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# STUDIES ON NET ZERO ENERGY RESIDENTIAL BUILDING

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ABSTRACT

The term Net Zero Energy Building is defined as the building with zero net energy consumption i.e., the total amount of energy used by the building on annual basis is roughly equal to the total amount of renewable energy created on the site. Buildings have a significant impact on energy use and the environment. Commercial and residential buildings account for about 33% of the total electricity in India. The concept of a Net Zero Energy Building, one which produces as much energy as it uses over the course of a year, recently has been evolving from research to reality. Currently, there are only a small number of highly efficient buildings that meet the criteria to be called "Net Zero". As a result of advances in construction technologies, renewable energy systems, and academic research, creating Net Zero Energy buildings is becoming more and more feasible. The aim of this Research Paper is to be focusing on the building to create it a Net Zero by using a Renewable Energy Resources instead of Non-Renewable Resources. In this work, we have carried out a study to analyze the performance of a zero-energy building and found that it is possible to have such building in India.



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## 1. INTRODUCTION

India is the developing country and has become one of the major energy consumers in the world. This is due to industrial growth and globalization which increases the energy demand of the consumers. It is reported in the literature that the urban areas contribute 70% and the housing construction and estate development contribute 40% to the GHG emissions. Few researchers reported that the buildings contribute approximately 50% of the world's air pollution, 42% of GHG emissions, 50% of water pollution and 48% of solid waste to the environment.

### 1.1 Zero-Energy Buildings:

Definitions

A zero-energy building can be defined in several ways, depending on the boundary and the metric. Different definitions may be appropriate, depending on the project goal and the values of the design team and building owner. Net Zero Site Energy: A site ZEB produces at least as much energy as it uses in a year, when accounted for at the site.Net Zero Source Energy: A source ZEB produces at least as much energy as it uses in a year, when accounted for at the source. Source energy refers to the primary energy used to generate and deliver the energy to the site. To calculate a building's total source energy, imported and exported energy is multiplied by the appropriate site-to-source conversion multipliers.Net Zero Energy Costs: In a cost ZEB, the amount of money the utility pays the building owner for the energy the building exports to the grid is at least equal to the amount the owner pays the utility for the energy services and energy used over the year.Net Zero Energy Emissions: A net-zero emissions building produces at least as much emissions-free renewable energy as it uses from emissions-producing energy sources.

### 1.2 Zero-Energy Buildings (Examples)

#### *1.2.1 India*

India's first net zero building is Indira Paryavaran Bhawan, located in New Delhi,inaugurated in 2014. Features include passive solar building design and other green technologies.High-efficiency solar panels are proposed. It cools air from toilet exhaust using a heat recovery wheel in order to reduce load on its chiller system. It has many water conservation features.

### *1.2.2 Malaysia*

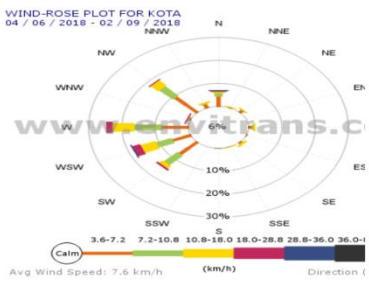
In October 2007, the Malaysia Energy Centre (PTM) successfully completed thedevelopment and construction of the PTM Zero Energy Office (ZEO) Building. The building has been designed to be a super-energy-efficient building using only 286 kWh/day. The renewable energy – photovoltaic combination is expected to result in a net zero energy requirement from the grid. The building is currently undergoing a fine-tuning process by the local energy management team. Findings are expected to be published in a year.

### *1.2.3 China*

One example of the new generation of zero energy office buildings is the 71-story Pearl River Tower, which opened in 2009, as the China National Tobacco Corporation headquarters. It uses both modest energy efficiency, and a big distributed renewable energy generation from both solar and wind. Designed by Skidmore Owings Merrill LLP in Guangzhou, China, the tower is receiving economic support from government subsidies that are now funding many significant conventional fossil-fuel (and nuclear energy) energy reduction efforts.

## 2. SITE SELECTION

Kota and Jhalawar has a tropical wet and dry climate. The weather is hot and humid for most of the year. The hottest part of the year is late May to early June. Hence solar energy is available on the site which makes the site suitable to harness solar energy. Wind is the main mechanism of wind driven ventilation for supplying and removing air through an indoor space without using mechanical systems. For effective design of natural ventilation system, it is important to study about wind direction and speed over a particular location.




Wind Rose Diagram

## 3. STRUCTURAL DESIGNING

The proper design and alignment of the building can make the building cheaper than that of the conventional type of buildings. Usage of hollow bricks and avoidance of columns and beams will result in lowering of temperature inside the building. Design experience in the following areas has been gained during the course of the project.

i. Design of slabs
ii.Design of footings
iii. Design of wall using Hollow bricks
Design of solar panels

## 4. OPTIMIZATION OF TECHNICAL SOLUTION ENGINEERING SYSTEMS

Design solutions should provide control and monitoring of equipment within an integrated environment with the use of modern solutions in the field of information technology, automation, digital audio and video systems and engineering equipment. Building systems that must be integrated
into a single system management and monitoring:

Heating ,
Ventilation ,
Air conditioning ,
Heat supply ,
Power supply ,
Lighting, including automatic and automated control of lighting ,
Fire protection ,
Video surveillance ,

Telecommunications (telephone, LAN building with access to a global network, television).

## 5. ESTIMATION

Net zero energy cost refer to the cost of the energy consumed by the building. Most building owners, particularly in urban areas, see this as a primary concern. The cost of energy often includes infrastructural elements and peak demand costings by utility providers. Therefore, cost does not necessarily reflect the energy consumed vs. the energy produced by the building or on site. The quantities of the various materials in conventional building and NZERB are calculated. The rate analysis for various description of work are calculated based on the PWD. The total cost of the NZERB is higher than that of conventional building.

### 5.1 ADVANTAGES

- Reduces the menace of destruction of the Non-renewable conventional energy resources.
- The cost of energy of a NZEB does not increase with time relative to the similar non- renewable energy building.
- Future legislative restrictions and carbon emission taxes/penalties may force expensive retrofits to inefficient buildings.
- It is an area contractionary technique which requires a less area for the installation of setup.
- By improving the energy efficiency, it reduces the total cost of ownership as well as the total cost of living

### 5.2 DISADVANTAGES

- Initial cost is much higher i.e. a money blockage technique which recovers after a few years.
- Variation of weather plays a vital role for that the PV solar system is not sufficient for all type of weather.
- High skilled labor is required of having necessary information for the installation of setup.
- Solar energy system using the house envelope only works in locations unobstructed from the South. The solar energy capture cannot be optimized in facing shade or wooded surroundings.

## 6. CONCLUSION

We have produced a series of studies. It corresponds to identifying and practical application of a body of architectural and planning solutions to reduce the heat lossthrough the building of the building envelope. Hence by using the renewable resources the impact on the active energy loads can be reduced, thus we can conserve electricity locally and globally.

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