

Design Aspects and Energy Efficiency of Green Buildings

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Abstract- Green building, also called sustainable design and development, is the practice of using healthier and more resource-efficient land planning, construction, renovation, operation, maintenance and demolition. Today, it's much more than the original understanding of simply incorporating recycled materials into a home. In this globalization era, sustainable constructions have taken on some new steps to stimulate green building practice. Green buildings help reduce negative impacts on the natural environment by using less water, energy, and other natural resources; employing renewable energy sources and eco-friendly materials; and reducing emissions and other waste. Green building criteria basis are energy efficiency, material and resource conservation and sustainable design of the building itself. Energy efficiency still has a long way to go, due to some barriers that prevail in the practice of energy efficiency. This study will be done using a case of the construction sector in Malaysia. The data will be collected through an interview with several Property Development Companies or projects that apply the green building criteria. The recommendation is that more property development companies should be interviewed so that more comprehensive results can be gathered.

Index Terms- Green Building, Green Building Construction, Green Construction.

I. INTRODUCTION

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building. Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

Efficiently using energy, water, and other resources
Protecting occupant health and improving employee productivity
Reducing waste, pollution and environmental degradation. For example, green buildings may incorporate sustainable materials in their construction (e.g., reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g., reduced product emissions); and/or feature landscaping that reduces water usage (e.g., by using

Green Building (also known as green construction or sustainable building) expands and compliments the building design concerns of economy, utility, durability and comfort. A Green Building is one which uses less water, optimizes

energy efficiency, conserves natural resources, generates less waste and provides healthier space for occupants as compared to conventional building. Green buildings are designed to reduce the overall impact on human health and natural environment. Using energy, water and other resources efficiently. By reducing waste, pollution and environmental degradation. native plants that survive without extra watering. Green building (also known as green construction, sustainable building, or eco-friendly building) refers to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance,

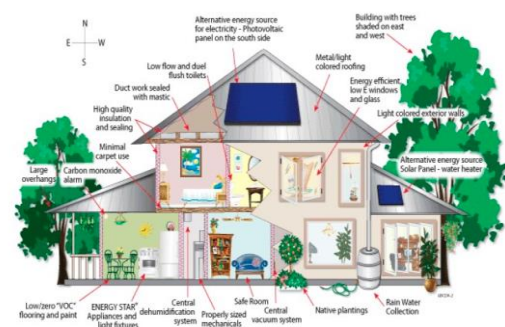


Figure 1: Green Building

Concept of Green Building

- Sustainable site planning
- Building Design Optimization
- Energy Performance Optimization
- Renewal Energy Utilization
- Water and Waste Management
- Solid Waste Management
- Sustainable Building materials and Construction Technology
- Health, well being and Environmental Quality

II. HOW TO MAKE A BUILDING GREEN

- Sustainable site planning with bioclimatic architectural planning Design energy efficient lighting and HVAC (Heating, Ventilation, and Air conditioning) system.
- Use low energy and renewable materials.
- Choose construction materials and interior finishes products with zero or low emissions to improve indoor air quality.
- Use dimensional planning and other material efficiency strategies.
- Design for gray water system that recovers rain water for site
- irrigation and dual plumbing system for use of recycled water for toilet flushing.
- Green buildings incorporate measures that are environmentally friendly and resource-efficient across the building lifecycle.

III. LITERATURE REVIEW

1. Sustainable Construction

Sustainable construction refers to the ways of how the developers design, develop, build and control a project that make as little negative impacts on the environment and public as possible (Nazirah, Nor'Aini, & Ayman, 2013). It is defined as the establishment of buildings that makes use of little untouched materials and energy, and creates pollution and waste that are minimal (Zimmermann, Althaus, & Haas, 2005). According to Hong Kong Housing Authority (2009) environmental, social, and economic sustainability are the three aspects of Sustainable construction. The main objective of sustainable construction is to set up healthy set up surroundings based on effective utilisation of materials and resources and excellent and sustainable building designs (Hwang, Zhao, & Tan, 2015).

2. Green Building

Green building serves as the basis of sustainable construction development (Samari et al., 2013). Green building is claimed to be a building that meets the prerequisite building performance standards while diminishing the disruption to,

and enhancing, the ecosystems in the native, provincial and universal circumstances in the whole life cycle (Glavinich, 2008). Additionally, green building also helps to enhance residents' health through the design of a healthy interior environment (Allen et al., 2015).

Green building is deemed necessary to fulfill the fundamental building code terms and reduce its life-cycle environmental impacts and cost (Ali & Al Nsairat, 2009). The decision in selecting an appropriate green building rating tool is highly important and the selection has to lean on the climate and various characteristics of that particular country's agenda (Lizawati et al., 2015), based on four norms namely appropriate, accessible, up-to-date, and quantifiable (Wu et al., 2015). It has to meet an anticipated level of performance according to the standards that have been predetermined (Ali & Al Nsairat, 2009). Also, the Building Research Establishment Environmental Assessment Methodology (BREEAM) is widely employed in the UK especially for companies like the Housing Corporation (Wong & Fan, 2013), and it is applicable to various types of buildings (Chen, Yang, & Lu, 2015).

3. Green Building Index

Green Building Index (GBI) is the first green rating tool introduced in the Malaysian construction industry. Established in 2009 by Malaysian Institute of Architects (PAM) and the Association of Consulting Engineers Malaysia (ACEM), its aim is to improve the awareness and create sustainable and green architecture or green building (Abdullah, Jumadi, Sabu, Arshad, & Mohd Fawzy, 2015) (Sim & Putuhena, 2015). The establishment of GBI adheres to the initiatives to formulate Malaysian green policies, or specifically the National Green Technology Policies, 2009 (Lizawati et al., 2015). It was devised based on international green building rating systems like USA's LEED and UK's BREEAM, and assessed to become compatible with the Malaysian climate and geographical conditions (Samari et al., 2013). Tropical climate, environmental conditions, and social and cultural needs of Malaysia are all deliberated upon by GBI (Wu et al., 2015).

4. Energy Efficiency

Energy efficiency is regarded as a benchmark of energy utilized to supply a service. By making improvement to the energy efficiency, the public will receive and save more energy from the energy used (Department of Energy and Climate Change, 2012). According to Murer, Alonso-Herranz, de Waal, Spliethoffl, van Berlo3, and Gohlke (2013), energy efficiency is the essence towards achieving sustainability in the society, and it is also broadly acknowledged as a tool to reduce greenhouse gas (GHG) emissions (Zimmerman, 2012).

Next, energy efficiency refurbishment and retrofit will help minimize the gas emission of greenhouse gases (GHGs) (Department of Energy and Climate Change, 2012); (Morrissey, Dunphy, & MacSweeney, 2014); (Milner, et al., 2015), and the reduction has led to the energy efficiency of buildings (Organ, Proverbs, & Squires, 2013). The constructed environment point to 30-40% of global energy consumption and connected greenhouse gas (GHG) emissions, enabling any industry to save energy and prevent =GHG emissions (Dunphy, Morrissey, & Mac Sweeney, 2013).

5. Green Building Materials

Environmental impacts, resource efficacy, waste reduction, life cycle cost, social welfare, and performance competence are several vital factors that have to be considered when choosing appropriate green building materials (Akadiri & Olomolaiye, 2012). Building material evaluation and selection are two significant phases during the detail design phase as sound decisions have to be made with respect to building assemblies (Gething, 2011). Reclaimed wood is a good material for the doors, and the material that can be used to make wiring is the virgin copper because it

The main purpose of GBI is to promote sustainability in the built environment and get the involvement of all the players in the construction industry towards the environmental issues. Sustainability consists of six criteria as shown in Table 1.1 (Fauzi & Malek, 2013), seeking to save energy, resources, recycle materials and adapt buildings to the Malaysian climate, culture and environment (Rahardjati & Khamidi, 2011) and it aims to increase the awareness of all the relevant parties in the construction field and hence contributes to the environmentally friendly settings in Malaysia (Habibullah, Abdullah Halim, & Abdullah Halim, 2012). The points for the GBI certification will be given for performance based on the stipulated benchmarks and the current industry practice (Rahardjati & Khamidi, 2011).

IV. NEED OF GREEN BUILDINGS IN PRESENT SCENARIO

- Buildings are responsible for 40% of world wide energy flow and material use conventional buildings have been identified as the largest source of green house gas emissions, even more than that of the transport and industry sector.
- 8000lbs of waste are typically thrown into a landfill during the construction of a 2000sqft home.
- The buildings in the US consume more than twice as much energy as all the cars
- Buildings account for 68% of total electricity consumption
- Buildings use 80% of total drinking water consumption

- Indoor levels of pollution are commonly 2 to 5 times higher than outdoor pollution levels.

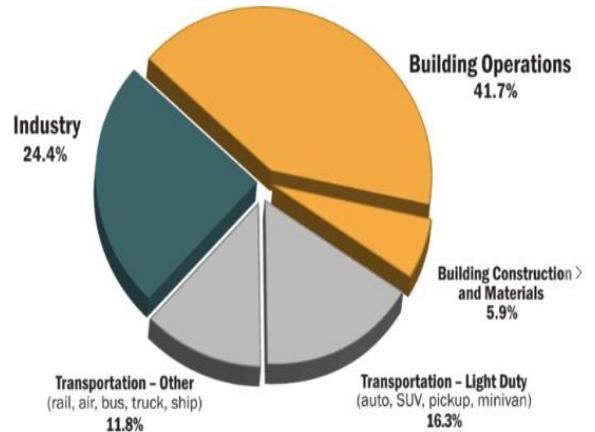


Figure 2: Ratio of Green building

Objectives of Green Building

- Protecting Occupant Health
- Improving employee productivity
- Using energy, water and other resources more efficiently
- Reducing overall impact to the environment
- Optimal environmental and economic performance
- Satisfying and Quality Indoor spaces

V. IMPORTANCE OF GREEN BUILDINGS

- Nowadays we should make a way to maximize our natural resources to help our mother earth to get relief from the pollutions like global warming that we are all experiencing.
- Non- renewable sources are expensive and unsafe.
- Green Building concept is the practice of creating structure using processes that are environmental friendly and resources efficient during building life-cycle;

selection of site, design, construction, operation, maintenance, renovation and destruction.

The importance is to lessen the consumption of energy and pollution as well.

- More use of non-renewable energy leads to more pollution.
- The growth and development of our communities has a larger impact on our natural environment.
- The manufacturing, design, construction and operation of buildings are responsible for the consumption of our natural resources.

Six Areas with a BIG Impact

- Sealing the envelope: insulation
- Green heating, ventilation, and air conditioning (HVAC)
- Green plumbing
- Green lighting
- Green paints and carpets
- Green landscaping.

The Leadership in Energy and Environmental Design



Figure 3: Energy and Environmental design

Six Fundamental Principles of Sustainable Building Design

While the definition of sustainable building design is ever changing, the National Institute of Building Sciences defines six fundamental principles.

- Optimize Site Potential
 - Optimize Energy Use
 - Protect and Conserve Water
 - Optimize Building Space and Material Use
 - Enhance Indoor Environmental Quality (IEQ)
 - Optimize Operational and Maintenance Practices
8. Six Fundamental Principles of Sustainable Building Design

1. Optimize Site Potential

Whether designing a new building or retrofitting an existing building, site design must integrate with sustainable design to

achieve a successful project and begins with the proper site selection, including the existing building's rehabilitation. The location, orientation, and landscaping of a building all affect local ecosystems, transportation methods, and energy use.

According to the WBDG Sustainable Committee, "The site of a sustainable building should reduce, control, and/or treat storm-water runoff. If possible, strive to support native flora and fauna of the region in the landscape design."

2. Optimize Energy Use

Improving the energy performance of existing buildings is important to increasing our energy independence. Operating net zero energy buildings is one way to significantly reduce our dependence on fossil fuel-derived energy.

3. Protect and Conserve Water

Freshwater resources in the United States are increasingly becoming a scarcity. A sustainable building design and construction is one that uses water efficiently to minimize the impact that affects freshwater stock. Additionally, sustainable construction and building design should encourage the practice of recycling water on certain on site projects when possible.

4. Optimize Building Space and Material Use

As the world population continues to grow; the use of natural resources (and the demands for them) continues to increase. A sustainable building is designed and operated to use and reuse materials in the most productive and sustainable way across its entire life cycle.

Utilizing sustainable materials can also help to minimize environmental impacts such as global warming, resource depletion, and toxicity. According to wbdg.org, "environmentally preferable materials reduce impacts on human health and the environment, and contribute to improved worker safety and health, reduced liabilities, and reduced disposal costs."

5. Enhance Indoor Environmental Quality (IEQ)

The indoor environmental quality (IEQ) of a building has a significant impact on occupant health, comfort, and productivity. Among other attributes, a sustainable building maximizes day lighting, has appropriate ventilation and moisture control, optimizes acoustic performance, and avoids the use of materials with high-VOC emissions.

Although all buildings require different measures, HVAC modifications can go a long way toward improving commercial air quality.

6. Optimize Operational and Maintenance Practices

Building owners face unique challenges to meet increasing demands for new or renovated sustainable building designs that are balanced with safe, secure, and productive environments.

Through collaboration, engineers, architects, and other site contractors can specify materials and systems that simplify operational practices and reduce maintenance requirements. On-site and within the facility, these practices not only aim to reduce water and energy requirements, and require less toxic chemicals use, but are also cost-effective and reduce life-cycle costs.

Energy Engineering Company Makes an Impact

Ultimately, energy efficiency can be enhanced through the integration of sustainable architecture and engineering and can have direct impacts on our environment, society and economy. With experience in multiple LEED projects and energy intensive markets, our experts at KMB look to propose and implement environmentally sound practices on all projects based upon historical evidence of practical, economical results.

VI. ESSENTIAL FEATURES OF GREEN BUILDING DESIGN FOR A SUSTAINABLE FUTURE

Green buildings are designed to minimize the environmental impact of construction while providing a healthy and comfortable living environment for occupants.



Figure 4: Green Building Design

The following are some of the key features of our buildings (green buildings):

Sustainable Site Design

This involves careful planning of the site to minimize the impact on the environment.

Indoor Environmental Quality

Our buildings prioritize the health and comfort of occupants by providing high-quality indoor air, adequate lighting, and proper temperature and humidity control.

Water and Energy Efficiency

Buildings constructed by Litedares use technologies and practices that reduce water and energy consumption, such as low-flow fixtures, and energy-efficient lighting.

Sustainable, Non-Toxic Building Materials

Our buildings use materials that are environmentally friendly, healthy for occupants, and can be recycled or reused at the end of their lifecycle.

Renewable Energy

Our buildings often incorporate renewable energy sources like solar or wind power to reduce reliance on non-renewable energy sources.

Pollution and Waste Reduction Systems

Litedares buildings employ systems that reduce waste and pollution, such as recycling programs and extractor hoods.

VII. CONSIDERATIONS FOR GREEN BUILDINGS

A green building has following key elements or components which are incorporated in the design:

Site Selection

The building site is selected so that no natural features of the landscape are damaged or disturbed. Important facilities for the inhabitants such as transit or hospitals are easy to access.

Design

The building is designed to improve the living conditions of the inhabitants. The building is easily accessible. The building incorporates features of the natural landscape and blends into its surroundings.

Materials

Only high quality, non-toxic and renewable materials are used. Waste materials of other processes (such as coal ash from coal power plants or plastic waste) can also be incorporated in the building.

Energy

The building is designed to minimize energy losses. Most of the energy is produced through non-perishable sources such as Solar Energy or Wind Energy. Natural Light and Wind are used to reduce electricity usage.

Air Quality

Using the aforementioned factors, air quality is improved. Ventilation systems with humidity controls are used to control the climate inside the building. Good quality filters for filtering out allergens and pathogens are also incorporated.

Water

Minimum amount of water is used in the construction process while ensuring that water quality in the surrounding is not

impacted by the building or construction processes. Purified water is supplied through high-quality plumbing to the inhabitants.

Ecology

Environmental factors are considered, and it is ensured that minimum disturbance is produced to the natural ecology of the surroundings.

Adaptability

Green buildings can incorporate changes stemming from the everchanging environmental conditions. As the building demands increase, the building can be easily modified with minimal losses.

VIII. CONCLUSION

Green buildings are next-gen buildings. The future of building is green buildings. It works on the principle of sustainability. In next 20-30 years the pollution level and other environment threatening hazards may grow, so to prevent this condition we should have work hard in present time and using the resources in a sustainable way, only then we should be able to make a bright future for our upcoming generations. Green buildings are one of them.

They help sustain life and provide a better future for next generation. In now days Green building construction has takes steps in India and variety of Green Building constructions were take place or either they are in under construction. In conclusion we can say that Government Subventions along with the concern for terrain due adding mindfulness about the demanding terrain pollution will have a positive impact in creating the demand for green structures. People should be made apprehensive of the demeaning terrain being due to rise in concrete structures constructions and depleting trees. If we see the construction statistics of the last decade, sustainable measures if not taken incontinently for unborn structure construction may drastically increase the position of environmental pollution.

Air pollution, Noise pollution, Soil pollution, Green house emissions, Ozone layer depletion, Water pollution, Tsunamis, Global warming these are some of the main cause which are responsible in running our mother nature, our earth. To control these causes, we have to immediately take serious steps with proper law enforcements to tackle this.

In past few years, the green construction or green building construction has emerged in the construction industry and taking a proper shape. Green construction is the new trend of this era. Green buildings greatly differ from conventional buildings and cause less effect on the environment.

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