

# Effectuate Energy Efficiency Building Using Passive Design

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**Abstract:** Designing energy efficient and comfortable buildings requires harmonizing the complex interactions of architecture, construction and building service engineering. The building envelope has a particular importance, since it integrates many functions and has direct influence on indoor climate. Focusing on satisfaction of the user means that the indoor climate is a key for a holistic design approach. Only a satisfied user will not intervene with the designed energy concept or the indoor climate control; dissatisfaction results in multiple system interventions which may cause waste of energy and sometimes even damage to building envelope components. Satisfaction with the indoor environment also increases working productivity or enables effective recreation of residents. The paper deals with international research activities in the field of climate specific building design. Various comfort and energy monitoring surveys of office buildings as well as residential buildings provide substantial information about the occupants' behavior and their needs during specific situations under different outdoor climates. This information allows summarizing basic climate dependent design principles which architects should keep in mind during the early stages of the design process. It also helps to develop strategies aiming at reducing building energy demand and at the same time consider comfort aspects. The second part of this paper demonstrates application of the climate dependent design principles in a housing project in Chennai.

**Keywords:** climate specific design, hybrid cooling, hurothermal building, energy efficiency.

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## 1. INTRODUCTION

Passive design refers to a design approach that uses natural elements, often sunlight, to heat or cool or light a building. Passive solar or passive cooling designs take advantage of the sun's energy to maximize heating or cooling based on a building's sun exposure. Systems that employ passive design require very little maintenance and reduce a building's energy consumption by minimizing or eliminating mechanical systems used to regulate indoor temperature and lighting. A passive house is a building for which thermal comfort can be achieved solely by post-heating or post-cooling of fresh air mass, which is required to achieve sufficient indoor air quality conditions- without the need for additional recirculation of air. Energy saving is a high-priority in developed countries. For this reason, energy- efficient measures are being increasingly implemented in all sectors. The residential sector is responsible for an important part of the energy consumption in the world. Most of this energy is used in heating, cooling and artificial ventilation systems. As the population increases day by day at rapid pace, the demand for electricity also increasing every day. Today electricity has become necessity for all. Be it a business or regular job, it is nearly impossible in this competitive world especially in Chennai. Large amount of Co2 and other harmful gases are being released into atmosphere burning these fuels which is resulting in poor air quality. Global warming and depletion of valuable resources, but to our dismay, these methods are too costly and the output is also not satisfactory. So, I thought of innovating a building which will generate more energy than the building requires for functioning namely "Effectuate energy efficiency building using passive design for apartments in Chennai". By using low e glasses we can bring down the temperature and cool the building. The project can be implemented to all existing residential buildings, existing commercial buildings, new residential buildings, new commercial buildings. Shopping malls etc. and make them energy efficient building using passive design.

**PASSIVE DESIGN:**

Passive design is design that takes advantage of the climate to maintain a comfortable temperature range in the home. Passive design reduces or eliminates the need for auxiliary heating or cooling. The importance of passive design cannot be overstated. Paying attention to the principles of good passive design suitable for your climate effectively 'locks in' thermal comfort, low heating and cooling bills, and reduced greenhouse gas emissions for the life span of your home. Passive design utilises natural sources of heating and cooling, such as the sun and cooling breezes. It is achieved by appropriately orientating your building on its site and carefully designing the building envelope (roof, walls, windows and floors of a home).

**2. SCOPE OF THE PROJECT**

- The project will enhance and support of power in housing of Chennai.
- The project will help in designing the energy efficiency building using passive design and meet the energy demand.

**3. PROCESS**

- Site Study.
- Energy usage in each house.
- Low E glass.
- Research Analysis.
- Conclusion

**A. Site Study:**

The project was started by studying the energy efficiency of the four buildings in Chennai. Followed by this, a study of various climatic condition, energy used, and passive architecture sources was carefully observed. Low e glasses are used, it reduces the indoor temperature keeping the building cool. In this project the analysis of building has been done using revit software which show the temperature of the building before and after using low e glasses for the windows.. Site location at each direction of Chennai are represented according to the H1, H2, H3 and H4.H1 represent the south part of Chennai (Alandur) , H2 represent the east part of Chennai (Nelankarai) , H3 represent the north part of Chennai (Perambur), H4 represent the west part of Chennai (Korattur).

**B. Energy Usage in Each House:**

According to the square feet of the houses in north, south, east and west of Chennai, the power requirements as been calculated. The power requirement in each houses that is H1 – 5.6, H2-6.2, H3-8.2, H4-7.3.The usage of electrical production in houses as been given

Types of houses	Specification	Usage of electrical products	Requirements of power in KWh
h1	2BHK	4 fans and 1 air conditioner 4 lights 1 washing machine	5.6
h2	2BHK	4 fans and 1 air conditioner 4 lights 1 washing machine	6.2
h3	2BHK	4 fans and 2 air conditioner 4 lights 1 washing machine	8.2
h4	2BHK	4 fans and 2 air conditioner 4 lights 1 washing machine	7.3

**C. Low E Glass:**

Glass is one of the most popular and versatile building materials used today, due in part to its constantly improving solar and thermal performance. One way this performance is achieved is through the use of passive and solar control low-e coatings. In order to understand coatings, it's important to understand the solar energy spectrum or energy from the sun. Ultraviolet (UV) light, visible light and infrared (IR) light all occupy different parts of the solar spectrum – the differences between the three are determined by their wavelengths.

**HOW LOW E GLASS WORKS:**

Heat always flows towards the cold. Therefore, window glass without a low-e coating will absorb the heat from your home and radiate it onto the colder outside surface, where it is lost. Low-e glass has a special coating which is a poor radiator of heat and does not allow heat to be transferred to the outside. Instead, the low-e coating actually reflects the heat back into your room.

**D. Research Analysis:**

SITE	BEFORE		AFTER	
	SUMMER	WINTER	SUMMER	WINTER
ALANDUR H <sub>1</sub>	35.11C	24.61C	34.2C	26.11C
NELANKARAI H <sub>2</sub>	33.11C	21.11C	32C	24.44C
PERAMBUR H <sub>3</sub>	39.11C	29.66C	36C	29.44C
KORATTUR H <sub>4</sub>	40.51C	30.11C	35C	28.11C

**CLIMATIC STUDY OF VARIOUS SITE:**

The climatic condition for H<sub>1</sub>, H<sub>2</sub>, H<sub>3</sub>, H<sub>4</sub> is studied for both summer and winter before and after installing low e glass windows. Here during summer heat is reflected back to the atmosphere whereas in winter heat is absorbed maintaining the temperature inside the room

**4. CONCLUSION**

Social and environmental changes have increased focus on conservation of natural resources and sustainable living. Recent economic changes have also caused consumers to reevaluate how they use energy, with new attention being given to maximizing efficiency. As a result, more builders and consumers are turning to green building design and construction. Research is leading to new ways to conserve energy in the construction and daily use of buildings. Developing building methods and financial incentives employed in new construction and in renovation could reduce the amount of energy consumed, save money, and reduce air emissions resulting from generating electricity. The building's heat is considerably reduced by the use of low e glass and also various climatic conditions of Chennai has been studied

- By using rivet software difference in temperature before and after installation of low e glass is found.
- The energy requirement of a residential building can be fulfilled by applying the concept of energy efficient building with low e glass.
- Harmful CO<sub>2</sub> emission and release of harmful gases into atmosphere is reduced and burning of fossil fuels is prevented.
- The building's heat is considerably reduced by the use of low e glass. It reduces the room temperature up to 10°C which not only keeps the heat out of our homes, but also brings down the use of air conditioners and electricity consumption by making the building cool and energy efficient.

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