IMPLEMENTING ZERO ENERGY EFFICIENCY IN RESIDENTIAL BUILDING

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Abstract - *India is the developing country and has become one of the major energy consumers in the world. The major use of energy in a building includes lighting, heating, cooling, ventilation, etc. The main objective of this paper is to study and design the zero-energy residential building. To analyze electricity consumption, to carry out approximate estimate of conventional building, and finally to compare the costs of conventional and Zero Energy Building.*

Key Words: Zero Energy Building,

1. INTRODUCTION:

Currently, there is almost no doubt about the processes of global warming on Earth in the scientific community. Partly, this is confirmed, including changes in regulatory documentation. In the history of our planet periodically climate change has happened before but for the first time these changes associated with human activities. Carbon dioxide (CO2) that is emitted during the combustion of fossil fuels changes the composition of our atmosphere. The uncontrolled use of fossil energy leads to the depletion of world reserves of non-renewable energy sources. The area, where it is possible to reduce the consumption of fuel and, consequently, energy consumption and emissions into the atmosphere, is the housing stock, which according to various estimates consumes 30 to 40 % of all energy. It is enough to increase regulatory requirements for insulation levels to improve the degree of building automation when adjusting the parameters of the coolant that enter the building, to install systems heat recovery of exhaust air and a more efficient heating system. It was the time when the consequences of the oil crisis became noticeable and the issue of fossil fuels sources and energy use started to be broadly discussed. Over the decades, in many articles and research projects number of Zero Energy Building's were described and evaluated; however, almost for each case the Zero Energy Building was defined differently or no exact definition was adopted. Moreover, often the path for achieving the zero goal affected significantly the Zero Energy Building definition.

1.1 Zero Net Site Energy Use:

In this type of Zero Net Energy, the amount of energy provided by on-site renewable energy sources is equal to the amount of energy used by the building. In the United States, "zero net energy building" generally refers to this type of building.

1.2 Zero Net Source Energy Use:

This Zero Net Energy generates the same amount of energy as is used, including the during electricity transmission. This Zero Net Energy must generate more electricity than zero net site energy buildings.

1.3 Net Zero Cost:

In this type of building, the cost of purchasing energy is balanced by income from sales of electricity to the grid of electricity generated on-site. Such a status depends on how a utility credits net electricity generation and the utility rate structure the building uses.

1.4 Net Off-Site Zero Energy Use:

A building may be considered a Zero Energy Building if 100% of the energy it purchases comes from renewable energy sources, even if the energy is generated off the site.

2. Proposed Residential Building:

Research and Design the Zero Energy Residential Building in an affordable price.
Our main focus is to produce the electricity with the help of solar panels system for achieving the Net Zero Residential Building.

Figure -1: Proposed Residential Building.

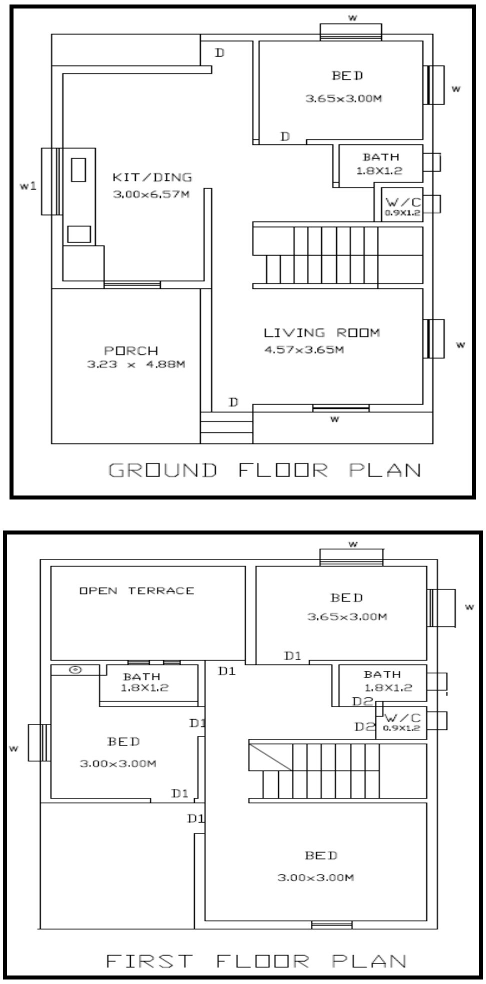

Figure -1: Plan of Residential Building.

Sr. No.	Units	Wattage/Hrs.
1	Fan	70
2	Bulb	9
3	Tube	40
4	Night Bulb	0.5
5	Exhaust Fan	40
6	Mixer	500
7	T.V.	100
8	Freezer	150
9	Motor	375
10	P.C.	160
11	Inverter	1620
12	Geyser	1200
13	Air Conditioner	2500

Table -1: Wattage consumption of electricity units.

2.1 Determining power consumption demands:

Total appliance use = (70 W x 10 hours x 7) + (9 W x 10 hours x6) + (40 W x 6 hours x 8) + (0.5 x6 hours x 15) + (40 + 4 hours x 1) + (100 x 4hours x 2) + (500 x 0.5 x1) + (150 x 18 x1)+ (375 x 1x 1) + (160 x 3 x2)+ (1620 x 0.15x 1) + (1200 x 1.5 x2)+ (2500 x 1x 1)
= **18993 Wh/day**

2.2 Design requirements of Solar Panel:

- Total PV panel energy needed is 24690 Wh/day.
- System should be powered by at least 52 modules of 110 Wp PV modules.
- The inverter size should be about 23741.25 W or greater.
- So the battery should be rated 12 V 5600 Ah for 3 day autonomy.
- Solar charge controller should be rated 40 A at 12 V or greater. PV module specification
- Size of 110 Wp PV module : 1095 mm x 795 mm x 35mm
- Total Area required for panels : 40.044 sq. m

2.3 Economical Evaluation of Project:

Total electricity consumption per day = 18993 W/day.

- Conversion of watt into units. (unit shown on electricity meter)

1000 w/hr. = 1unit. (Unit shown on electricity meter)

Therefore, 18993 W /Day = 18.99 units / Day.

For one month
30 days x 18.99 units = 569.7 units = 570 unit/month …….. (say)

- For one year.
  570 units x 12 month = 6840 units

- Cost of Electricity per year
  MSEB Rate of electricity for one unit.
  a. 0 – 200 = 7.30 Rs.
  b. 200 – 500 = 10.61 Rs.

For a single month electricity consumption is 570 units

Calculating Monthly electricity bill,

Considering out of 570 units first 200 units will be charged as rate 7.30 Rs per unit
& remaining 370 units will be charged as 10.61 Rs. Per unit.

Therefore monthly average electricity bill
= (200 X 7.30) + (370 X 10.61)
= 5386/-

Cost of electricity for one year
= 5386 X 12
= 64632 /-

Assuming 10 % increment in bill after 10 years,
= 64632 + 6463.2
= 71095/-

So,

Total Electricity expenses for next 20 years,
= (64632 X 10) + (71095 X 10)
= 646320 + 710950
= 13,57,270/-

2.4 Cost of ZEB Implementation:

Sr. no.	Materials	Unit cost	Cost in Rs.
1	Solar Panel (110 wp)	8000/-avg.	8000X52 = 416000/-
2	Battery	50000/-	50000/-
3	Solar Inverter	10,000/-	10,000/-
4	Wind mill	40,000/-	40,000/-
5	Hybrid Inverter	10,000/-	10,000/-
6	Solar charge controller	10,000/-	10,000/-

Table -1: Cost estimation of ZEB implementation on building.

- Total material cost = 5, 36,000/-.
- Other charges
    1. Fabrication cost = 30,000 Rs. (Aprox.)
    2. Years battery charges = 50,000 Rs.
    3. Company Charges

  After 10 years 10% of total cost = 53600/-

- Total Cost = 6,69,600/- Rs.

Subsidy by Government:
Under NABARD scheme 40 % subsidy is given to installation of solar panels.
Cost Deducted as a subsidy = 40 % of 6,69,600/-
= 2,67,840/-

Therefore cost of Material + installation of solar panel is
= 669600- 267840
=4,01,760/-

Therefore,
Net Profit for period of 20 years after Application of ZEB concept is
= 1357270 – 4,01,760
= 9,55,510/-

3. NZEBs In India:

- A living Laboratory CEPT, Ahmedabad.
- Indira Paryavaran Bhawan Moef, New Delhi.
- Akshay Urja Bhawan Hareda, Panchkula.
- Eco Commercial Building Bayer Material Sciences, Greater NOIDA.
- Malankara Tea Plantation, Kottayam.
- Office Complex GRIDCO, Bhubaneswar.
- Net Zero Energy Building SunCarrier Omega, Bhopal.

4.1 Advantages:

- Isolation for building owners from future energy price increases.
- Reduced total cost of ownership due to improved energy efficiency.
- Reduced total net monthly cost of living.
- Improved reliability-photovoltaic systems have 25 year warranties.
- Extra cost is minimized for new construction compared to an afterthought retrofit.
- The higher resell value as a potential owners demand more ZEBs than available supply.
- The value of ZEB building relative to similar conventional building should increase every time energy cost increases.

4.2 Disadvantages:

- Initial cost can be higher- effort required to understand, supply and quality for ZEB subsidies.
- Very few designers or builders have the necessary skill or experience to built ZEB.
- The new photovoltaic solar cells equipment technology price has been falling at roughly 70 percent per year.
- Climate-specific design may limit future ability to respond to rising or falling ambient temperature (global warming).
- While the individual house may use an average of net zero energy over a year it may demand energy at the time when peak demand for the grid. in a such case, the capacity of the grid must still provide

electricity to all loads. Therefore, a ZEB may not reduce the required power plant capacity.

5. CONCLUSIONS:

- Evidence from project experience shows that Zero Energy Building's are feasible, potentially economical even in the shorter term.
- Project proponents believe that, in general, Net Zero Energy Buildings perform better than conventional buildings. Here the total electricity consumption is try to nullify by provision of Renewable energy generations such as solar & Wind mill system.
- The proposal has been given for implementation of Zero Energy Building along with cost estimate, though initial cost is high the estimation shows that the project is significantly economical in long run it can save tremendous amount of energy in future. Cost and performance are not necessarily the main motivating factors for going to net zero energy.
- Projects seek to demonstrate the benefits of integrated design, long-term economic value, and healthier occupant spaces. Also the detailed study can be extended with future investigation & experimentation in which total Zero Energy Building concepts can be applicable.

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