

# A Review Paper on Energy Efficient Building

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**Abstract:** This paper is based on a review of research that describes user experiences with different types of energy efficient building, reduction of energy demand and emission of carbon gases <sup>[1]</sup>. Energy efficient building may also be required a specific architectural solution <sup>[2]</sup>. An energy efficient building must have followed by these three aspects, 1)Minimum efficiency standard 2)minimum life cycle cost 3) greater energy saving<sup>[1]</sup>.With modernization, the design of buildings and construction is also evolving with time. In this paper, our first priority is to build zero efficient building <sup>[3]</sup>. Zero efficient building means the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site <sup>[1]</sup>. During the time of research, we found that this energy building design was also

Diminished the environmental issues and also helps to prevent the other problems related to the construction <sup>[11]</sup>. Some requirements are essential for designing such type of building (ZEB), 1) skilled engineer 2) material should be appropriate <sup>[2]</sup>. Energy is used in every stage of building life cycle (these stages are the choice of locality, architectural design, building construction, structural system, material selection, usage and maintenance, and waste disposal) <sup>[8]</sup>. According to the World Watch Institution Data, buildings are responsible for the annual consumption of 40% of the world's energy <sup>[9]</sup>.

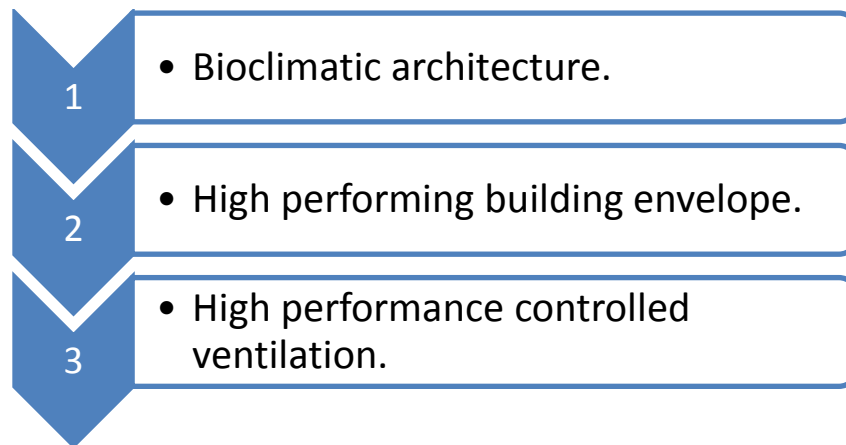
**Keyword** Green Building, Zero Efficient Building (ZEB), Indian Green Building Council (IGBC), Renewable Energy

## Introduction

An energy efficient building means to that type of building whose design provide the significant reduction of the energy need for the heating and cooling, independently of the energy <sup>[2]</sup>. The energy performance of a building shall be determined on the basis the calculated or actual annual energy that is consumed by the utilities and provide for general purposes <sup>[3]</sup>.

There are example of “energy efficient “ buildings in every major country <sup>[5]</sup>. The CIB (international council for research and innovation in building and construction) provide all the aspects for the energy efficient building <sup>[2]</sup>. Some aspects are; 1) defining an energy efficiency standard for new building, and 2) comparing the energy efficiency of different buildings. In this research we explain the Trias Energetica Concept <sup>[2]</sup>.

This can be achieved by;-



**The Trias Energetica concept:**  
the most sustainable energy is saved energy.



Fig. 1

**Zero Efficient Building**

Total amount of energy used by the building on an annual basis is roughly equal to amount of renewable energy created on the site [7]. Most zero efficient building get half or more of their energy from grid, that means the grid provide the main energy to the utilities of building [8]. And we can get the energy from the other sources of energy like non-conventional source of energy which is unlimited in stock [6]. The main source of non-conventional energy is Sun, wind, water and thermal energy; inside and outside the sea [9]. But how can we use these types of energies on the site to getting the efficient building. In case of efficient building better concrete should be provides as the CIB if it needed [9]. Rice husk ash as a partial replacement of cement in high strength concrete containing micro silica: evaluating durability and mechanical properties [4].

RHA produced by burning rice husk between 600de to 700de temperature for 2hrs contains [3];

90 – 95% SiO<sub>2</sub>

1 – 3% K<sub>2</sub>O

<5 % un-burnt carbon

Indian Standard Code of practice for plain and reinforced concrete is IS: 456:2000, recommends use of RHA but not specify the quantity [3].

**Make building more energy efficient:-**

- 1) Site selection and placement of an energy efficient building [5].
- 2) Implementing a whole-building system approach to new construction [6]
- 3) Build near existing infrastructure to save money and resources [9].
- 4) Efficient use of water and electricity and other natural resources [7].
- 5) To minimize the waste and material [4].
- 6) The design should take into consideration building orientation [8].
- 7) The design of an energy efficient building should be sustainable [9].
- 8) Using energy software is an effective way to estimate a building's energy [6].
- 9) Provides thermal insulation, which is low in cost, widely available [6].
- 10) Frame and structure should be tightly sealed and building must be wrapped in a water and breathable material [10].

**Concept of Zero Energy Building**

The zero energy building meant to that building which use the renewable sources of energy (solar, wind, geothermal) at the building site to provide part of all of its energy needs [7]. In USA almost 48% of energy goes to residential and commercial buildings [8]. Net zero building is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site [2]. These building contribute less overall greenhouse gas to atmosphere as comparison to similar buildings [7]. Zero net energy gets half or more energy from the grid, and returns the same amount at other time [1].

Some advantages of these buildings are as follows;

- 1) Integration of renewable energy resources.
- 2) Integration of plug-in electric vehicle.



Fig. zero energy building layout

## Literature

Heerwagen and Paul state that those buildings which mainly design for the green building also perceived as more comfortable, and contribute to a healthier and better living and working environment, reveal case studies have to be conducted [10]. It has been mentioned previously that the architectural and aesthetic of energy-efficient building may have a meaning for the users [8]. But in their research, they have focused only on architectural evaluation and architectural aspects [8].

## Indian Green Building Concept

### IGBC - Indian Green Building Council (2004)

A green building in which used less water, optimizes energy efficiency, conserves natural resources, generate less waste and provides healthier spaces for occupants, as compared to the conventional buildings [1].

IGBC is leading green building movement in the country [11].

Some traditional buildings were energy efficient because architecture dependant on the places instead of sources. Buildings in the hot and dry regions, had corridors directing the wind to cool naturally. In wet regions, structure used natural light and breeze [10][7].

For example;-

Hawamahal

Golkonda

## Conclusion

The construction industry in India rapidly increases day by day. As the sector is growing rapidly, preserving the environment poses lot challenges [7]. The construction must gear up for eco friendly practices which help in creating new jobs and inspiring case from India and around the world [7]. Indian industry needs to adopt the green building concept as soon as possible to preserve the environment and reduces the waste materials which mainly causes the air pollution [10]. Preserving the environment is one of the biggest issue in this modern era in front of all over the world not to any particular country or continent [5]. So, Green Building or ZEB takes a step forward to preserve it. It should be targeted that the energy consumption in construction and operation stages should be transformed from negative to positive, which means that the building should be producing more energy than they consume [1].

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