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IMPLEMENTATION OF ZERO ENERGY BUILDING

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ABSTRACT

This report is based on zero-energy building, also known as a zero net energy (ZNE) building, net-zero energy building (NZEB), or net zero building, is a building with zero net energy consumption This means 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, or in other words by renewable energy sources elsewhere.These buildings consequently contribute less overall greenhouse gas to the atmosphere than similar non-ZNE buildings. They do at times consume non-renewable energy and produce greenhouse gases, but at other times reduce energy consumption and greenhouse gas production elsewhere by the same amount.Implementations of zero energy building are mostly in foreign countries and in India examples of this kind are very few.Our report includes solar energy, biogas plant, natural ventilation, day light, night purge, radiant cooling system, green wall, solar chimney, exhaust fan, rain water harvesting, bore recharge, orientation of building according to sunlight and wind, green cement is used, hollow concrete blocks with wood blocks in inner hollow portion, use of biological organic waste as fertilizers and short farm is produced using fertilizer, LED bulbs, tube lights, 1/3rd power saving lights, solar heaters are used to reduce consumption of artificial energy etc.

Keywords: Biogas, Biological Organic, Fertilizers, Greenhouse Gases, NZEB, Renewable,Led Bulbs.

I. INTRODUCTION

This article describes a transformation occurring within the architectural/Engineering spheres of the building construction industry that allowed this small, but technically challenging project to achieve success on a minimal budget. With the advent of Building Information Modelling (BIM) and increasing demand by clients for high performance structures, a bridge is being forged between the realms of energy modelling and architectural building modelling. Today, a number of commercial and non-commercial building analysis platforms are becoming accessible to design teams, fostering an unprecedented opportunity for integrated, multi-

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disciplinary project delivery and a guided design decision making process based on information provided by computer models that take climate data and project information to simulate actual building performance. This project proved that it is possible to achieve net zero energy on a budget and that type of ambitious goal also proved helpful capturing enough interest to obtain the necessary grant funding.

A net zero energy building can be defined as a building which generates as much energy through renewable sources as much as it consumes from the Grid.During the last 20 years more than 200 reputable projects claiming net zero energy balance have been realized all over the world which extensively utilise the non-renewable energy sources to air the tag of ZEB.

II. LITERATURE REVIEW

The reviewed literature has indicated that there is wide diversity among ZEB definitions. Thus the definitions are divided into a number of groups in order to spotlight the most important topics for the discussion before formulating a ZEB definition.

In the report, written in 2006 by Torcellini et al., authors use the general definition for ZEB given by The U.S. Department of Energy (DOE) Building Technologies Program:"A net zero energy building (ZEB) is a residential or commercial building with greatly reduced energy needs through efficiency gains such that the balance of energy needs can be supplied with renewable technologies." However they also point out clearly undefined "zero": "Despite the excitement over the phrase "zero energy," we lack a common definition, or even a common understanding of what it means." Considering different definitions of Zero Energy Building Torcellini, et al. (2006), distinguish and point out four most commonly used definitions:

- **Net Zero Site Energy:** A site ZEB produces at least as much energy as it uses in a year, when accounted for at the site.
- **Net Zero Source Energy:** A source ZEB produces at least as much energy as it uses inyear, when accounted for at the source. To calculate a building's total source energy, imported and exported energy is multiplied by the appropriate site-to-source conversion multipliers.
- **Net Zero Energy Costs:** In a cost ZEB, the amount of money the utility pays the building owner for the energy the building exports to the grid is at least equal to the amount the owner pays the utility for the energy services and energy used over the year.
- **Net Zero Energy Emissions:** A net-zero emissions building produces at least as much emissions-free renewable energy as it uses from emissions-producing energy sources.

Kilkis, (2007) in his work refers to Torcellini, et al. (2006) however, in the discussion on ZEB definitions, he takes slightly another direction. Kilkis indicates that in balancing the "zero" both quantity and quality (energy) of energy should be taken into consideration, since only by using energy we are able to assess the complete impact of the building on the environment. Therefore ,author proposes a new definition for the ZEB a Net-Zero Energy Building and defines it as " a building, which has a total annual sum of zero energy transfer across the

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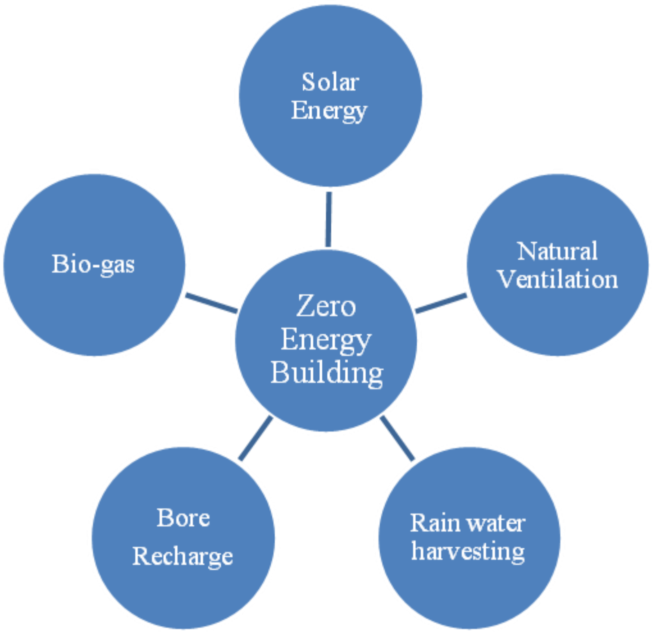
building-district boundary in a district energy system, during all electric and any other transfer that is taking place in a certain period of time".

III. MAJOR COMPONENTS OF ZERO ENERGY BUILDING



1. **Solar Energy:**Solar energy is radiant light and heat from the sun harnessed using a range of ever-evolving technologies such as solar heating, solar photovoltaic, solar thermal energy, solar architecture and artificial photosynthesisIt is an important source of renewable energy and its technologies are broadly characterized as either passive solar or active solar depending on the way they capture and distribute solar energy or convert it into solar power. Active solar techniques include the use of photovoltaic systems, concentrated solar power and solar water heating to harness the energy. Passive solar techniques include orienting a building to the Sun, selecting materials with favorable thermal mass or light dispersing properties, and designing spaces that naturally circulate air

Solar energy systems:

- Concentrated Solar Power
- Photovoltaic
- Solar Light Or Tube

2. **Rain water harvesting:** Rainwater harvesting is the accumulation and deposition of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from rivers or roofs, and in many places the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock, irrigation,

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domestic use with proper treatment, and indoor heating for houses etc. The harvested water can also be used as drinking water, longer-term storage and for other purposes such as groundwater recharge.

Fig 1: Implementation of Rain Water harvesting

3. Natural Ventilation: Natural ventilation is the process of supplying air to and removing air from an indoor space without using mechanical systems. It refers to the flow of external air to an indoor space as a result of pressure differences arising from natural forces. There are two types of natural ventilation occurring in buildings: wind driven ventilation and buoyancy-drivenventilation. Wind driven ventilation arises from the different pressures created by wind around a building or structure, and openings being formed on the perimeter which then permit flow through the building. Buoyancy-driven ventilation occurs as a result of the directional buoyancy force that results from temperature differences between the interior and exterior. Since the internal heat gains which create temperature differences between the interior and exterior are created by natural processes including the heat from people, and wind effects are variable, naturally ventilated buildings are sometimes called "breathing buildings".

4. Biogas: Biogas typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source and in many cases exerts a very small carbon footprint. Biogas can be produced by anaerobic digestion with anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials.

Fig 3: Implementation of Domestic Biogas Plant using waste from kitchen

5. Boring Recharge: Groundwater recharge or deep drainage or deep percolation is a hydrologic process where water moves downward from surface water to groundwater. Recharge is the primary method through which water enters an aquifer. This process usually occurs in the vadose zone below plant roots and is often expressed as a flux to the water table surface. Recharge occurs both naturally (through the water cycle) and through anthropogenic processes (i.e., "artificial groundwater recharge"), where rainwater and or reclaimed water is routed to the subsurface. Groundwater is recharged naturally by rain and snow melt and to a smaller extent by surface water (rivers and lakes). Use of groundwaters, especially for irrigation, may also lower the water tables. Groundwater recharge is an important process for sustainable groundwater management, since the volume-rate abstracted from an aquifer in the long term should be less than or equal to the volume-rate that is recharged.

IV. DESIGN AND IMPLEMENTATION OF ZEB

The most cost-effective steps toward a reduction in a building's energy consumption usually occur during the design process. To achieve efficient energy use, zero energy design departs significantly from conventional construction practice. Successful zero energy building designers typically combine time tested passive solar, or artificial fake conditioning, principles that work with the on-site assets. Sunlight and solar heat, prevailing breezes, and the cool of the earth below a building, can provide daylighting and stable indoor temperatures with minimum mechanical means. ZEBs are normally optimized to use passive solar heat gain and shading, combined with thermal mass to stabilize diurnal temperature variations throughout the day, and in most climates are superinsulated. All the technologies needed to create zero energy buildings are available off-the-shelf today.Sophisticated 3-D building energy simulation tools are available to model how a building will perform with a range of design variables such as building orientation (relative to the daily and seasonal position of the sun), window and door type and placement, overhang depth, insulation type and values of the building elements, air tightness (weatherization), the efficiency of heating, cooling, lighting and other equipment, as well as local climate. These simulations help the designers predict how the building will perform before it is built, and enable them to model the economic and financial implications on building cost benefit analysis, or even more appropriate – life cycle assessment.

Zero-energy buildings are built with significant energy-saving features. The heating and cooling loads are lowered by using high-efficiency equipment, added insulation, high-efficiency windows, natural ventilation, and other techniques. These features vary depending on climate zones in which the construction occurs. Water heating loads can be lowered by using water conservation fixtures, heat recovery units on waste water, and by using solar water heating, and high-efficiency water heating equipment. In addition, daylighting with skylights or solartubes can provide 100% of daytime illumination within the home. Nighttime illumination is typically done with fluorescent and LED lighting that use 1/3 or less power than incandescent lights, without adding unwanted heat. And miscellaneous electric loads can be lessened by choosing efficient appliances and

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minimizing phantom loads or standby power. Other techniques to reach net zero (dependent on climate) are Earth sheltered buildingprinciples; superinsulation walls using straw-bale construction, Vitruvianbuilt pre-fabricated building panels and roof elements plus exterior landscaping for seasonal shading.

Zero-energy buildings are often designed to make dual use of energy including white goods; for example, using refrigerator exhaust to heat domestic water, ventilation air and shower drain heat exchangers, office machines and computer servers, and body heat to heat the building. These buildings make use of heat energy that conventional buildings may exhaust outside. They may use heat recovery ventilation, hot water heat recycling, combined heat and power, and absorption chiller units.

V. CONCLUSION

Construction of zero energy building to undertaken think for "human comfortable with eco-friendly". With thetremendous increase in global population, energy use has increased from time to time. Today, structures use approximately 40% of all energy consumed in the world. If we continue on this path of energy use in conjunction with population growth projections, with few new sources of fossil fuels,we could deplete all natural resources within few years. The buildings sector has major opportunity to reduce environmental impact by incorporating energy efficient technologies in design, construction and operation of both new and existing buildings. Net zero energy buildings are more effective and advantageous, making up applications likely to expand and permitting better and more sustainable energy systems.Zero energy building is a financially, health wise, and most importantly environmental friendly responsible concept that more people need to adopt in their construction techniques.India green building council developed LED in order to help customers, designers, and builders to work together to create building with minimum impact on environment maximum possible..Use fibre lighting and solar energy for healthy environment.

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