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CONCEPT OF NET ZERO ENERGY BUILDING: REVIEW

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ABSTRACT

In recent year the concept of zero energy building has attracted international interested. There is a worldwide attempt to define the concept of Zero energy building. Advancements in residential net-zero energy buildings (NZEBs) could significantly reduce energy consumption and greenhouse gas emissions. Buildings consume 30 % to 40 % of the yearly primary energy in developed countries, and approximately 15 % to 25 % in developing countries. Renewable energy sources considered here are solar photovoltaic and solar thermal, wind, and biomass including micro combined heat and power (CHP) systems. NZEB design considerations broadly categorize into energy infrastructure connections, renewable energy sources, and energy-efficiency measures. There is a lack of systematic literature review focused on recent progress in residential NZEBs.

Keywords: Worldwide, Zero Energy Building, Energy Consumption, Renewable Energy Resources.

I. INTRODUCTION

There is increasing world-wide interest in net-zero energy buildings (NZEBs) to reduce emissions. In this paper NZEBs are defined as buildings that generate at least as much energy as they consume on an annual basis when tracked at the building site. There are many approaches to realize residential NZEBs, either through minimized building energy demand (via improved building designs and/or occupant behaviors) or increasing renewable energy generation.

The goals of zero energy building takes us out of designing low energy building with the energy saving goal into sustainable energy This review provides various technology options in a systematic way (energy infrastructure connections, renewable energy sources, and energy efficiency measures), focusing on residential buildings.

1.1. Examples of Some Worlds Net-Zero Energy Buildings

1. **The Unisphere, Maryland, U.S.A | Net Zero Buildings**

2. **National Renewable Energy Laboratory, Colorado, U.S.A**

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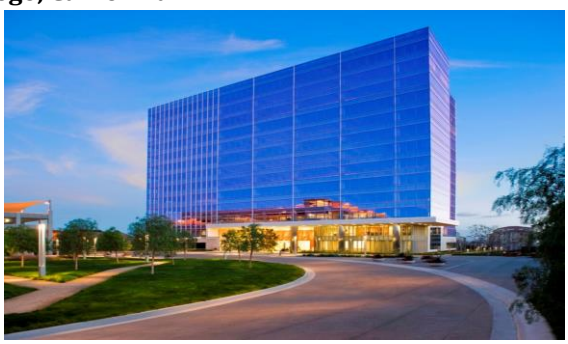
3. **La Jolla Commons, San Diego, California**



4. **Indira Paryavaran Bhawan, Ministry of Environment and Forest, New Delhi, India**

5. **Avasara Academy, Lavale, Pune, India | Net Zero Building**

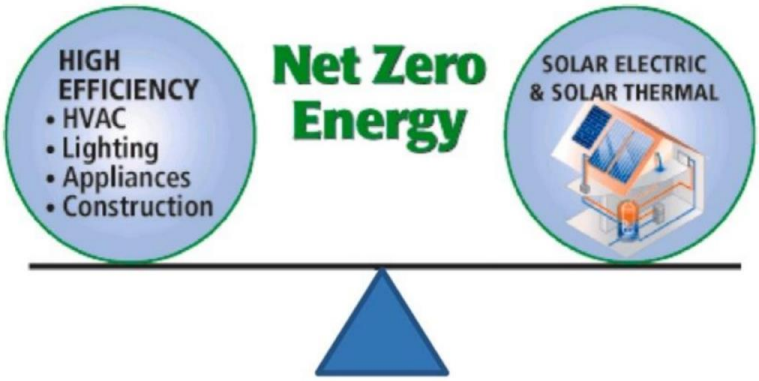
1.2 Aim

1. To Achieve important criteria for sustainable building.

2. Net zero energy building be achieve in climate zone of Pune.

3. The aim of this research is assessing the net zero energy building requirement for sustainable construction. For achieving this goal, a comprehensive research of the relevant literature is done as well some cases are employed for better illustration of the topic.

II. LITERATURE REVIEW



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A statistics provided by the Ministry of Statistics and Programme Implementation, Government of India indicates that the per capita energy consumption. This is due to the improved urban living standards energy consumption from households to industrial sector. The energy use in Indian buildings are responsible for at least 30-40% of total energy consumption and this demand is growing annually at 11- 12%. Most of this energy is consumed for heating, cooling, lightning and other appliances.

In buildings in India are designed to reduce the energy consumption, water requirements and technologies are developed to recycle used water for secondary usage.

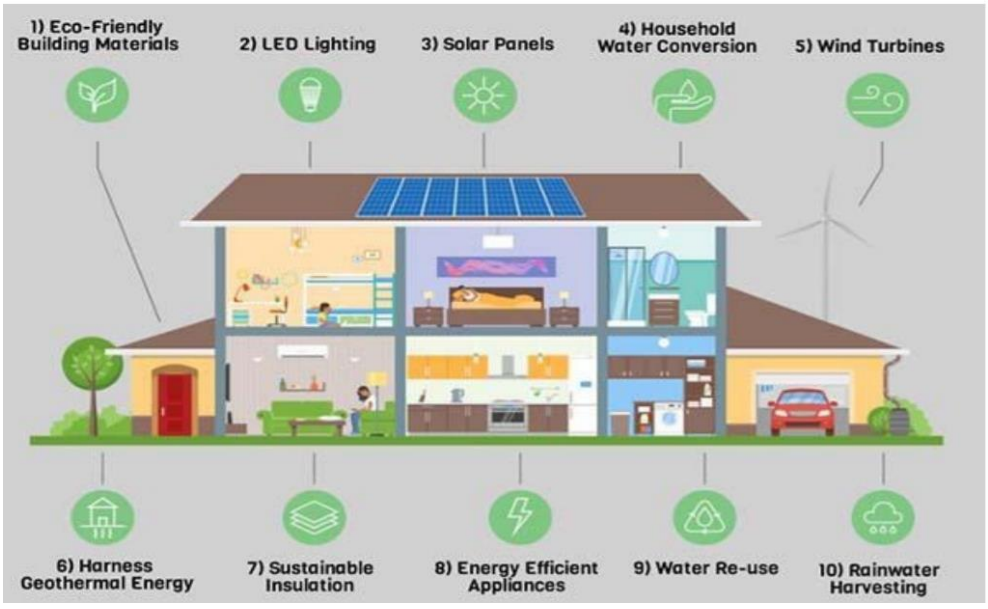
1. Nicolae Bajenaru work regarding the design of a net zero energy building with ventilation system which assures the thermal comfort of the occupants according to the ASHRAE 55/2010 Standard In India, with a rational consumption of energy environmental impact. The study relied on the use of easily accessible building materials and customary Air Conditioning(AC) equipment, in order to meet the requirements.

2. That the idea of a zero-LCCO2 home is to reduce the annual energy consumption and increase solar energy use so that photovoltaic (PV) energy generation substantially exceeds the total energy consumption of the home. He that the annual CO2 absorption by PV generation exceeds the annual CO2 emissions owing to energy use. He simulated the annual energy use and CO2 balance of the house and evaluated the embodied CO2 of the house using. the material added for better energy efficiency and CO2 emissions generated during the manufacturing and construction periods have a positive effect on reducing the LCCO2 of homes.

3. Reshmi Banerjee suggest that the Net Zero Energy Building (NZEB) do not increase the amount of greenhouse gases in the atmosphere. In the building-grid interaction, the Net ZEBs become an active part of the renewable energy infrastructure increasing number of buildings are realistic given current building technologies and design approaches.

2.1. Application of Renewable Energy Sources

Housing prototype was designed to be energy-efficient to minimize negative impact on environment. The analysis house experiences nearly net-zero energy consumption and the house provides its occupants comfortable and healthy indoor living environment (NZEB).India.



They reported that the governance context. They also reported that the instruments and strategies related to energy efficiency and renewable energy integration in buildings are available; however they are not part of a holistic program. The energy consumption of residential buildings has grown fast in recent years, thus raising a challenge on zero energy residential building (ZERB) systems, which aim at substantially reducing energy consumption of residential buildings.

Thus, how to facilitate ZERB. In particular, the architecture for both schematic design and passive technology. the selection of high-efficiency appliance and renewable energy sources for ZERB residential building. In addition classical residential building has been investigated in the proposed case, in which several critical

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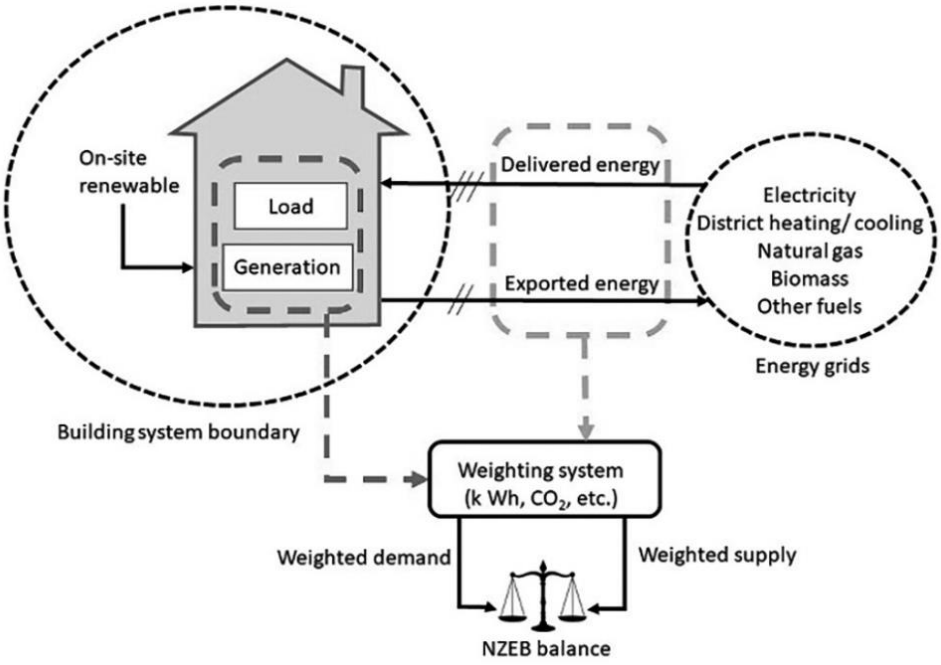
aspects such as building optimization, passive design, PV panel and HVAC system integrated with solar water heater, Phase change materials, natural ventilation, etc., have been taken into consideration.

Balance in Energy produced and energy consumed For developing the building more energy efficient. It also demonstrates how every individual can contribute in reducing the carbon footprint without compromising on the comforts and aesthetics one aspires in a home or office space. This building can be used as home or office as it has air-conditioning systems that use geo thermal energy i.e earth air tunnel system, radiant flooring, efficient water and lighting fixtures and it uses local and recyclable material.

III. METHODOLOGY

The aim of the paper is to investigate the literature on the existing NZEB to make them self-sustaining and net zero in order to improve energy efficiency of the buildings the most important features of each methodology with regards to met-ric, period and type of the balance, types of energy use included, renewable supply options, primary energy and CO2 factors and unique features

The case study is presented by the authors of the architectural design and construction management of the Zero building and its neighbourhood For the electricity measurements, there were 45 energy meters in the Zero Building and 35 more for the Ideo Campus connected with M-Bus modules that can be applied to future project designs to meet the challenge of designing positive energy buildings and districts.



In this simulation, the typical office building is presented as the reference building. The CO2 emissions from the Zero building amount to 14.2 kgCO2/m2y, which is 37% of the emission of the reference building and results in it achieving an A rating. The operational energy corresponds to the technical building systems as stated in the EPBD for office buildings, which include energy consumed for heating, cooling, hot water systems, lighting and ventilation;

This building is energy sufficient building and uses renewable energy sources for heating and power generation to operate the electrical and electronic appliances the energy balance calculation of a building equipped with on-site and/or off-site renewable energy generation systems and/or interacting with the utility grid and striving to fulfil 'zero' goal is not an easy task. Moreover, with no clear standardized support for 'zero' calculating methodology. Some voluntary environmental assessment methods like LEED Survey methodology to measure knowledge transfer during the design process

. In this section, we present each specific methodology in detail. the building energetic and economic performance and to investigate the influence of climates differences on the zero energy balance. The excel spread sheet was distributed among all eight participants in order for them to become familiar with it and test

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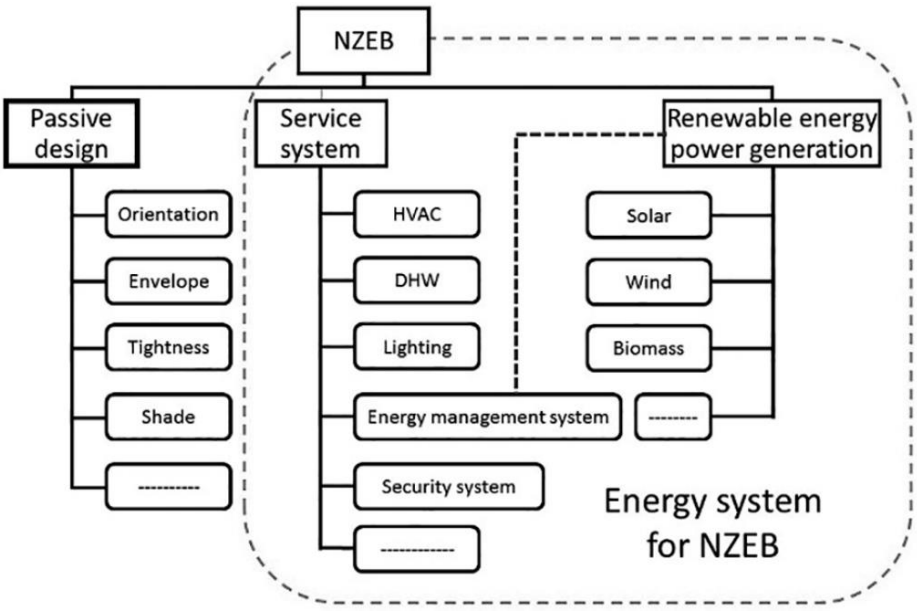
known national Net ZEB projects against the other methodologies. finally the participants explained the differences between the "know practice" for energy calculation of Net ZEBs and their national building code.

3.1. Definitions of NZEB

Net zero site energy use In this type of ZEB, the amount of energy provided by on-site renewable energy sources is equal to the amount of energy used by the building . This ZEB generates the same amount of energy as is used, including the energy used to transport the energy to the building. This type accounts for losses during electricity transmission.



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These ZEBs must generate more electricity than net zero site energy building An ZEB is a very high-performance building, determined based on annual energy consumption associated with typical use, including indoor temperature control to maintain a predetermined temperature. The 'nearly zero' amount of energy required should be sourced to a 'very significant extent' by renewable energy sources on-site or nearby.

zero net energy consumption and zero carbon emissions annually. Zero energy buildings can be used autonomously from the energy grid supply – energy can be harvested on-site. The net zero design principle is overlaid on the requested comfort of the building occupant. Generally, the more extreme the exposure to the elements the more energy is needed to achieve a comfortable environment of human use The zero-energy approach has potential to reduce carbon emissions, and reduce dependence on fossil fuels.

Most ZEB definitions do not include the emissions generated in the construction of the building and the embodied energy of the structure. So much energy is used in the construction of a new building that this can dwarf the operational energy savings over its useful life.

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.

Net off-site zero energy use A building may be considered a ZEB if 100% of the energy it purchases comes from renewable energy sources, even if the energy is generated off the site.

3.2. Design and constructions

The most cost-effective steps toward a reduction in a building's energy consumption usually occurs 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 natural 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 day lighting and stable indoor temperatures with minimum.

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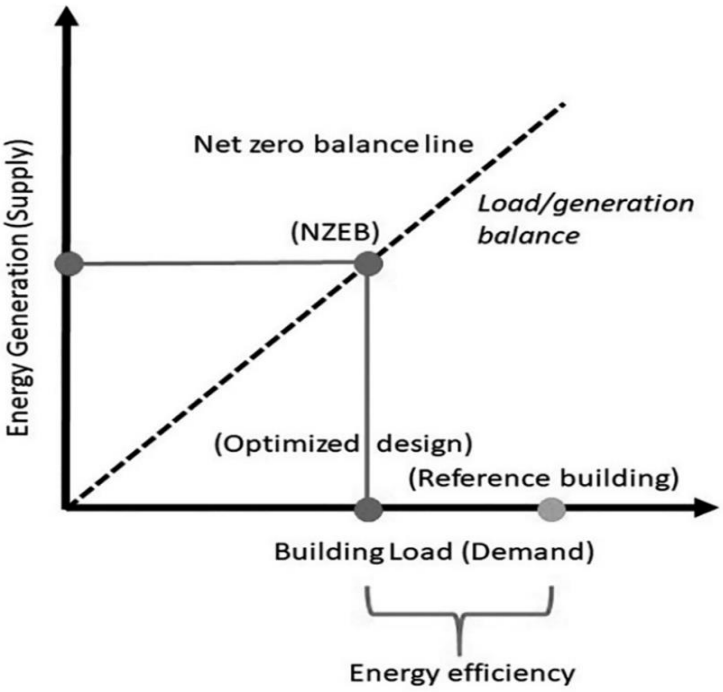

Mechanical mean These buildings make use of heat energy that conventional buildings typically exhaust outside. They may use heat recovery ventilation, hot water heat recycling, combined heat and power, and absorption chiller units.

Zero-energy buildings are built with significant energy-saving features. The heating and cooling loads are lowered by using high-efficiency equipment (such as heat pumps rather than furnaces.

Heat pumps are about four times as efficient as furnaces) added insulation (especially in the attic and in the basement of houses), high-efficiency windows (such as low emissivity, triple-glazed windows), draft-proofing, high efficiency appliances (particularly modern high-efficiency refrigerators), high-efficiency LED lighting, passive solar gain in winter and passive shading in the summer, natural ventilation, and other techniques.

Zero-energy buildings are often designed to make dual use of energy including that from 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.

IV. CONCLUSION

The zero energy concept will reduce global warming and helps to retain the nature.. The every aspect of the building was planned with 'green' approach, showcasing the latest in HVAC technology alongside recycled materials. Also it is necessary to optimize the usage of water, chilled water and hot water and STP and solar

energy conversion using suitable energy conversion devices. The building automation system will help in optimizing the above said parameters.

The prana building is developed to demonstrate the feasibility of constructing zero energy building and demonstrate the functionality of zero energy building in energy saving.

Indira Paryavarn Bhawan first govt. building in the country to achieve the landmark of net zero energy building which has an annual energy consumption of 14.21 Lakh kWh met with equivalent annual energy generation of 14.3 lakh kWh from Solar BIPV installed on-site and one of the very few full-fledged multifunctional office buildings in the world to do so on a tight urban site.

V. REFERENCES

[1] International Journal of Applied Engineering Research ISSN 0973-4562 Volume 13, Number 1 (2018) pp. 136-140 © Research India Publications. http://www.ripublication.com Studies on Zero Energy Building.

[2] International Journal of Research Publication and Reviews Journal homepage: www.ijrpr.com ISSN 2582-7421 A Review Paper On Zero Energy Building.

[3] Marszal, A. J., & Heiselberg, P. (2009). A Literature Review of Zero Energy Buildings (ZEB) Definitions. Department of Civil Engineering, Aalborg University. DCE Technical reports No. 78 A literature review of Zero Energy Building (ZEB) definitions.

[4] International Journal Of Scientific & Technology Research Volume 9, Issue 11, November 2020 Issn 2277-8616 Case Study: India's First Net-Zero Energy Building- Indira Paryavaran Bhavan

[5] Energy and Buildings journal h om ep age: www.elsevier.com/locate/enbuild A review of Net Zero Energy Buildings with reflections on the Australian context

[6] Zero-energy building - Wikipedia

[7] Zero-energy building (ZEB) | Materials, Technology, & Features | Britannica

[8] India's first net zero energy building | Delhi News | The Hindu

[9] 5 Net Zero Buildings around the world - RTF (re-thinkingthefuture.com)

[10] Procedia Engineering 100 (2015) 1505 – 1514 ,25th DAAAM International Symposium on Intelligent Manufacturing and Automation, DAAAM 2014 Concept Project of Zero Energy Building.