

TECHNOLOGY INTERVENTIONS IN SUSTAINABLE ECOLOGICAL BUILDING CONSTRUCTION

Ajith Naik, Dr Renuka Prasad B

Student, Associate Professor & Associate Dean,

Department of MCA,

RV College of Engineering, Bengaluru, India.

ABSTRACT:

It is a fact that in this fast-growing world construction has a significant role in the emergence of environmental problems. As per Indian green building council Traditional buildings use more of the energy resources than required and causes a variety of emissions and wastage. The solution to these problems will be sustainable ecological buildings. One of the most significant aspect in the concept of sustainable ecological building will be using renewable energy. Solar and wind are best sources of energy, so these sources must be incorporated with other sources of energy. While batteries and supercapacitors are a perfect option for small-term energy storage, on the other hand regenerative hydrogen-oxygen fuel cells are an ideal option for long-term energy storage. Green building design aspects are area planning, constructing envelope design, constructing heating, ventilation, and air conditioning design, indoor environmental quality, use of ecological sustainable, high recycled and renewable materials. Problems like shortage of power, water and environmental problems are the factors which encouraged building industry's focus on sustainable ecological buildings. Buildings annually uses more than 20% of the power used in India. It minimizes operating price, boosts marketability, and maximizes productivity. Building design has economic, social, environmental, and renewable elements that benefit to all stakeholder owner, public, and business community. This paper points out the various technologies which are used to construct the ecological buildings. And explains about how these technologies helps in solving environmental problems.

KEYWORDS: Ecological Buildings, Renewable energy sources, Energy resources, solar energy, wind energy

I.INTRODUCTION

The uncommon outcomes of environmental issues are increasing more today, and buildings are adding different issues to this circumstance in different stages. The methodologies that will decrease this issue direct building plans towards practical, eco-accommodating ecological developments. Consequently, need is given to building plans which have less impact on climate in the nations with high ecological mindfulness. Ecological Buildings are the development which are created to construct and support generally good associations with every one of the parts of its nearby environment. A feasible building is a development that, considering its development and qualities, can support or update the norm of life of the environmental factors where it is put. As indicated by different sources, building and construction exercises overall devour 3 billion tons of scrap materials consistently. By utilizing sustainable ecological building innovation, we can limit this number without trading off the durability and strength of our constructions. Sustainable ecological Building Technology will end up being a gift for non-industrial countries, as it helps in restricting energy usage and advancing feasible turn of events Some environmental decisions should be taken during designing stage for

these constructions deemed as eco-friendly.[1] These decisions bring along many environmental and economic benefits. The procedures which are named as ecological, environment friendly, ecological and sustainable building criteria's cover subjects such as reducing the usage of restricted natural resources, use of reusable or limitless resources as much as possible, usage of minimum but effective energy, minimizing the production of emission and other toxic pollutants and at the exact time by safeguarding human health inhouse. There is a decent measure of proof demonstrating that sustainable ecological buildings give monetary prizes to proprietors, occupants and those working the designs, as they have low yearly expenses for energy, water, fix, and so forth In particular, these improved expenses don't come to the detriment of higher starting expenses. Utilizing current procedures and coordinated plans, the absolute expense of the building can be scaled down to the cost of a conventional building and here and there even lower. A few plans may have a somewhat higher beginning expense; however, the existence cycle and recompense cost investment funds of the building make up for that after some time.

II.SUSTAINABLE TOOLS AND TECHNOLOGIES USED IN ECOLOGICAL BUILDING CONSTRUCTION

Following are some of the tools and technologies which are used for the ecological building construction

a. Solar Power: Solar power has been majorly pointed as sustainable construction technology. In sustainable ecological construction, it can be used in two ways, one related to active solar energy and one more is passive solar power. Whereas active solar power uses functional solar systems that captures the radiation of the sun to use for heating and electricity supply. It decreases the requirement of electricity or gas. On the other side, passive solar power utilizes the sun rays to heat homes with the help of the strategical placing of windows and with the help of heat-absorbing surfaces which reduces the need of warming the house during winter seasons. Mainly there are three technologies by which solar energy is equipped: photovoltaics (PV), which does the conversion of light to electricity. Second one is concentrating solar power (CSP), which utilizes thermal energy to drive utility-scale, electric turbines and third one is solar heating and cooling (SHC) systems, which collect heat of the sun to provide air heating or conditioning and hot water .The advance installation charge is much more than that of traditional installation charge, but in the long-term, it saves on power tabs and decreases greenhouse gas emissions from non-renewable fuel sources like fossil fuels.

b. Biodegradable Materials: Most conventional building materials lead to the accumulation of unwanted products and poisonous chemicals, the most of which take decades break down. And even after they broke down, they pollute and harm the environment. Biodegradable materials like bamboo, timber and organic paints can be used as construction materials. They minimize the negative effects on the environment as they easily degenerate without liberating any toxins. Green concrete is a type of technology which was invented to upgrade sustainability. It contains reused and waste materials such as mining wastes, mud, sawdust, burnt clay, etc. This biodegradable material is of minimum maintenance and durable. They decrease the negative impacts on the environment as they easily breakdown without releasing toxins. The biodegradable materials used for building foundation, walls, and insulators are also forming part of sustainable construction technologies.

c. Green Insulation: When it comes to the homes and building construction insulation is one of the major concerns. insulators are simple wall filters. Insulators doesn't need to be made up of costly and highly finished materials.[6] Green insulation is a sustainable construction technology because it removes the need for high-end finishes made from unrenewable materials. It provides a solution with the help of materials that are old and used, like denim and newspaper. In other words, green insulation uses reusable material to line the walls. Green insulation uses recycled material that is low-cost, readily accessible, and still represents as afresh in

insulation technology. recycled denim, Cellulose, and some waste materials and plants are used for insulation. Porotherm Bricks contain natural insulation properties. Constructing insulated building with the help of these bricks will reduce energy costs.

d. The Use of Smart Appliances: World's most of the power is used by Commercial buildings and homes. Therefore, smart appliances are needed as a part of sustainable construction technologies. The durable construction technologies highlights on the setting up of fuel-saving and efficient appliances. tools like a dishwashers, micro oven and Smart Grid refrigerators are some examples of sustainable technologies.[3] The main objective of the technology is establishing zero-energy commercial buildings and homes.

e. Cool Roofs: Cool roofs are type of sustainable construction technologies which helps in reducing the reflection of heat and sunlight. It helps in keeping buildings and homes at the normal room temperatures by reducing thermal emittance and heat absorption. The cool roof design uses reflective special tiles and paints which absorb minimum heat and reflect maximum solar radiation by minimizing temperatures as much as 50 degrees Celsius in the summer days. Cool roofs also help in minimizing the dependence on air conditioning by that reduces energy usage, which helps in minimizing increasing greenhouse gas discharge from power plants.

f. Sustainable Resource Sourcing: Sustainable resource sourcing is the Key aspect of sustainable construction technology as it ensures that construction materials are designed and created with the help of recycled products and are environmentally friendly. Most of the time farming wastages or by-products are used to manufacture construction materials. Overall, these sustainable resource materials are remanufactured, reused, reusable, and acquired from sustainable sources.

g. Low-Energy House and Zero-Energy Building Design: Sustainable construction technologies help by providing procedures to decrease the energy usage. Constructing building with the help of wood minimizes the usage of incorporated energy as compared to general concrete construction. That's why it is a sustainable construction technology. These techniques minimize the relying on air conditioning and interior heating by using reusable energies like solar energy for lighting and water heating.[6] Sustainable ecological construction also uses designs which cut back air discharge and allows air free flow while using insulation techniques and maximum performance windows. The planned windows placement makes day-lighting available and by that minimizes usage of electric lighting during the day.

h. Low-Emitting Materials: Using minimum emitting products and materials is a key factor in Building construction and designing. It upgrades individual's health and assists in safeguarding the overall surrounding. It helps in construction projects to achieve sustainable ecological building approval from different standard sustainable ecological building agencies. These low-discharging materials credits normally applies to a large scale of atmosphere friendly construction products, including gums, inner paints, coatings, and sealants used on-site, composite wood, flooring, thermal, ceilings and walls.

i. Electrochromic Smart Glass: These helps majorly in summer days to minimize heat from solar radiation. These uses tiny electric signals to charge the windows to change the sum of solar radiation it reflects. It is added into the building's main control system which helps in allowing the users to select the quantity of solar radiation to stop. With the help of this technology, commercial buildings and homes can save a lot on air conditioning, ventilating, and heating costs.

j. Water Efficiency Technologies: Water-efficient technologies are part of sustainable construction technologies. Mainly these technologies help in recycling and application of well-organized water systems. These technologies also involve the use of processes like twofold plumbing, greywater re-use, water saving and rainwater harvesting. Twofold plumbing minimizes sewage system traffic and maximizes the chances of

reusing water.[3] On the other side, rainwater harvesting helps to provide water for different type of usage, and it can be stored for future use. These methods ensure that water is appropriately controlled, reused. These technologies minimize water usage cost and help in water saving. And reduces misuse of water by 15% and helps to concern about the freshwater shortage in urban areas.

k. Self-Powered Buildings: Self-powered buildings bring the awareness of zero-energy usage enabled construction. These buildings are constructed in such a way that they can generate enough power to aid their energy demand and even sends excess energy back to the energy grid. Majorly wind power technology is used in self powered building. It will be more efficient if wind turbines are mounted at the top of the roof. Continuous and significant wind at higher height move the turbine blades and generates the energy requirements for the whole building.

l. Passive House: Passive House is one of the most advanced form of solution for sustainable ecological construction with amazing positive impact on nature. It doesn't use mechanical or electrical devices but depends solely on the design of the building. Every part of a building utilizes the building design to manage the temperature with the help of solar power, either increasing the heat in the winter or decreasing the heat in the summer.

m. Rammed Earth Brick: Rammed earth brick is one of the ancient ideas which are effectively used as a sustainable construction technology nowadays. The rammed -earth brick's formation and sourcing make it perfect for sustainable construction as it minimizes negative impacts on environment. Building construction using rammed-earth structure is more accessible nowadays as because of technological advancements; however, still, ancient rammed earth brick preparation process is much followed. Rammed-earth structures helps to lessen the emissions and the material can fairly manage the warmth of a building, ensuring that buildings temperature remain constant in all the seasons.

n. Biomimicry: Biomimicry is a technique of copying innovations and ideas which are found in surrounding. These are an optimal answer for the clash between different activities of human and nature. nature is a best and finest solution for the sustainability problem. Therefore, architects found it very essential to mimic these approaches to minimize the negative impacts on the environment and achieving overall sustainability. Biomimicry gives a large range of solutions for different type of problems like structural efficiency, water efficiency, zero-waste systems, thermal environment, and energy supply. Using biomimicry in construction minimizes the straight impact a building has on the surrounding. It also improves the quality of life for the individuals and animals.

III SUSTAINABILITY CONSTRUCTION BENEFITS

Sustainable construction provides benefits in every stage of a construction project. Below are some of these benefits:

a. Cost reduction: Construction is a Big industry which costs around \$10 trillion. Even though it's a rich industry financial struggles still exists and those can't be pass overed. Smart and functional alternatives are more than necessary because of its efficiency and rework rate. Sustainable construction can supply substantial aid in that direction. Overall, a sustainable ecological building costs less than a normal building in terms of construction as it uses fewer resources (e.g. water and energy) for the completion of the project. And sustainable construction provides great Return on investment as well. In simple terms the value of the property is significantly increased as sustainable building emerged.

b. Increased productivity: The article in Guardian international edition by Tanya Ha reported that environmentally friendly working spaces increases the employee's performance and reduces the absenteeism. The finer the environment, the easier it is to focus and work successfully toward the efficient completion of required tasks.

c. Improved health: Ecological buildings can be favorable to good health also. According to the Environmental Protection Agency's (EPA) Report on Environment (ROE) outside air is three to five times less contaminated than inside air. constructing and furnishing materials like paints, cleansing products and carpets will harm for individual health. The usage of sustainable constructing materials can help with the purification of the air.

d. Waste minimization: In Europe, the Building construction industry is accountable for 35 percent of the continent's entire waste. ecological constructions decrease wastage rate with their minimum environmental impact and use of reusable resources and materials. Products such as destruction scraps, sand and burnt charcoal can be resulted in these outstanding environmental and aesthetic results.

e. better use of materials: Sustainable constructions control water in a more effective and environmentally favorable manner. Sustainable constructions can be equipped with systems that reuse water, such as collecting rainwater for toilet cleaning. Sustainable buildings can gather and conserve natural energy like solar or wind energy, saving it and reusing it whenever needed.

f. Environmental protection: Reusable materials used during the building process are contributing remarkably to the preservation of the environment and to minimize the waste rate. Also, sustainable construction takes into serious consideration about several critical elements. The installation of best insulated windows, ceilings and walls can make sure that no energy is going to waste. moreover, usage of solar heaters, insulated air-conditioning pipes and photovoltaic panels can help with making constructions more energy efficient and less impactful to the environment.

g. Noise avoidance: Noise will have a notable effect on a person's health. Sustainable construction put extra effort to avoid the noise using different ways. One of the methods is to use the distance augmentation between the noise source and the subject. Also planting of more trees closer to the source of noise to absorb helps reducing noise avoidance; and creating noise barriers (in between a highway and a building for example).

h. better quality of life: Sustainable Building construction has a excess of benefits in every aspects of a construction project. enhanced health with usage of safer materials, increased efficiency, finer surroundings, and more efficient noise protection are only a few of the advantages. sustainable ecological buildings will improve quality of life.

i. Room for experimentation: Sustainable construction provides an outstanding opportunity for creative and productive experimentation in the industry. New materials are being used and as a outcome, more innovative effective techniques are being developed and implemented, such as the ski slope opening implemented in power plant in Copenhagen.

IV.CONCLUSION

Sustainable building Technology is not only environmentally favorable, but also very cost efficient and it is being followed by various building companies around the world. These buildings are a major example of a modern construction that meets the need of the present without giving up the needs of upcoming generations. Ecological buildings help in saving a large amount of energy, which can later be used for other works, thus these helps to minimize the usage of fossil fuels. Ecological building Technology will prove to be a boon for

developing nations, as it helps in minimizing energy consumption and boosting sustainable development. Sustainable construction is evolving day by day and different chances are opening for the construction industry. Keeping an unbiased, well-functioning and efficient plan can result in extra groundbreaking changes.

V. REFERENCES

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