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A Review Study On Net Zero Energy Building

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ABSTRACT

The main objective of this paper is to study and analysis the existing building.It is much difficult to understand the overall concept of a net zero energy building. As all we know that the building has significant impact on the energy use and the environment which is turn affect on the development of the present era. In present the lack of conventional energy sources encourages in developing the NZEBs.According to the survey a major effect of building on the total worldwide energy consumption level i.e. around 40% of the total energy is consumed by only buildings and becoming a major primary energy consumptive part of the worldwide structure. The ZEB definition can be describe significantly the demand and fuel supply strategies and conversion accounting are appropriate to meet a ZEB goal.

KEYWORDS:Energy Consumption, Energy Resources, Non Renewable Energy Resources, Renewable Energy Resources, PV Solar Modul

I.INTRODUCTION

The term of Net Zero Energy Residential building is define 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. 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.

1.1 Energy Resources

1.1.1 Non Renewable Energy Resources

A non-renewable resource (also called a finite resource) is a resource that does not renew itself at a sufficient rate. Fossil Fuels such as Coal, Petroleum, Natural Gas are all considered as Non renewable Energy Resources.

1.1.2 Renewable Energy Resources

The source of energy which can be used again and again without threatening the nature so much is known asRenewable Energy Resources. Sunlight, wind, rain, tidal energy and geothermal heat are some examples of Renewable Energy Resources. The aim of this Research Paper is to focussing on the building to create it a Net Zero by using a Renewable Energy Resources instead of Non Renewable Resources. We can use Solar Energy, Wind Energy, Tidal Energy etc to make the building net zero. We cannot use Geothermal source of energy at a level due to lack of technology.

We can use the Wind Energy when the velocity of air is very high. It works only in the open areas. The widely use Renewable Source of energy is Solar Energy. Solar Panel can be used as Solar Photovoltaic cell, solar thermal heater, etc.

1.2 Connections of PV Solar Modules

There two types of connections which are given below:

1.2.1 Grid Connection

A grid connected photovoltaic power system, or gridconnected PV power system that is connected to the utility grid. A grid-connected PV system consists of solar panels, one or several inverters, a power conditioning unit and grid connection equipment. When, conversely, on-site energy generation exceeds the building energy requirements, the surplus energy should be exported back to the utility grid, where allowed by law. The excess energy production offsets later periods of excess demand, resulting in a net energy consumption of zero. Due to current technology and cost limitations associated with energy storage, grid connection is usually necessary to enable the Net Zero Energy balance.

1.2.2 Off Grid Connection

An off grid photovoltaic is when your solar photovoltaic system is not connected to the utility grid and you are producing your own electricity via solar, wind, generator, etc. This system will generally have a battery bank in order to store the electricity for use when needed.

II.CASE STUDY

Indira Paryavaran Bhawan, the new office building for Ministry of Environment and Forest (MoEF) sets is a radical change from a conventional building design.

The project team put special emphasis on strategies for reducing energy demand by providing adequate natural light, shading, landscape to reduce ambient temperature, and energy efficient active building systems. Several energy conservation measures were adopted to reduce the energy loads of the building and the remaining demand was met by producing energy from on-site installed high efficiency solar panels to achieve net zero criteria. Indira Paryavaran Bhawan uses 70% less energy compared a conventional building. The project

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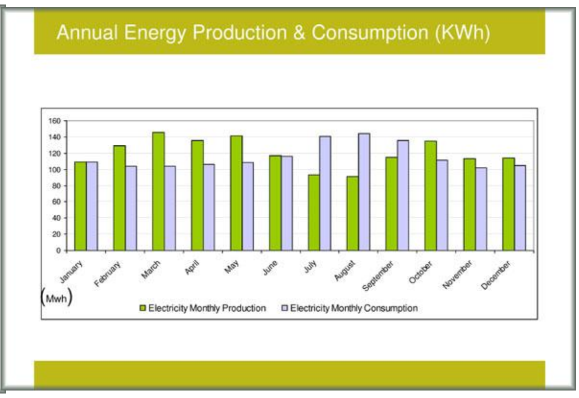
adopted green building concepts including conservation and optimization of water by recyclingwaste water from the site.

Indira Paryavaran Bhawan is now India's highest green rated building. The project has received GRIHA 5 Star and LEED Platinum. The building has already won awards such as the Adarsh/GRIHA of MNRE for exemplary demonstration of Integration of Renewable Energy Technologies.



2.1Passive Design Strategies

- **Orientation:** Building is north south oriented, with separate blocks connected through corridors and a huge central court yard. Orientation minimizes heat ingress. Optimal window to wall ratio.
- **Landscaping*:*** More than 50% area outside the building is covered with plantation.Circulation roads and pathways are soft paved to enable ground water recharge.
- **Daylighting:** 75% of building floor space is day lit, thus reducing dependence on artificial sources for lighting. Inner courtyard serves as a light well.
- **Ventilation*:*** Central courtyard helps in air movement as natural ventilation happens due to stack effect. Windows and jaalis add to cross ventilation.

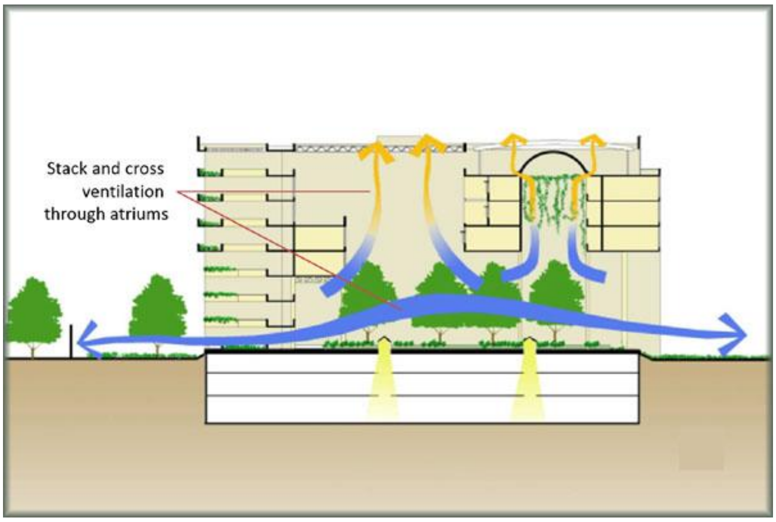
2.2Building Envelope and Fenestration:

- Optimized Building Envelope – Window assembly (U-Value 0.049 W/m^{2}K),VLT 0.59, SHGC 0.32
- uPVC windows with hermetically sealed double glazed using low heat transmittance index glass
- Rock wool insulation
- High efficiency glass
- Cool roofs: Use of high reflectance terrace tiles for heat ingress, high strength, hard wearing.

2.3Materials and construction techniques :

- AAC blocks with fly ash
- Fly ash based plaster & mortar
- Stone and Ferro cement jaalis

- Local stone flooring
- Bamboo jute composite doors, frames and flooring
- High efficiency glass, high VLT, low SHGC & Low U-value, optimized by appropriate shading
- Light shelves for diffused sunlight



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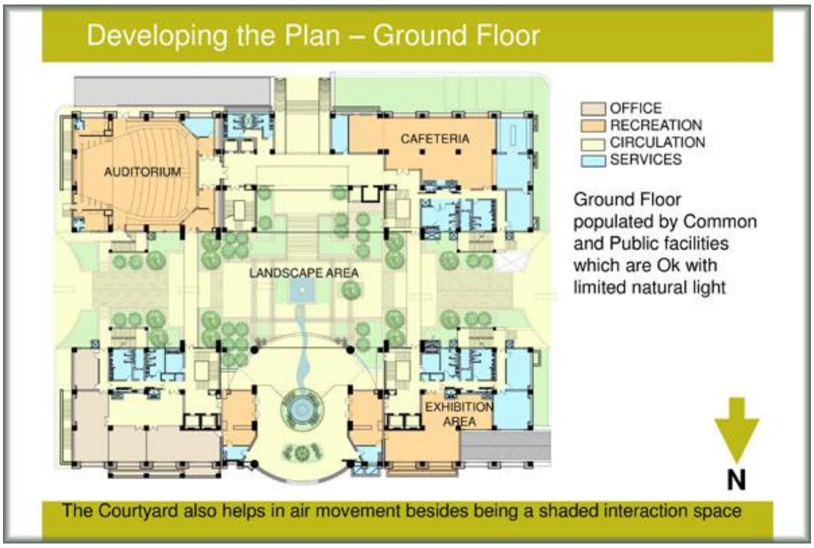


III.ACTIVE STRATEGIES

3.1Lighting Design

1. Energy efficient lighting system (LPD = 5 W/m^2) , nearly 50% more efficient than Energy Conservation Building Code 2007 requirements (LPD = 11 W/m^2) reduces energy demand further.
2. Remaining lighting load supplied by building integrated photovoltaic (BIPV).
3. Use of energy efficient lighting fixtures (T5 lamps).
4. Use of lux level sensor to optimize operation of artificial lighting.

3.2Optimized Energy Systems / HVAC system

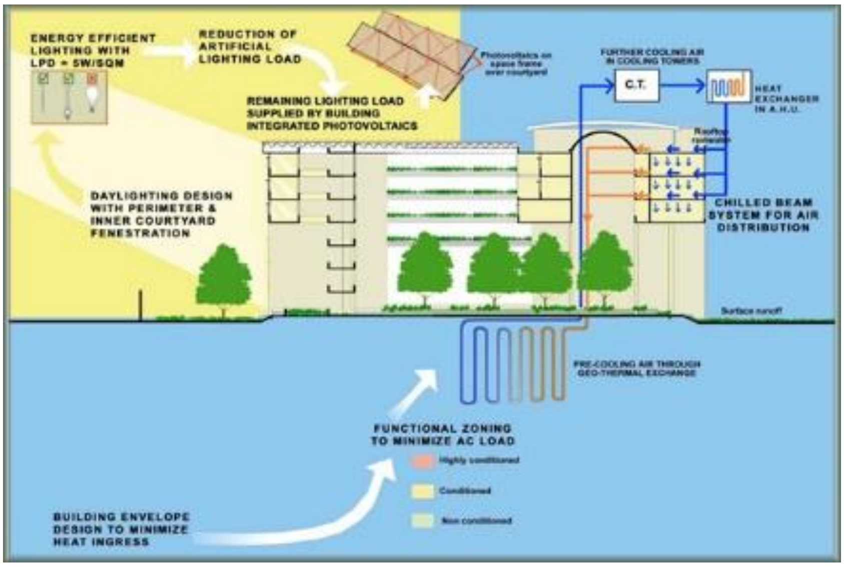
Chilled beam system/ VFD/ Screw Chillers

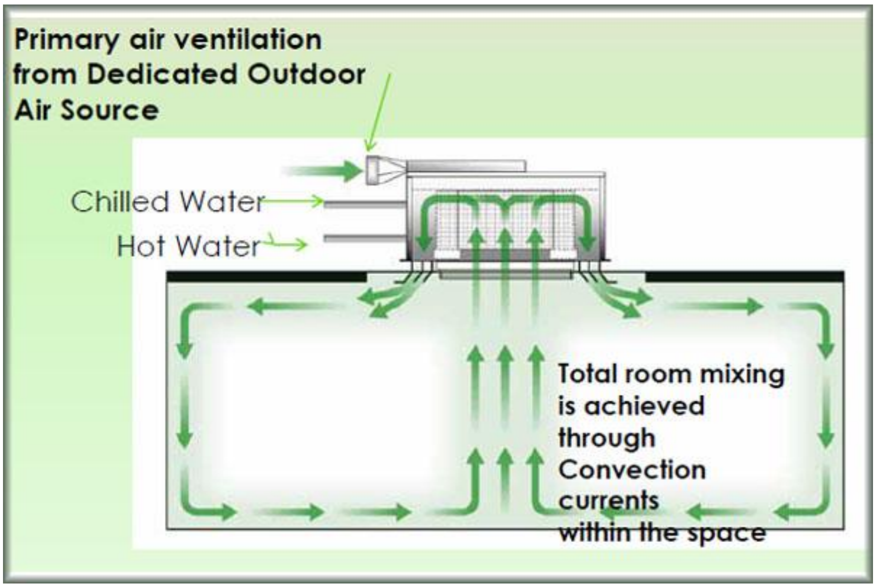
- 160 TR of air conditioning load of the building is met through Chilled beam system. Chilled beam are used from second to sixth floor. This reduces energy use by 50 % compared to a conventional system.
- HVAC load of the buildings is 40 m^2/TR, about 50% more efficient than ECBC requirements (20 m^2/TR)
- Chilled water is supplied at 16° C and return temperature is 20° C.
- Drain pans are provided with the chilled beams to drain out water droplets due to condensation during monsoon.
- Water cooled chillers, double skin air handling units with variable frequency drivers(VFD)
- Chilled beams save AHU/FCU fan power consumption by approximate 50 kW.
- VFDs provided in chilled water pumping system, cooling tower fans and AHUs.
- Fresh supply air is pre cooled from toilet exhaust air through sensible & latent heat energy recovery wheel.
- Control of HVAC equipment & monitoring of all systems through integrated building management system.
- Functional zoning to reduce air conditioning loads.

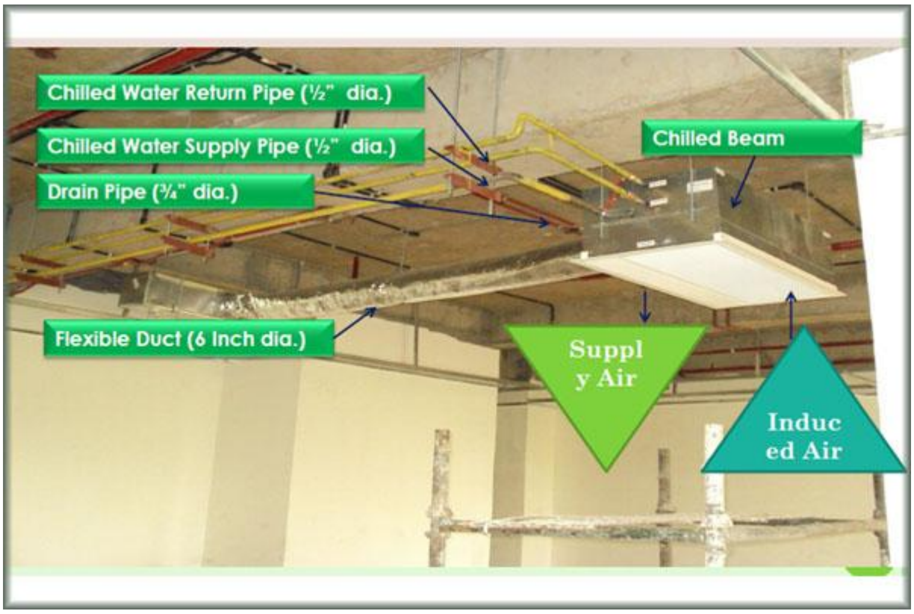
- Room temperature is maintained at 26 ±1 ° C

3.3Geothermal heat exchange system

1. There are 180 vertical bores to the depth of 80 meter all along the building premises. Minimum 3 meter distance is maintained between any two bores.
2. Each bore has HDPE pipe U-loop (32mm outer diameter) and grouted with Bentonite Slurry. Each U-Loop is connected to the condenser water pipe system in the central air conditioning plant room.
3. One U-Loop has 0.9 TR heat rejection capacity. Combined together, 160 TR of heat rejection is obtained without using a cooling tower.







3.4Renewable Energy

- Solar PV System of 930 kW capacity
- Total Area : 6000 m^2
- Total Area of panels : 4650 m^2
- No of panels : 2,844
- Annual Energy Generation : 14.3 lakh unit

3.4ACTUAL GENERATION ON SITE (as on 25.01.2014)

- Power supply to grid started on 19.11.2013
- Power generation achieved : 300 kWh per day
- Total generation : 2.0 kWh

IV.ADVANTAGES

 Reduces the menace of destruction of the nonrenewable 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.

V.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 houseenvelope only works in locations unobstructed from the South. The solar energy capture cannot be optimized in facing shade or wooded surroundings.

VI.LOW AND ZERO ENERGY BUIDING EXAMPLES

For the purpose of developing a low energy consumed environment it must be necessary to study and analyzing the nearly about to net zero energy buildings. A study of the impact of less consumed energy of these buildings is taken in to account. Each was designed to minimize energy and environmental impacts and used a combination of lowenergy and renewable energy technologies. Understanding the energy performance of the current stock of highperformance buildings is an important step toward reaching the ZEB goal. The designing and construction of these building is based on the phenomenon of energy conservation improvement and enhancement of PV power generation in the building.

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