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Design of net zero energy residential building

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ABSTRACT

The main objective of this paper is the whole design of a Net Zero Energy Residential Building. It is much difficult to understand the overall concept of a net zero energy building. As all, we know that the building has a significant impact on the energy use and the environment which is turn effect on the development of the present era. The proposed site for the Net zero residential building is in Lakkidi near Palakkad, Kerala. A complete design has done for the proposed NZERB using Indian standard codes. We have selected the site for the proposed building and various climatological surveys were conducted. Structural and functional design of the (G+1) residential building is completed and detailed estimates of conventional building and zero energy building has been prepared and conducted the comparative study.

Keywords: NZERB, Indian standard codes, Design.

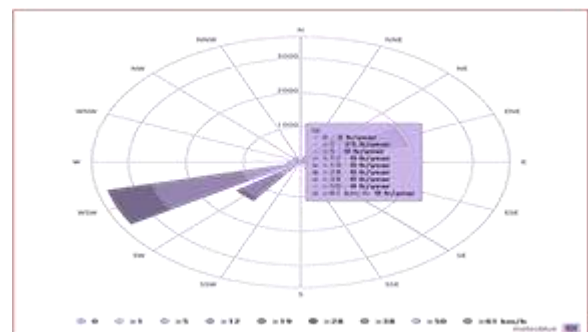
1. INTRODUCTION

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. With rapid urbanisation, there has been a steady exodus from rural parts of the country to urban areas, leading to increased energy consumption especially in the commercial sector. The concept of a Net Zero Energy Building (NZEB), 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.

2. SITE SELECTION AND METEOROLOGICAL STUDIES

Lakkidi, Palakkad 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. For the design of ventilation system, we had collected data about wind direction and speed in the form of wind rose direction. A Wind rose diagram is used to study the direction and speed of wind in a particular location

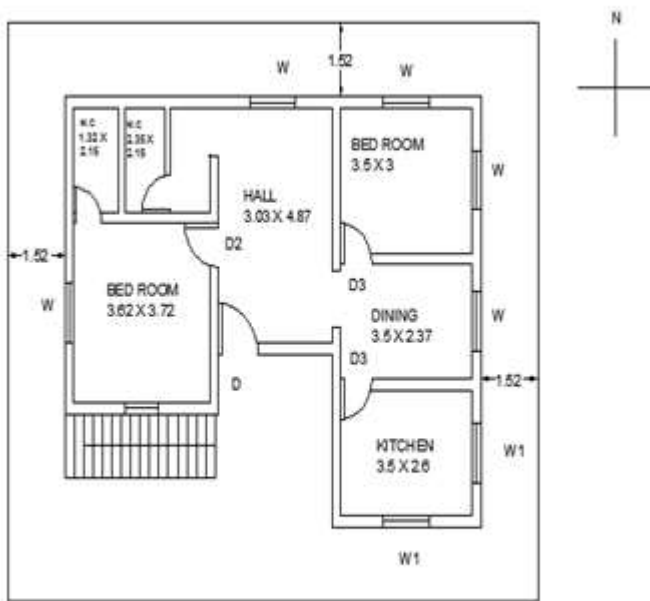


Wind Rose Diagram

Weather plays a critical role in construction projects, affecting everything from safety issues to the day to day running of any building site. Our site is situated in Lakkidi near to Palakkad. Climate data studied for the design of the building.

3. FUNCTIONAL DESIGNING

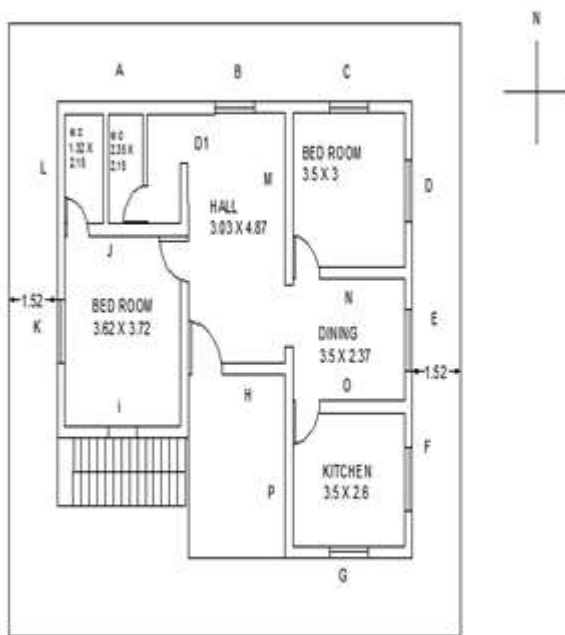
The ground floor of the building consists of one hall, two bedrooms, one dinning, one kitchen. The allocations of the rooms in the plan has been done with due consideration of sun diagram as per the requirement of zero energy building. The first floor of the building consists of one hall, two bedrooms, one dinning, one kitchen. The allocations of the rooms in the plan has been done with due consideration of sun diagram as per the requirement of zero energy building. The plan has been prepared using Auto CAD software.



GROUND FLOOR PLAN

ALL DIMENSIONS ARE IN METER

Ground Floor Plan



FIRST FLOOR PLAN

First Floor Plan

4. 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
- iv. Design of solar panels

5. DESIGN OF SOLAR PANEL AND ITS COMPONENTS

Brief revision of the major components found in a basic solar power system. A basic solar powered system is shown in Figure .The solar panel consists of solar regulator it is connected to DC storage battery and then DC is converted to AC by an inverter. AC can be directly used for the appliances.



Working of solar panels

The total cost of the solar panel is Rs. One lakh forty two thousand six hundred for our residential building .In these solar panel cost is based on the solar panels, regulator, batteries and inverter. The output of solar panel can be expected to vary by 0.25% for every 5 degrees variation in temperature. In NZERB, decrease in temperature for using of hollow bricks and solar panels produces the electricity. When compared to conventional building, the initial cost is high but in future the electricity cost is reduced

6. ESTIMATION

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.

7. CONCLUSION

In this project we have completed the design of the Conventional building by using modular bricks and Net Zero Energy Residential Building by using Hollow Brick The Comparison of the Conventional Building and NZERB was completed by using the parameters such as the temperature by using instrument infrared thermometer which was found to be 4oC less in NZERB compared to conventional building under same condition. Hence by using the renewable resources the impact on the active energy loads can be reduced, thus we can conserve electricity locally and globally.

8. FUTURE SCOPE OF THE PROJECT

The building designed as a NET ZERO ENERGY BUILDING produces its own electricity, thus it can save a huge amount in electricity bill. These kinds of buildings are environmental friendly reducing the environmental hazards (eg. It would release zero carbon content that would help in controlling global warming).The design for the building should be such that the requirement of temperature regulation does not fluctuate throughout the year.

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