International Journal of Regional Planning

Journal homepage: https://ojs.unikom.ac.id/index.php/injurplan/index

Net Zero Building

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ABSTRACTS

The purpose of this study is to analyze the concept of zero energy buildings in optimizing the use of environmentally friendly renewable energy resources. This research was conducted using descriptive analysis method through literature study from secondary data. The results of this study show that with the advancement of renewable technology, Net Zero Buildings can be achieved in the future, with one understanding and contribution made by everyone in understanding the responsibility to reduce energy consumption. This can be known by paying attention to the level of awareness and sense of responsibility of everyone in creating a sustainable environment.

ARTICLE INFO

Article History:
Received 12 Dec 2023
Revised 8 Jan 2024
Accepted 16 Jan 2024
Available online 27 Feb 2024
Publication date 1 Jun 2024

Keywords:
Energy,
Building,
Zero,
Suistainable.

1. INTRODUCTION

Net Zero Energy Building (NZEB) is a high-performance building concept that integrates passive design and renewable energy systems taking into account certain technical characteristics of clean zero energy buildings, carried out by several different systems, including: 1) Geothermal – Air Exchange (EAHE), 2) Underground Tank (UNT) and 3) Solar Thermal Collector (Benzaama *et.al.,* 2021). This is based on the acute problem of carbon dioxide emissions into the atmosphere which becomes very important at concentrations of about 0.04 percent (400 parts per million) by volume, because most energy resources produce carbon dioxide as a by-product. In addition, with the energy demand in the building sector that drives the need for changes in the use of energy resources and environmentally friendly from fossil fuels in reducing the impact of global warming and climate change. Thus, the concept of energy-

efficient buildings for a sustainable future was formed by taking into account the physical effects and challenges faced in the path and location (Saini *et.al.,* 2021). According to Lu *et.al.,* 2021 there are two strategies for reward-penalty mechanisms to promote clean zero energy buildings, namely building-level-based strategies and community-based strategies. The building-level-based strategy considers the rate of change in costs versus the curve at the building level without energy.

Buildings are the primary energy consumers contributing to more than 40%of the energy usage. A 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. At the heart of the ZEB concept is the idea that buildings can meet all their annual energy requirements from low-cost, locally available, non-polluting, renewable sources. Research conducted in Morocco in achieving zero energy buildings, efficiency practices carried out are by combining architectural energy efficiency practices and renewable energy for the production of hot water and electricity. The design features considered in achieving the zero energy building concept are building orientation, window type and Window-to-Wall Ratio, wall and roof insulation, and infiltration rate. With the application of this concept, energy savings of more than 21%, reduction of heating load by 28%, and cooling activity of 40% in cooling are achieved. In addition, 45% of the energy load of buildings can be covered instantly by renewable energy systems in all climatic zones of Morocco (Abdou *et.al,* 2021).

Meanwhile, according to Meathhil *et.al.,* 2021 clean Zero Energy buildings connected to the Photovoltaic power grid help in achieving a net zero energy balance in Net Zero Energy Buildings (NZEB) homes. The results of the NZEB evaluation will provide insight into cost savings for clean energy consumption by consumers and reduction of carbon footprint using the Differential Evolution (DE) optimization algorithm. The concept of Differential Evolution (DE) is the demand for electrical energy through an effective tool scheduling routine. Therefore, this study was conducted with the aim of analyzing the concept of net zero energy in minimizing energy use in a building optimally, through literature studies from journals and articles related to the research subject.

2. METHOD

1. Design for an Energy Efficient Building

Elements that should be included are site selection, climate, size, R-value, ventilation and insulation. Selecting a site location with adequate exposure to the sun is vital to ensure optimal conditions for energy-efficient materials and appliances. The type of climate zone you're building can affect different variables that contribute to the overall energy level of your home or building. Air, moisture, and amount of daylight differ in different climates and have a massive impact on the way you build for energy efficiency.

2. Utilize Green Construction Technology

Rainwater Collection System, fuel and biomass cells, biogas, photovoltaic cells, EPA wood stove for heating, photoelectric daylight sensor, occupancy sensor are some environment friendly techniques that can be applied on ZEB. Contractors can utilize Building Information Management (BIM) technology throughout the building process. BIM is a tool used to create 3D models throughout a construction project. BIM software has helped contractors adapt to the building technique prefabrication. Prefabrication is the process of assembling buildings or parts at a site other than the job site itself. Prefabrication has a lower environmental impact by reducing waste and allowing controlled building environments to build structures with better air filtration and wall insulation, directly influencing energy efficiency.

3. Super-Insulate and Super-Seal the Building Envelope

Super-sealing, a building, is the process of making a building airtight. A continuous seal within the structure ensures that the drywall is running at optimal energy-saving efficiency and proper cooling and heating of the building. Popular techniques include the use of ADA (airtight drywall) and adhesive attachment of sheathing. The process of super-insulating a home includes sealing the outer wall in double construction, sealing the inner wall, and sealing all other cavities in the house. This includes electric boxes, doors and windows, and attic and crawl spaces. The combination of super-sealing and super-insulation creates the foundation for building a net-zero structure.

4. Utilize the Power of Solar Energy

A PV system or solar power system is the decrease in monthly energy bills. , commercial buildings typically see a return on investment, on average, in 8-10 years, and homeowners can expect to see a profit anywhere between 7-20 years, depending on the project size. Solar can also be used to maximize a building's heating and cooling capabilities. For example, using the sun for heating through the south-facing windows during the winter lowers heating costs. Shading those same windows in summer reduces cooling costs.

5. Install Energy Efficient Systems and Appliances

Geothermal heat pumps (GHPs) are also an option, GHPs heat, cool, and supply hot water through ground-source pumps that transfer heat from the earth. Some other techniques can be used are underfloor air distribution, HVAC designs, gray water reclamation, radiant floor heating and cooling, retractable external. To complete your home or building, equip it with appliances that work to save energy. High-performance stovetops, microwaves, and dishwashers can save 2-3 times the amount of energy regular devices use. Energy Star offers cost-effective appliances that use less energy.

3. RESULTS AND DISCUSSION

Zero Net Energy can be applied with four basic concepts, namely Net Zero Site Energy, Net Zero Source Energy, Net Zero Energy Costs, Net Zero Energy

Emissions, and Net Zero Site Energy (Singh, 2019).

- Net Zero Site Energy

Site Energy is based on the equality of energy consumption and income in a building, regardless of where or how the energy comes from. In a net-zero site energy building, it means that if a consumer uses one unit of energy, then the site also produces one unit of energy with renewable resources.

- Net Zero Source Energy

Net zero source energy is the use of primary energy sources to extract and deliver energy to buildings, including energy for the building's electrical energy generation, transportation, and distribution.

- Zero Net Energy Cost

Zero Clean Energy, namely energy consumed and produced by buildings or consumers alike, i.e. from renewable sources or other processes, with the net cost being Net Zero Energy Costs. Buildings that still use natural gas for preparation or cooking choose this definition as a way to produce buildings efficiently and reduce costs.

- Net Zero Energy Emissions

Zero Emissions Building Clean Energy is a concept that uses energy which results in a building free of energy and reduces the effect of greenhouse gases. Most of the clean energy zero buildings generate their energy again through solar panels and other sources of energy within a period of one year.

The zero net energy consumption principle is viewed as a means to reduce carbon emissions and reduce dependence on fossil fuels. While the initial up-front costs can be higher for a net-zero home, the monthly cost of living can be lower due to energy efficiency improvements and lower electricity bills (**Fig. 1**). But it can have several benefits like Tax Incentives. Many tax breaks and incentives exist for those who choose to own a Net Zero Energy home.

1. Superior Insulation Quality.
2. Home Orientation.
3. Energy Bills.
4. Higher Resale Value.
5. Minimizing your Ecological Footprint.
6. Comfortable Living Space.
7. Budget Flexibility.

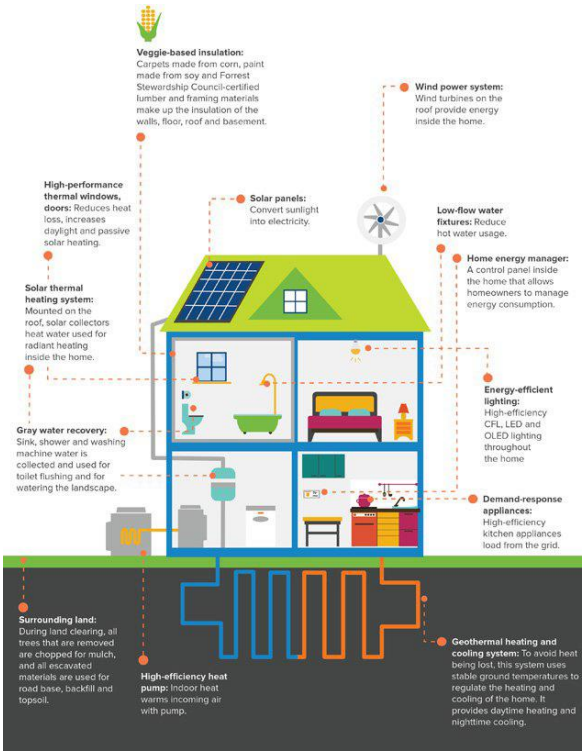

Fig. 1. Ilusstartion of Net Zero Energy home

(http://www.heliostat.gr/infographic-what-the-net-zero-homes-of-the-future-will-look-like/)

According to Sing *et.al.*, 2020, there are four NZEB classifications seen based on the choice of renewable energy use, namely: NZEB: A, B, C and D.

a) Classification A is a building that collects energy within the building site and combines it (energy efficiency and renewable energy) to generate and utilize energy.
b) Classification B is a building that combines energy efficiency and renewable energy to generate and use energy with a footprint and renewable energy generated within the building.
c) Classification C is a building that uses offsite renewable resources are brought to the site to produce energy. In this classification requires two buildings that are interconnected. However, in these buildings it is difficult to cover the costs incurred in purchasing renewable materials and bringing them to the site.
d) Classification D is a building that uses an energy strategy as in classification C. However, in this classification, renewable strategies in locations between buildings are used as much as possible, and the purchase of a renewable energy certificate is required.

4. CONCLUSION

With the advancement in renewable technology Net Zero Buildings are the future. But the goal of NZB would not be fulfilled till the time all the people understand their responsibility and contribute towards reducing energy consumption. Its very much important to spread awareness and importance of

both replenishing resources and Net Zero Buildings concept.

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