with good solar access , while remaining sheltered from cold winds during winter.

2.Orientation – Position the buildings long axis toward solar north which willmaximize solar gain during winter month and limit western exposed windowsin the summer.

3.Window placement –choose energy efficient glass European windows, arranging them with consideration to minimize summer heat and winter heat gain.

4.Shading – configure shading devices , such as eave overhangs or external shadingdevices.

5.Room Layout –rooms used more frequently placed on the north side for optimal use of natural light during day.

6.Insulation – supply a continuous insulation layer, with thickness appropriate toclimate, surrounding the entire conditioned space of the building.

7.Air-sealing – supply a continuous air barrier surrounding the entire building envelope , in contact with the insulation layer.

8.Ventilation – every building must have ventilation in order to sustain good indoor air quality. Energy efficient , air tight buildings need a heat (energy)recovery ventilation system.

9.Thermal mass – heavy material such as brick, concrete, tile and stone should be utilized in appropriate thicknesses and areas to insulate the building envelope to store heat and help balance temperature fluctuations.

10.Landscaping – carefully planned landscaping and planting can aid in maximizing performance of passive solar design and assist with imperfect

Situation and site problems.

DESIGN ELEMENTS OF SOLAR PASSIVE BUILDING:

a. Placement of room-types, internal doors and walls, and equipment in the houses.
b. Orienting the building to face the equator (or few degrees to the east to capture morning sun).
c. Extending the east/west axis.
d. Adequately sizing windows to face the midday sun in the winter , and be shaded in the summer.
e. Minimizing windows on other side, especially western windows
f. Erecting correctly sizes, latitude-specific roof overhangs, or shading elements.
g. Using the appropriate amount and type of insulation including radiant barriers and bulk insulation to minimize seasonal excessive heat gain or loss
h. Using thermal mass to store excess solar energy during the winter day (which is then re-radiated during the night).

ORIENTATION FOR PASSIVE HEATING AND COOLING:

For maximum solar gain, a building will be located, oriented and design to maximize window area facing north(or within 20degrees of north). Orientation of solar gain will also depend on other factor such as proximity to neighbouring buildings and trees that shade the site. For solar gain as well as considering

location, orientation, and window size and placement, it is also important to consider the thermal performance and solar heat gain efficiency of the glazing unit itself.

Where solar gain of passive heating is important, other considerations include noise, daylight, protection from prevailing winds access to breeze for ventilation and shade to prevent summer overheating.

Where passive cooling is more of a priority than passive heating, the building should beoriented to takeadvantage of the prevailing breeze**.** If optimal orientation cab be achieved , it will reduce some of the heating requirement, reduce energy costs and reduce greenhouse gas emissions.

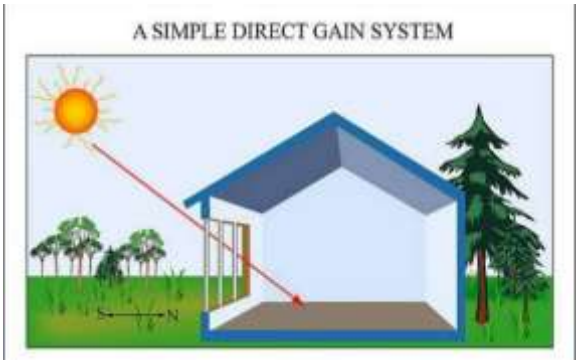
SYSTEMS:

The system is classified into 3 types of gains.

a. Direct Gain.
b. Indirect Gain (Trombe wall).
c. Insolated Gain (Sunspaces).

1. Direct Gain.

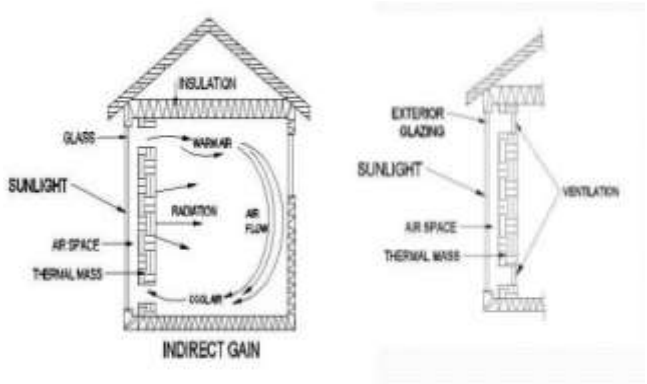
In a direct gain design, sunlight enters the house through north-facing windows and strikes masonry floors and/or walls which absorb and store the solar heat. As the room cools during the night, the thermal mass releases heat into the house.



2 .Indirect Gain (Trombe wall).

An indirect gain passive solar home has its thermal storage between the north-facing windows and the living spaces.

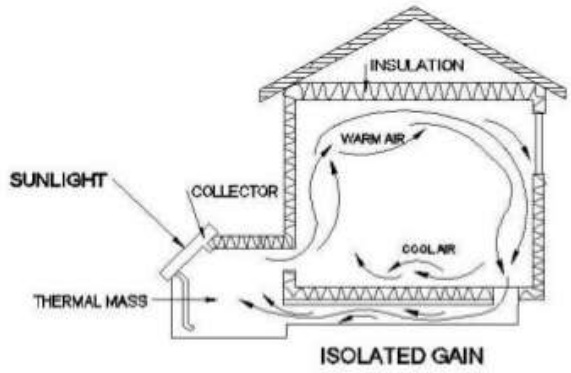
The common indirect gain approach is a Trombe wall.



3. Isolated Gain (sunspaces)

The most common isolated gain passive solar home design is a sunspace that can closed off from the house with doors, windows, and other operable openings. Also known as sunroom, solar room, or solarium, a sunspace cab beincluded in a new home design or added to an existing home.

Sunspaces should not be confused with greenhouses, which are designed to growplants. Sunspaces serve three main functions ---they provide auxiliary heat, a sunny space to grow plants, and a pleasant living area.



ADVANTAGES OR BENEFITS

a. Solar passive building brightens up the interior of the building would be filled with sufficient light this is due to the transmission of visible light frequencies . the system is designed in such a way that the control over lighting is kept in mind.
b. Ultraviolet energy is blocked. The direct ultraviolet rays are harmful. The passive solar building system has the advantage of blocking almost 99.9% of the ultraviolet radiation energy. Preventing this would save the interior fabrics as well as décor and make them long lasting.
c. Summer is made cooler and comfortable. It keeps the interior cool during the hot season. This would obviously reduce cooling energy costs.
d. We can harness the power of sun as India is blesses with 300 days of sunny weather out of 365 days.
e. Winters are made warmer and comfortable.
f. Cost of installation is low and less or almost no use of convectional equipments.

CONCLUSION:

Solar energy has been used for centuries and has only improved with time, as scienctists and researchers made it into effective way of use. Passive solar energy is very cost efficient way to take steps towards sustainability. Due to its advantages of direct entering of lights it brighten up the interior and transmits visible lights. It blocks ultraviolet energy it get cooler and comfortable in summer and warmer in winters due to the use of special material such as thermal mass, thrombe walls and radiant panels. These design can perform effortlessly and quietly without mechanical or electrical assistance. The reduction can be made to heating bills by as much as 40% annually and also improve the comfort of living spaces. Simple techniques can make huge difference in comfort and energy consumption through years. And hence the economical solution to a warmer house in the winter and cooler house in the summer is to insulate well,

while understanding the movement of heat it is the better solution.

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