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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 and also to give an overview on an existing building to make it a perfect Net Zero Energy 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 Module

1. 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 as **Renewable 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 grid-connected 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.

2. CASE STUDY

Research about the affordability of NZEB-dwellings on Moradabad Institute of Technology campus and also improving the building energy performance when compared to the current norms.

Our main focus is to replace the current scenario of electricity in Moradabad Institute of Technology with the help of Solar Panels System for achieving the Net Zero Building.

Fig 1- M.I.T Campus
Source "M.I.T. Moradabad"

- The total energy consumed by the M.I.T Campus is 375600 kWH per year which cost is nearly about Rs 60 lakhs. At present we spend a lot of money in the energy consumption which is a serious problem on the economical condition of present era. For the purpose of preventing the energy it is must necessary to replace the non-renewable energy sources to the renewable energy sources such as PV module system.

2.1 Characteristics of Proposed Solar PV system installed in M.I.T

Units produced by 1 kW system(1 Panel) is 4-5 kW/day

- Area Covered by 1 kW system is 10 sq m(100 sq ft)
- Total cost of 1 kW system(1 Panel) is Rs 75,000-90,000 (Grid Connected)

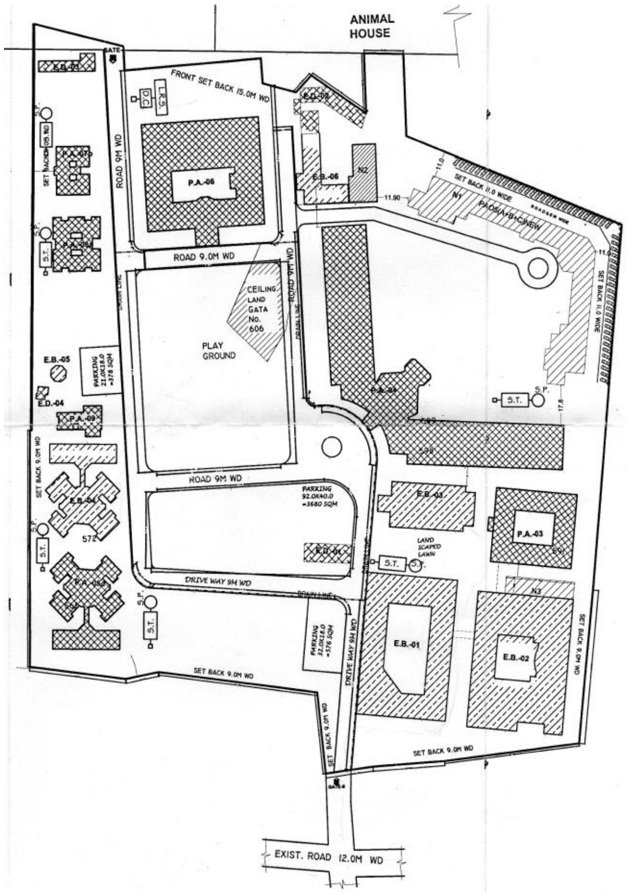

Fig: 2- Layout of M.I.T. Campus
Source "M.I.T. Moradabad"

2.2 Calculation for PV System

For the analyzing purpose the photovoltaic solar cells are used in the module system. PV module should be connected to the appropriate inverter for the establishment of indoor energy consumption.

Total units consumed by college per month is 29070 kW

Total Energy Consumed by MIT per day is (29070/28) = 1038.2 kW (approx. 1100 kW) So we have to produce 1100 kW energy per day with the solar PV system to completely replace the current scenario of electricity in M.I.T Campus.

As we know that

- Units produced by 1 kW system(1 Panel) is 4-5 kW/day
- Area Covered by 1 kW system is 10 sq m(100 sq ft)

Let us assume that Units produced by 1 kW system is 4 units per day
So, Numbers of Panels required are (1100/4)= **275 panels**

Total cost of Panels are (275*90000**)= 24750000 (approx 25000000) or Two crores fifty lakh rupees**

2.3 Recovery of Cost of installed panels

Electricity cost of MIT campus in a month (February) is **Rs 428202 (Four lakhs twenty eight thousand two hundred two rupees).**

Electricity cost per year is (Rs 428202*12)= **Rs 5138424**

As we know Total cost of Panels are **(25000000+1500000)=26500000**

No. of years required for recovery of Total cost of panels = (**26500000/5138424)= 5.15 years**

So, Total number of years for completely recover the present electricity scenario on MIT college are 5.15 years.

2.4 Area of Panels Required

Area covered by 1 panel is 10 sq m.

Total area covered by 275 panels are (275*10)= **2750 sq m(27500 sq ft)**

Total area of MIT is 52657.7 sq m**.**

So, in the MIT campus, the solar panels can easily be installed due to its wide open area for the installation purpose.

3. 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.

4. 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.

5. 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 low-energy and renewable energy technologies. Understanding the energy performance of the current stock of high-performance 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.

(1) Passive House Ebner: Am Eichengrund 16, 8111 Judendorf-Straßengel: Residential Non-residential Public New Renovated X X Single-family house with a small integrated office.

(2) KBC Gooik Zero Energy Office Edingsesteenweg, 1755 Gooik Residential Non-residential Public New Renovated X X Office building.

(3) Technical University – Sofia, University Research Centre8 Climent Ohridski blvd., blok 8, Sofia 1000 Residential Non-residential Public New Renovated X X University research centre building.

(4) Multifamily building Lenišće East; "Šparna hiža" Zvonimira Goloba 1,48 000 Koprivnica Residential Non-residential Public New Renovated X X Multi-family house.

(5) Sems Have, Roskilde, Denmark Parkvej 3-5, 4000 Roskilde

6. CONCLUSION

In conclusion, we decided that for our Zero Energy Project using solar energy is the best energy source in regards to saving energy and cost efficiency. After brainstorming and researching we came to an agreement that photovoltaic solar panels are the best solution for generation of the electricity in Moradabad Institute of Technology. The installation of the solar panels initially would be costly, but in the long run the owner of the building would save money on their energy bill. More importantly, in the scarcity of natural resources we would be providing a self-sufficient, energy saving, non-polluting, Zero Energy building. The solar panels that would be installed would be on the back side of the building, which would be facing south. This would allow for the most direct sunlight to be absorbed by the panels. So. according to us it is most efficient to install the PV Solar system in the MIT campus. We need 275 PV Solar panels in the Campus to equalize the present scenario of Energy Consumed in the Campus and 5.15 years are required to recover the installation cost of PV system.

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