Implementation Of Net-Zero Energy Buildings in Constructions

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Abstract—

As the usage of resources like Coal, Oil ,Cement ,Etc is been increasing day by day which is creating a great environmental impact on the environment. The increase in the emissions of the harmful gases like CO_2.Fossil Fuels Etc is creating a great impact on the environment and in the increase in the harmful gases and also the usage of with taking into consideration the increase in the construction is leading to a usage of great amount of resources which are now available at a very low rate. So here the question arises from where the energy to run the commercial sectors will be produced. So a new concept should be included in the construction purposes and that is Zero-Energy Building. This paper presents a detailed and verified information about the concept Zero-Energy Building.

Keywords: Zero-Energy Building(ZEB),Zero-Net Energy(ZNE)

1.Introduction

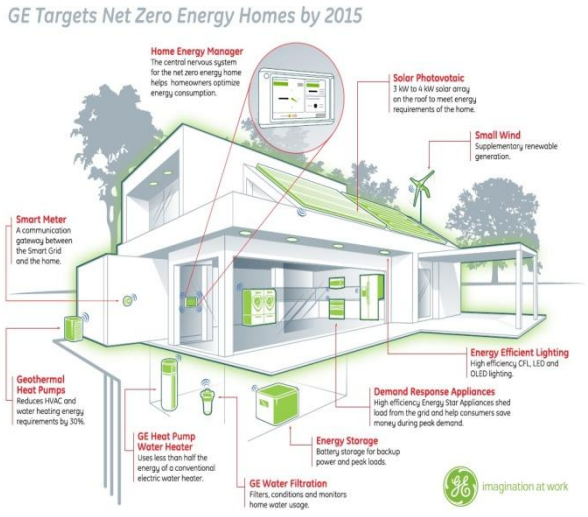

Fig-1 Pictorial Presentation of ZEB

A zero-energy building, also known as a zero net energy (ZNE) building, net zero energy building - (ZEB), or net zero building, is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site. These buildings still produce greenhouse gases because on cloudy (or non-windy) days, at night when the sun isn't shining, and on short winter days, conventional grid power is still the main energy source. Because of this, most zero net energy buildings still get half or more of their energy from the grid. Buildings that produce a surplus of energy over the year may be called "energy-plus buildings" and buildings that consume slightly more energy than they produce are called "near-zero energy buildings" or "ultra-low energy houses". Most zero-energy buildings use the electrical grid for energy storage but some are independent of grid. Energy is usually harvested on-site through a combination of energy producing technologies like solar and wind, while reducing the overall use of energy with highly efficient HVAC and lighting technologies. The zero-energy goal is becoming more practical as the costs of alternative energy technologies decrease and the costs of traditional fossil fuels increase. The development of modern zero-energy buildings became possible not only through the progress made in new energy and construction technologies and techniques, but it has also been significantly improved by academic research, which collects precise energy performance data on traditional and experimental buildings and provides performance parameters for advanced computer models to predict the efficacy of engineering designs. Zero Energy Building is considered as a part of smart grid. The zero-energy concept allows for a wide range of approaches due to the many options for producing and conserving energy combined with the many ways of measuring energy (relating to cost, energy, or carbon emissions). The worldwide CO2 emission mitigation efforts, the growing energy resource shortage and the fact that buildings are responsible for a large share of the world's primary energy use drives research towards new building concepts, in particular Zero Energy/Emission Buildings(ZEBs). The buildings that over a year do not use energy that entails carbon dioxide emission. Over the year, these buildings are carbon neutral or positive in the term that they produce enough CO2 free energy to supply themselves with energy. Carbon Buildings differ from Zero Energy Building in the way that they can use for instance electricity produced by CO_2.

2. Advantages

A. Cost

- Very often green building is considered to be expensive as usually all kind of modern building methods.
- However it saves much more money from the moment of creating during its lifetime as ordinary buildings.
- It works with any kind of green structures – office buildings, schools, churches, factories and others type of buildings.
- Designing and building green structures cost approximately the same as regular buildings.

B. Energy Efficiency

- Green building has a great advantage of reducing both embodied and operating energy consumption.
- Studies proved that those buildings which are built with wood will have a lower embodied energy than buildings made of brick, steel or other materials. What about operating energy?
- Designers try to find solutions to reduce it too. They use extra-insulation, high-performance windows, and passive solar design.
- The latter is very efficient especially if the windows are effectively placed. Also other ways of renewable energy are used too.
- Wind power and hydro power can also notably reduce the influence on environment

C. Water Efficiency

- Consumption is another objective in sustainable building.
- Water can be wasted by drip irrigation, leaking (toilet leaking can waste up to 90 gallons per day), pool showers.
- Recycling rainwater and using it for toilet flushing can save waste-water.
- Water saving shower heads, ultra-low flush toilets and other conserving fixtures can minimize waste-water.

D. Material Efficiency

- Green buildings are built from green, rapidly renewable, non-toxic, reusable and recyclable materials as lumber, bamboo, straw, recycled metal/stone, sheep wool, compressed earth block, concrete, cork etc.

E. Temperature Regulation

- Urban heat islands are elevated temperatures mostly in urban areas, formed mostly on surfaces where permeable and moist became impermeable and dry due to some buildings, roads etc.
- Urban heat island effect is caused mostly by the heat holding properties of tall buildings and urban (often toxic) materials – asphalt, concrete. It can be compensated by more green areas around the buildings such as green roofs and rain gardens.

F. Indoor Environment Quality

- Except poor air quality other circumstances like poor lightening, temperature variances, furniture, carpeting, pesticides, paints and high concentration of pollutants are causing different diseases – headaches, dermatological problems, allergies etc.
- The environmentally friendly circumstances of green building create healthier atmosphere.

G. Improved Employee Attendance

- Natural lightening, good ventilation, healthy circumstances all influence the health of green structures' occupants.
- People are becoming less sick, they are more productive and their impact on work is more high and effective.
- A study made in Seattle among 31 green buildings showed that in LEED-certified buildings the absence of employee was decreased into 40 percent.
- Another research showed 30 percent less sick days plus a 10 percent growth income per employee.
- This way green office is more attractive and retaining for employees.

3. Statistics

A. Energy Consumption In India

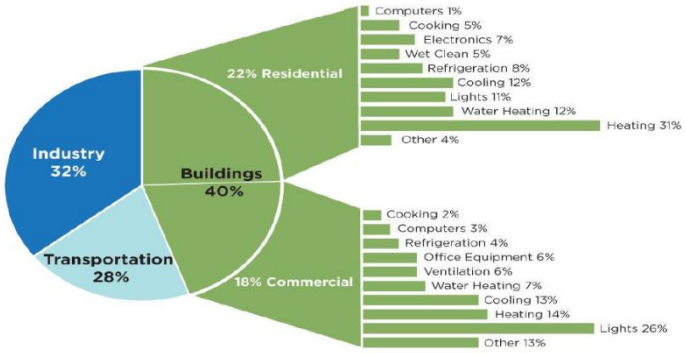

Fig-2 Energy Consumption In India

- World energy consumption is projected to grow by 53% from 2010 to 2030 (U.S. Energy Information Agency)
- Oil is forecasted to remain dominant energy source with coal forecasted as primary fuel for generating electricity
- Energy use increasingly shifting away from developed countries and becoming more carbon-intensive 120% Growth in CO_2 Emissions in the next 20 years.
- Environmental Impact of increasing Atmospheric CO_2 Levels 180 ppm to 380 ppm to 580 ppm to ????
- Requires new federal buildings to reduce their fossil fuel based energy use by 55% by 2010 and to zero by 2030.
- EPAC 2005 / EISA 2007 Existing Federal Buildings 30% reduction in energy use by 2015.

B. CO2 Emissions

- After burning of 1tonne of coal nearly 1tonne carbon dioxide is emitted.
- In world India is the 2nd largest country after China in emission of carbon dioxide.
- About 50% of carbon dioxide emission takes place from cement factories.

C. Fossil Fuels and Cements

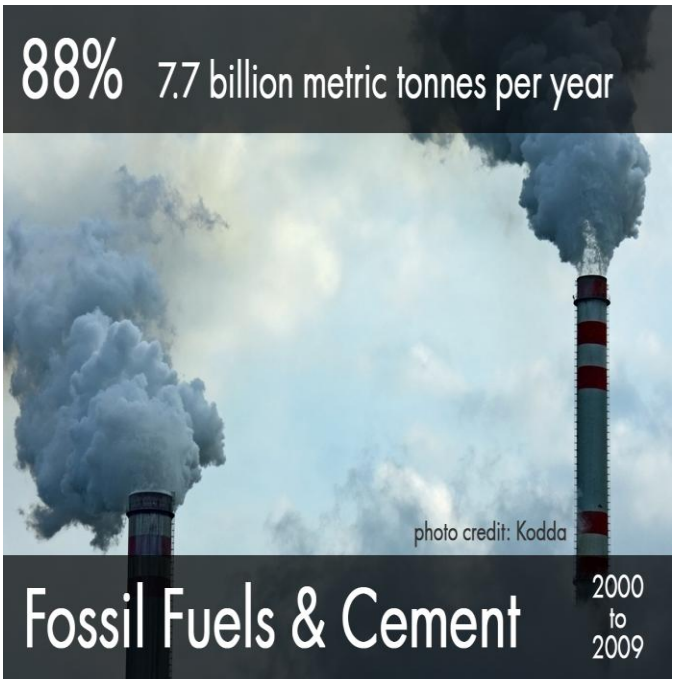

Fig-3 Statistical Image Of Fossil Fuels and Cement

4. Model Presentation Of ZEB

- So by taking all these factors into consideration we created a model presentation of the Zero-Energy Building…

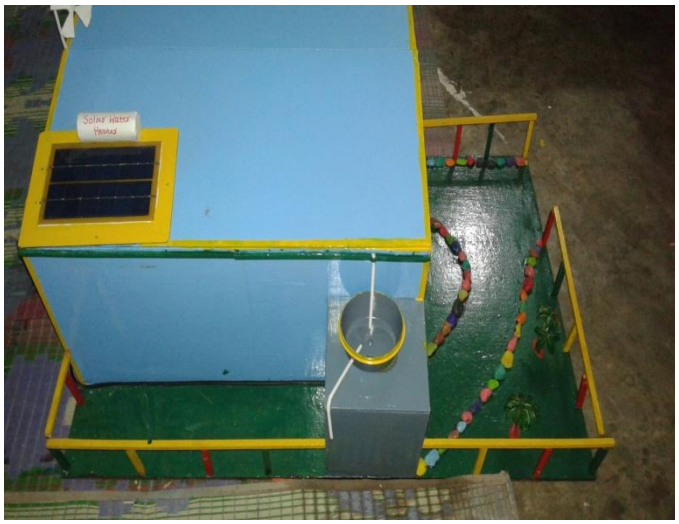

Fig-4 Model Of ZEB

- Here We have used Insul-Walls which are made of Plywood that has been coated with Hard plastic
- Here we have inserted Solar Pannels of 6 volts..
- OLED lights so that the light can be generated.
- Here we have used a 6 volts battery so that the energy generated from the solar pannels can be stored..

5. Implentation Of Zero-Energy Building

A. Comparision(Normally Constructed Building)

- Typical cost of construction ranges from Rs. 350-450/sq. ft.
- The plot of land is typically 2500 sq. ft. and will cost him around Rs. 2-3 lakhs.
- So total money spent on the house, including land, is about Rs. 7-8 lakhs.

B. Construction Cost Of Zero-Energy Building

- Here we have replaced the Brick Walls With Insul Walls.
- Inul-WallsThese are made of Plywood which are been coated with hard plastc

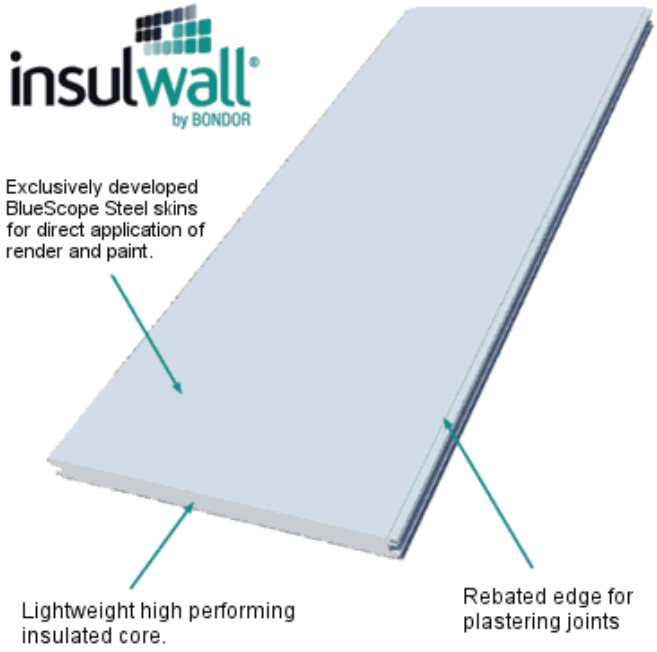

Fig-5 Insul Walls

Components	% Total Cost	Cost	Total
Insul Walls	50%	360000	
Cement/Steel	20%	250000	
Labour	15%	50000	
Other	15%	50000	
			610000

- So Estimating that a Zero-Energy Building Can be constructed on Less margins and thus can be implemented.

C. Solar Pannels

Fig-6 Solar pannels

D. Grid Tie Inverter

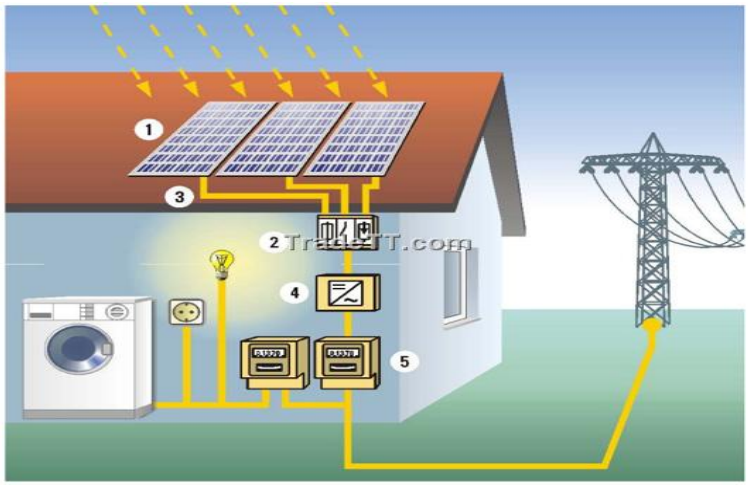

Fig-7 Grid Tie Inverter

- A Zero-Energy Building can be created with less amount of money and expenses and future savings.

6. Conclusion

- Integration of Passive and Active strategies leads to Net-Zero Energy Consumptions.
- Thus a Zero-Energy Building can be created and implemented in the constructruction sectors which will help in reducing the environmental impact.

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