iJRASET
International Journal For Research in Applied Science and Engineering Technology



INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 12 **Issue:** II **Month of publication:** February 2024

DOI: https://doi.org/10.22214/ijraset.2024.58259

www.ijraset.com

Call: 08813907089 | E-mail ID: ijraset@gmail.com

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 12 Issue II Feb 2024- Available at www.ijraset.com

A Review - Green Building and Energy Efficient Design

Vinayak Pavate[1], Arghya Kolekar[2], Ami Mendapara[3], Shreyas Patil[4], Sachin Amrutatti[5]
[1]*Lecturer,* [2, 3, 4, 5]*Student, Department of Civil Engineering, Sanjay Ghodawat Institution, Atigre, India*

Abstract: ***The rapid expansion of infrastructure plays a pivotal role in a nation's progress, yet this growth must integrate with environmental concerns. Pollution primarily resulting from construction activities, factories, and industries, significantly impacts the environment. The construction sector, accounting 40% of air pollution, heavily contributes to this issue through material production and transportation. Co2 emission which adversely affects the ozone layer, and leads to global warming, impacts on both the human and environment living condition. While complete shutoff of emission is unfeasible, adopting sustainable practices, such as constructing green building, using of eco-friendly materials, offers a feasible solution.***
Keywords: Pollution, Impact, Environment, Green Building, ecofriendly, sustainable.

I. INTRODUCTION

Green building, additionally referred to as sustainable or green construction, is an method to designing, constructing, and working homes with a focal point on minimizing their environmental impact and promoting sustainability. The primary goal of green building is to reduce the use of energy, water, and other resources while also minimizing waste, pollution, and the overall impact on human health and the natural environment. In green buildings, construction is done not only by using eco-friendly materials but also by using waste material that is taken from demolition sites. This will reduce the cost and ensure proper use of waste material. The eco-friendly materials used in green buildings are manufactured by using waste materials left over, e.g., plastic, cloth, grass, glass bottles, etc. By manufacturing such eco-friendly materials, it will reduce waste and also reduce pollution in the environment. To improve the indoor environment quality of a building, the construction of a green building should be done by considering the east direction, and the openings provided to the building should be of a larger size or else use of façade glass so as to achieve more sunlight and improve air quality, thus, reducing the use of electricity and improving the efficiency of the building. It regularly emphasizes taking benefit of renewable resources, e.g., the use of sunlight through passive solar, active solar, and photovoltaic equipment, and providing plants and trees inside the building and in gardens, which will improve relations between humans and nature. Sloping gardens and green roofs should be there for proper watering and reduction of rainwater runoff. Sustainable design of green buildings involve proper site selection, studying the natural condition of the site, Specifying 'green' constructing substances from nearby sources, lowering loads, optimizing systems, and generating on-site renewable energy. Green constructing generation makes a speciality of low consumption, excessive efficiency, economy, environmental protection, integration, and optimization. The primary goal of green building is to reduce the negative environmental and social impacts associated with construction and building operations while also enhancing the well-being of people who live and work in these structures. This approach not only benefits the environment and public health but can also lead to economic benefits and improved quality of life for all.

II. LITERATURE REVIEW

1) Sustainable Development: Goals, Importance, Coursera Staff

It describes about sustainable development; sustainable development is defined as "the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability is considered a paradigm for thinking about balancing environmental, economic, and social needs for the present and future. Sustainable development promotes the use of renewable energy and natural and human-made waste; this will reduce environmental pollution.

2) Sustainable construction: Goal, Importance, Benefits, Sustainable construction, sustainability

The use of recyclable and reusable building materials it minimizes energy consumption from the grid that mostly comes from fossil fuels, long lifespan building materials and waste production. To improve the environmental sustainability of construction projects, it is key to adopt the overall approach.

©IJRASET: All Rights are Reserved

This involves merging of sustainable building materials, which not only reduces the environment impact but also promotes energy efficiency and resources conservation. While adopting sustainable construction it reduces the impact on the environment. The construction industry contributes 36% of energy usage and 40% of Co2 emissions worldwide and the concrete manufacturers or cement plants have resulted in tons of Co2 increasing crucially every year.

3) Green Building Technologies Jeremy Gibberd

This chapter describes green building technologies and shows why they are important in addressing climate change and reducing the negative environmental impacts associated with built environments. Given the onset of weather change, inexperienced constructing technology should additionally now make sure that constructed environments can hold to aid their required features and hold snug situations below projected future climatic conditions.

Therefore, for you to recognize inexperienced technology in buildings, it vital to recognize the connection among constructed environments and the herbal environment. In particular, it's miles critical to envision the position that era performs on this relationship, as this has the capability to growth influences and environmental harm or to avoid damage and create beneficial impacts.

4) Adopting green building practices: Challenges, Lack of awareness, Clearances and Approvals, Lack of skilled manpower

People are still unaware of sustainable building practices, benefits and importance. Till date people are not familiar with some of the sustainable materials, in order to that they still work as a traditional method. Green Building market in India is a major obstacle due to lack of awareness.

While constructing the green building there are multitude of approvals required for the green building compliance often adds complexity and delays to overall approval process. Streamlining these procedures and promoting awareness about the long-term benefit of green building could help facilitate their faster adoption.

The current challenges in the construction industry in India revolve around the difficulty for workers to go along with the evolving technology and new construction methods, particularly in the context of green building practices. The scarcity of skilled experts and labour contributes to a slow adoption of environmentally friendly construction.

5) The 7 Green Building Components, Chris Jackson

Green Building has become an increasingly popular topic in recent years. More and more people are looking to build environmentally friendly homes and businesses are starting to catch on the sustainable trend.

The seven features and importance of green building components to help make the building more energy efficient and environment friendly.

a) Aluminium Weather Resistant Insulated Access Panel: It help regulate indoor temperature and avoid moisture and pests from entering. It is also essential to create a tight seal that will keep the inside place comfortable and dry.

b) Energy Efficient Windows: The most major source of heat loss in a home, it maintains the temperature. In market there are various types of style, design available in budget.

c) Green Roof: It is popular because they help to insulate a home and reduce the heat loss through the roof.
It helps to reduce the storm water runoff and also has space for plants and animals.

d) Solar Power: It is a renewable energy source that heats and cools a home and also provide electricity.
Even it is affordable and also reduces carbon footprints.

e) Water Conservation: It is the easiest and budget friendly way to conserve water by collecting rain water in barrels and buckets, by installing rain water harvesting system, by smart scaping or water conserving landscaping.

f) Recycling: It is a most excellent way to minimize the amount of waste generated in the home. Also, great way to reuse that material.

g) Landscaping: It helps to reduce the amount of heat absorbed by a home, and it can also allow cooling of the air around a home. It is necessary to make a relation between human and nature for that it is important to do landscaping or we can say that by gardening it will fulfil the indoor air quality.

6) Eco-Friendly Alternatives to Traditional Concrete

Concrete, a mixture of cement, gravel, sand, water, and aggregate is the world's second most consumed substance after water, with over 10 billion tons produced annually. It forms the backbone of global construction, used in structure like buildings and pavements.

Despite its strength and durability, there's concern about its contribution to greenhouse gas emissions. As climate awareness grows, there's a push for a "green revolution" in construction. Fortunately, the concrete industry is exploring eco-friendly alternatives known as Green Concrete to address environmental concerns.

Green Concrete: It is a form of eco-friendly concrete that is manufactured using waste or residual materials form different industries. It requires less amount of energy for production. Comparing to traditional concrete, it produces less Co2 and it is cheap and durable. Partial replacement of energy-consuming cement with reusable materials is aiming the best strategies to achieve sustainable construction. Cement can be replaced with Fly Ash, Silica Fume and Wood Ash, etc.

Advantages

• Reduction of the concrete industry's CO2-emmision by 30 %.
• Increased concrete industry's use of waste products by 20%.
• NO environmental pollution and sustainable development.
• Green concrete requires less maintenance and repairs.
• Green concrete having better workability than conventional concrete
• Good thermal resistant and fire resistant.
• Compressive strength behavior of ceracrete with water cement ratio is similar to conventional concrete.
• Flexural strength of green concrete is almost equal to that of conventional concrete.

Advantages

• It is eco-friendly alternative material.
• Fly ash include reduced bleeding
• Increases strength of concrete
• Reduces shrinkage
• Fly ash makes concrete resistant to alkali-silica reactivity.

Ashcrete: Fly ash is a by-product of combustion of coal which was previously discarded in the landfill, but now it is used/ manufacturing green concrete. Fly ash is mixed with line and water to make it strong and durable, similar to conventional concrete. By us of fly ash in ashcrete makes it an eco-friendly alternative material, by replacing of cement which helps to reduce Co2 emission, 25% of cement can be replaced using high-volume fly ash concrete.

Hempcrete as a building material: It is made up of hemp, hydraulic lime and water, is a sustainable building material with excellent thermal and structural properties. It serves as insulation for roofs, walls, and slabs, gaining popularity for its affordability and eco-friendliness, industrial hemp, is a fast-growing, pesticide-free resource. Its cultivation absorbs importantly carbon dioxide, contributing to environmental benefits. Hempcrete walls trap carbon, and at the end of their lifecycle, they can be returned to the earth, making it a renewable and environmentally conscious choice for construction.

Hempcrete as a building material: It is not a structural material which carry heavy load but used as a insulation material whose essential component is hemp fibre, which is desirable part of a hemp plant.

Properties:

- Moisture handling capabilities- Hempcrete walls are vapour-permeable, allowing natural moisture migration without condensation risks. With high moisture storage capacity and permeable skins, it minimizes issues in any climate. Hemp hurd, rich in silica, mineralizes gradually when mixed with lime, making it a resilient and eco-friendly building material.
- Compressive Strength: Hempcrete, as per S.Elfordy et al., has compressive strength ranging from 14.5 to 420 psi. While not typically used structurally, it supports and stiffens lightweight wall framing. Hempcrete's density falls between 93.6 and 136.4kg/m3, making it lightweight.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |



- Thermal Performance: The thermal properties of hempcrete are extraordinary. Hemp concrete achieves a steady state R value of approximately **1.5 to 2.0 per inch**. Values can vary based on binder/Hemp ratio and the density achieved in mix. It has also passed the stringent **75-minute European burn test.**

Advantages

• One of the remarkable things about hempcrete production is that, it has a carbon negative footprint.
• It is resistant against mold as well as it is a moisture absorbent. It allows for natural ventilation of the building.
• High level of Carbon dioxide is absorbed by hemp which makes hempcrete a better building material in comparison to the other zero carbon materials. Hemp is the only building material that can remove carbon from the air. Other methods of insulation such as fiberglass have a consequential carbon footprint.
• Hempcrete is almost 7 to 8 times lighter than concrete. Hence, hempcrete blocks are fairly lightweight which can drastically reduce the energy and to a certain extent expense used to transport the blocks.
• Over the lifespan of hempcrete, it tends to harden as it sets.
• Hempcrete building requires less heating to remain comfortable. The heating energy is stored by the walls and reflected back inwards, thereby not allowing it to escape outwards. This will lead to an energy saving of over 50% to 70% on the heating bill.

7) What is the concept of Biophilic design, by Pooja Khanna Tyagi?

Biophilia is a methodology that aims to establish an intrinsic human connection with the natural world through direct and indirect references to nature. It is highly recommended to go for biophilic decor that creates a positive space and deepens attachment to the natural world. Biophilia is a great way to breathe life into the home and establish a connection with us.

Biophilic design aims to design a green structure by considering nature to improve the relation between humans and nature so that it will be beneficial for both humans and nature, as by constructing a biophilic structure, it will reduce environmental pollution and also improve human lives. In biophilic design, each factor and part of the building is studied in detail so as to obtain good outputs.

8) Biophilic and bioclimatic architecture, Amjad Almusaed

It is a book that gives detailed information about how a green building should be designed by considering humans and nature. Biophilic and bioclimatic structure is a manual to revolutionary architectural layout for architects, engineers, and different specialists.

Studying how much CO2 is emitted by building a new house, David Hsu, MIT associate professor of urban and environmental planning

This paper describes how much carbon is released from a building material that is required for construction. Around 40% of carbon is emitted through the construction industry. Steel and concrete are particular emitters because creating them requires heating raw materials to high temperatures, and the energy to do this typically comes from fossil fuels. As a result, the creation of cement for concrete is responsible for 7% of the entire world's carbon emissions, while steel creates 2.3 tons of carbon for every ton of metal produced. 2 Among the other materials, aluminium is a particularly high emitter, causing 3% of the world's direct industrial CO2 emissions.

©IJRASET: All Rights are Reserved | SJ Impact Factor 7.538 | ISRA Journal Impact Factor 7.894 |

Paints used in buildings also release harmful gases, but in less quantity. The manufacturing process or preparation of these construction materials and their transportation involves the greater release of harmful gases. It can be reduced by green design, reusing, recycling of materials, use of natural resources, use of renewable energy, etc.

9) LEED rating system, by USGBC (U.S. Green Building Council)

LEED (Leadership in Energy and Environmental Design) is the world's most used green building rating system criteria. LEED rating provides a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social, and governance benefits. LEED certification is a globally used rating system of sustainability achievement, and it is backed by an entire industry of committed organizations and individuals paving the way for market transformation.

Criteria:



Rating	Points	Recognition
Certified	40-49	Best practices
Silver	50-59	Outstanding Performance
Gold	60-74	National Excellence
Platinum	75-100	Global Leadership

10) ITC Green Centre, Rajender Kumar and Associates, New Delhi,

The ITC green center houses the headquarters of ITC's hotel business and was declared the world's largest platinum-rated green building. The building was rated as a green building by LEED rating criteria. It is located in Gurgaon, India. This project is totally constructed using waste and eco-friendly materials, which were available in nearby areas; the use of solar panels to generate electricity; a storm water system to collect surface ground water; the use of rainwater systems; the use of waterless urinals; the maximum use of daylight; and the surrounding area of the building is covered with a garden.

GREEN FEATURES:
O% Water Discharge.
53% energy savings.
40% reduction in potable water use.
Use of Treated Grey Water for Flushing and Landscaping Fly-Ash Bricks and Concrete.
Alternative Transportation Facilities.
Storm Water Management System.
Solar Thermal Technology Reflective High-Albedo Roof Paint Separates Smoking Rooms with an Exhaust System.
Has a 30% smaller carbon footprint with the use of sensible technologies.

Sr. no.	Modules	Possible points
1	Sustainable architecture and design	5
2	Site selection and planning	14
3	Water conservation	18
4	Energy efficiency	28
5	Building materials and resources	16
6	Indoor environmental quality	12
7	Innovation and development	7
	Total	**100**

III. CONCLUSION

Green building stands as a pivotal response to the imperative for sustainable and responsible construction practices. Its focus on minimizing environmental impact, enhancing energy efficiency, prioritizing occupant well-being, and realizing long-term cost savings underscores a paradigm shift in the construction industry. As global awareness of environmental issues continues to grow, green building emerges not merely as a trend but as an essential pathway to creating resilient, energy-efficient, and health-conscious structures. By constructing green building, it will improve the relation between human and nature. The main focus of the project was to build with nature so as to improve the living condition of the people. Hence in this review we have studied about green building, sustainable living, green designing, factors affecting environment, etc.

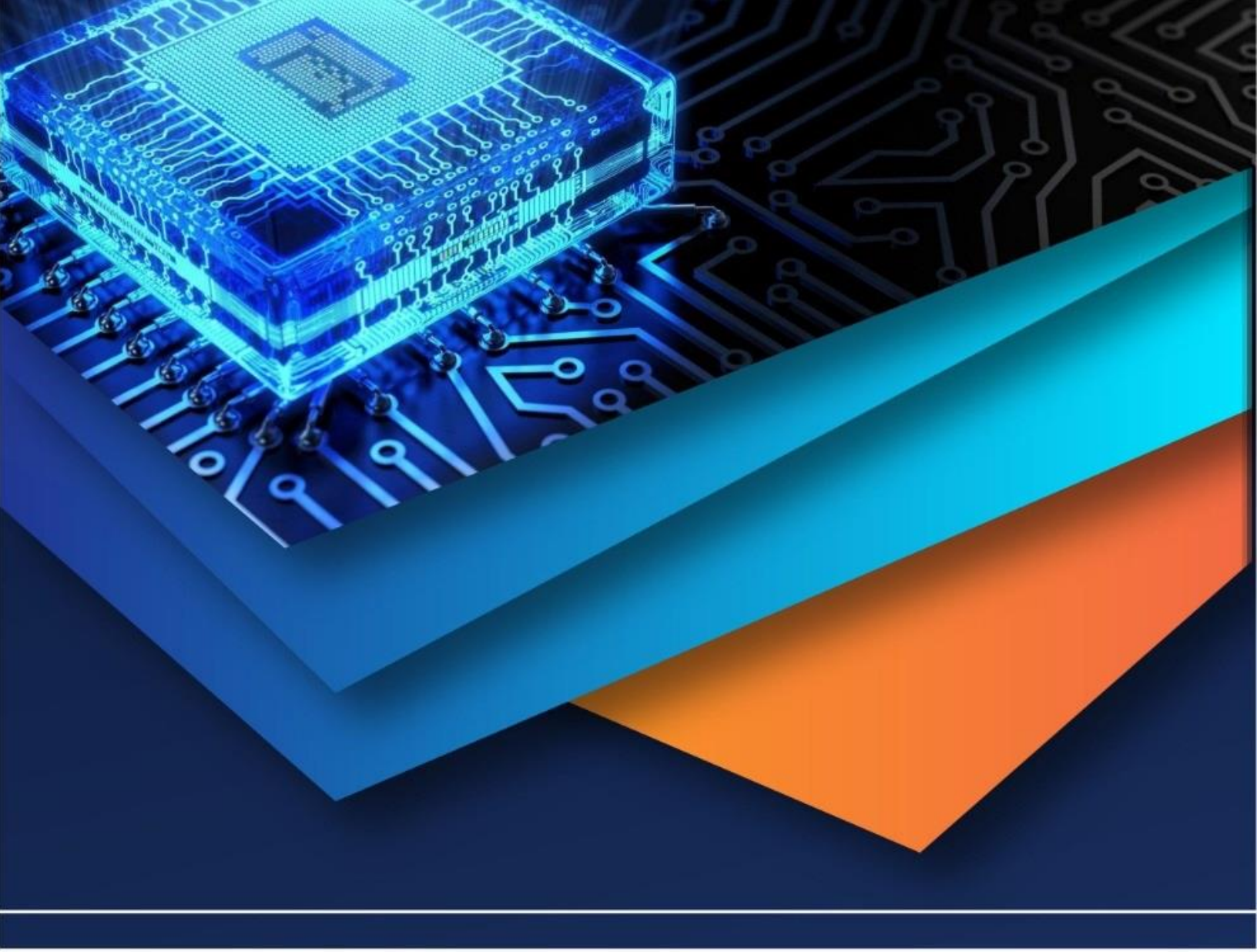
IV. ACKNOWLEDGEMENT

The authors are thankful to Ms. Vandana Shah, HOD, and Virat Giri, Principal of Sanjay Ghodawat Institution for a fruitful sharing of opinions and support.

REFERENCES

[1] Sustainable development: goals, importance, etc., Coursera (June 2023).
[2] Report of the World Commission on Environment and Development, Brundtland Commission report.
[3] Studying how much CO2 is emitted by building a new house, David Hsu, MIT associate professor of urban and environmental planning (9 December 2022).
[4] The carbon footprint of building materials, Georgette Kilgore.
[5] ITC Green Centre, Rajender Kumar and Associates, New Delhi (19 October 2020).
[6] LEED rating system by the USGBC (U.S. Green Building Council).
[7] What is the concept of biophilic design by Pooja Khanna Tyagi?
[8] Biophilic and bioclimatic architecture, Amjad Almusaed (21 December 2010).
[9] Green Building Technologies Jeremy Gibberd.
[10] Sustainable construction: Goal, Importance, Sustainable construction, sustainability (15 Dec 2021).
[11] Adopting green building practices: Challenges, Lack of awareness, Clearances and Approvals, Lack of skilled manpower (Jan 2023).
[12] The 7 Green Building Components, Chris Jackson.
[13] Eco-Friendly Alternatives to Traditional Concrete.

©IJRASET: All Rights are Reserved



10.22214/IJRASET

45.98

IMPACT FACTOR: 7.129

IMPACT FACTOR: 7.429

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Call : 08813907089 (24*7 Support on Whatsapp)