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# Passive Solar Technology and its Techniques

**J. Gowtham Narayanan***Department of Architecture**RVS School of Architecture, Dindigul, Tamil Nadu, India* <https://orcid.org/0009-0006-0760-1679>**Abstract**

*Passive solar technique is which converts the natural energy into usable energy resources. The passive solar energy is the sunlight that is been got directly or indirectly are been converted to heating or cooling purpose. This process is been effectively used all over the world for the future development. As the usage such as the solar technologies and other innovative techniques this does not involve in most of the mechanical process. Solar energy is mostly environmentally friendly and eco friendly that are blending with day to day life. The light and heat that are been got naturally are used to provide electricity that can be used in building's interior and exterior purpose. The most possible ways that the passive solar technique is that the maximum use of the windows and doors, shading devices, louvers and angular roofing are the methods that can be used for the passive solar energy techniques. The next method passive solar heating is also an technique that makes or traps the heat and saves the heat in any part of building based on the required material. This allows heat that is needed at required times during different weather conditions the passive solar technique plays an important role during different climatic conditions. During the summer season it prevents the direct heat entering the building and can be reduced based on growth of the plant such as shrubs and creeper plants. During the winter season it emits the heat to the entire building such as the material been used such as concrete, thermal mass material, stone slabs, these have more emitting power and makes the entire place more warm and heat. Most of the application techniques and methods will be studied later with following research ideas.*

**Keywords: Renewable, Eco Friendly, Louvers, Direct Heat, Thermal Mass.****Introduction to Passive Solar Technique**

The passive solar building design helps the windows walls, floors that are used to collect and store and reflect and distribute the gained solar energy that's been got naturally. This is been split up based on heat season and cold season. In the form of heat during the winter season and it rejects the heat during the summer. This in the need of solar heating systems it does not involve the use of mechanical and electrical devices. The basic key idea of the solar building is to make the best performance based on the local climatic condition and the exact site been analyzed. The most important aspect to be considered are the windows or the placement of windows at the correct position, the glazing typology, the thermal insulation for the sound proof materials or the thermal mass and shading. The passive solar design or the technique to be applied easily in the new buildings with new technologies, but the existing buildings can only be adapted or retrofitted. solar path also plays an vital role in the field of passive solar design techniques. The sun path indicates the change of the sun direction during the several months at different time period or intervals. Most of the sun path diagrams are been analyzed for the months of January, March, June, September, December. During each and every month the sun path moves in different directions which provides shading at various angles or direction that reduces the direct heat entering the building. The maximum amount of heat is been captured at the south region because of the equator present in that location.

The major difference been found in the altitude of the sun is that the solar noon that's between winter and the summer that forms the basis of solar passive design. The careful arrangement of the rooms is the major task for eh passive solar design. The basic recommendation for most of the dwelling places is to live in the areas that's been facing solar noon and the sleeping place at the opposite side for better feeling inside the room by the strategic placement of the shading devices such as louvers, windows that prevents the solar gain heat entering inside the building. This is been followed thought out the year for better experience of the climatic condition for the surrounding. The direct gain passive solar system is more sufficient thermal mass condition that is used to prevent large amount of temperature fluctuations in the indoor air quality

### Types of Passive Solar Heating

The three major types of passive solar heating systems are based on the certain weather conditions. The types are direct gain, trombe wall, and attached sunspace. Among the all three types , direct gain will be the more simplest form of common passive solar strategy. The other major methods of the passive solar heating are conduction, convection and radiation. conduction of materials is that the change of the particles from one place to another or its transformation. This occurs between the particles form one place to another. This occurs between the kinetic energy from other particles. It also indicates the need of direct contact with thermal energy. Convection is the method that works with the principles of transferred heat movement that converts heat such as air or water. Convection is the process that converts the heat from on have place to another through liquid and gases. the heat loss may be gained from the surrounding warm air to cooler air. The air that passes from one place to another is mostly transferred from skin surfaces not only evaporates moisture but it also transfers sensible heat to the body that produces heat content. When the rate of the air movement is large compared with the body temperature and the surrounding air movement. Radiation is the energy that comes from the source and that travels through space at the total speed of light. This type of light has more amount of electric

field and the magnetic field blended with it and has the wave properties that satisfies all characters. The radiation can be mostly divided into types such as non ionizing radiation and ionizing radiations. Non ionizing radiations are having more ionizing energy that transfers the large amount of atoms or molecules for a greater energy. The radiation is that has all the properties and its called as the electromagnetic radiation. Radiation is the flow of atomic and subatomic particles and of the wavers such as those are been characterized by the three different type of rays such as alpha rays, gamma rays, beta rays.

### Shading Devices

Shading devices are that which has the higher level of comfort inside the building and outside the building which provides more thermal comfort to the building and the people those who reside in the building. This automatically makes the indoor environment better occupants that satisfies the important factors such as the temperature, humidity, and the intensity of light. There are many possible reasons that the shading devices play an important role in the day to day life of the buildings. The amount of day lighting to be reduced in the cold climatic condition. In this type of climatic region the shading devices are mostly used to make the heat to enter the building and make it more warm condition. Similarly in the hot climatic condition the number of shading devices such as large windows, ventilators, and louvers are been reduced to prevent the direct heat entering the building. When this type of shading devices are been used it makes the region more warm condition. The well designed building such as the sun control and shading devices can be orderly reduce the building peak heat gain or heart loss and the cooling requirement that naturally improves the worth of the building interiors.

The basic sun control shading can be provide by the wide range of building components such as:

1. Landscaping elements and mature trees
2. Overhanging fins at the exterior features.
3. Light shelves at exterior elements.
4. Low shading devices such as glass.
5. Internal glare control and control devices.

## Passive Solar Building Concepts

The passive solar buildings uses most of the solar energy that is been gained during day time in enormous amount. The increase in the population growth maybe the reason for the increment of the heat energy during the time period of years. The growth of the industrialization may also leads to the need of energy consumption enormously in day to day activities. The high consumption have almost all the techniques for the increasing of energy consumption regularly. This mostly causes the negative impact towards the environment for the better living. The innovative methods been used are been implied for the better environment. The use of existing energy in the building with out exploiting the additional need of the electrical and mechanical sources are called as passive solar building concept. The major concept of the passive solar building is that the basic elements such as the usage of the floors, windows, walls, and the flooring materials that are been made to collect the solar energy and store them for their usage or regular use. Most of the collected energy that are been used naturally are been properly used during the winter and the summer season effectively. The workspace that we are working based on the human thermal comfort are been taken as granted for an safe and comfortable environment. The basic human body temperature is about 37 degree Celsius which emits more amount of radiation. If the heat content of the body increases the process of sweating takes place and makes the body more tired and uneasy. The uncomfortable environment makes the place more deadly and makes the impact of radiation. The thermal radiation indicates that the electromagnetic radiation or waves requires no medium. The property of the thermal radiation is that the convective heat transfer and must be included in computational free flowing dynamic modeling to have the best thermal comfort factors. Most of the electromagnetic waves are in full power that the load are been transferred form one place to another by different means. The radiation may be of different types such as short wave radiation and long wave radiation. The short wave radiation indicates the solar radiation and the long wave indicates the surface temperature and atmosphere radiation. The four major factors that are been considered for

the radiation are as the air temperature, humidity, wind speed and solar radiation.

## Implementation Process

The major implementation process is that it mostly takes the advantage of a building site , climatic condition of the location, building materials that is been used to reduce the energy that is been used regularly. The passive solar designed residence indicates that the reduction of the heat and cooling loads that are been reduced through the energy efficient strategies that are reduced in total loads in whole or part with the effect of solar energy. The major application of the process implementation is the use of appropriate materials that are suitable to heat such as dark floors, and south facing windows. The major use of the dark floor is that to absorb the direct heat to the building and it collects or traps the heat in he building and releases during the hot climatic condition.

## Out Come of the Study

The major outcome of the study is the passive terminology with less amount of used mechanical equipment so its easy to use solar or solar gain the and use of the electrical equipment with many solar energy and energy and solar energy.

## Conclusion

As in the current trends or current era we are in need of more amount of electrification process. But in the recent technology the use of mechanical equipment are been widely used. In order to prevent all these issues large amount of windows or ventilators, and louvers can be given to reduce the direct amount of heat entering inside the building. Thus the passive solar design plays an important role in designing of large scale buildings or commercial buildings.

## Reference

- Attal, A. S., et al. "Review on Passive Solar Buildings." *International Engineering Journal for Research & Development*, 2021.
- Brislin, Ralph. *The Effective Security Officer's Training Manual*. Elseveir, 1998.
- Chandel, S. S., and R. K. Aggarwal. "Performance Evaluation of a Passive Solar Building in

- Western Himalayas." *Renewable Energy*, vol. 33, no. 10, 2008.
- Charde, M., et al. "Passive Solar Design for Energy Efficiency in Buildings in Composite Climate." *International Conference on Recent Advances in Fluid and Thermal Sciences*, 2019.
- Chiras, Daniel D. *The Solar House: Passive Heating and Cooling*. Chelsea Green Publishing, 2002.
- Dash, Shanta, and Mahendra Joshi. "Analysis of Solar Passive Architecture for Historical Structures in Hot and Dry Climate." *International Journal of Engineering Research & Technology*, vol. 10, no. 3, 2022.
- Goel, Sushma. *Management of Resources for Sustainable Development*. The Orient, 2016.
- Mazria, Edward. *The Passive Solar Energy Book: A Complete Guide to Passive Solar Home, Greenhouse, and Building Design*. Rodale Press, 1979.
- Mishra, Ram Kumar, et al. *Smart Cities for Sustainable Development*. Springer, 2022.
- Saxena, H. M. *Environmental Ecology, Biodiversity and Climate Change: Towards Sustainable Development*. Rawat Publications, 2015.
- Schiller, Lindsey. *The Year-Round Solar Greenhouse: How to Design and Build a Net-Zero Energy Greenhouse*. New Society Publishers, 2016.
- Strange, Tracey, and Anne Bayley. *Sustainable Development: Linking Economy, Society, Environment*. OECD Publishing, 2008.
- Striebig, Bradley. *Engineering Applications in Sustainable Design and Development*. CL Engineering, 2015.
- Subramanian, C. V., and M. Divya. "Solar Passive Architecture Cooling Techniques." *International Research Journal of Engineering and Technology*, vol. 3, no. 12, 2016.

#### Author Details

**J. Gowtham Narayanan**, Department of Architecture, RVS School of Architecture, Dindigul, Tamil Nadu, India,  
Email ID: gowtham.architect@gmail.com