International Journal of Research in Economics and Social Sciences(IJRESS)
Available online at: http://euroasiapub.org
Vol. 15 Issue 02 February - 2025
ISSN: 2249-7382 | Impact Factor: 8.018|
(An open access scholarly, peer-reviewed, interdisciplinary, monthly, and fully refereed journal.)

GREEN ARCHITECTURE IN INDIA: ADVANCING SUSTAINABLE BUILDING FOR A RESILIENT FUTURE

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Abstract

The high speed of urbanization and economic progress in India has led to an increase in environmental concerns, which has necessitated the adoption of green design as a solution that is sustainable. For the purpose of achieving sustainability, green buildings, which are characterized by their emphasis on resource efficiency, energy conservation, and low impact on the environment, are gaining steam as an essential strategy. The fact that India is ranked third in the world in terms of LEED-certified buildings demonstrates the country's dedication to environmentally responsible building techniques. Further acceleration of the adoption of sustainable building methods has been brought about by a variety of factors, including government programs, financial incentives, technical improvements, and altering consumer tastes. The Indian Green Building Council (IGBC) and other regulatory frameworks are aggressively supporting green certifications, and as a result, the real estate industry is actively integrating energy-efficient designs, water conservation, and renewable energy sources into the construction process. Furthermore, India's infrastructure development is being brought into alignment with its climate targets for the year 2070 as a result of the move towards Net Zero buildings. On the other hand, expanding the use of environmentally friendly buildings calls for concerted efforts by policymakers, industry players, and the general public. The purpose of this study is to investigate the green construction environment in India, including policy interventions, problems, and future prospects. The paper places an emphasis on the necessity of collective action in order to guarantee a sustainable and resilient urban future.

Keywords: Green architecture, Sustainable Buildings, Green Economy, Net-Zero Buildings, Environmental Sustainability.

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I. INTRODUCTION

A contemporary approach to design is gaining traction in India. This method seeks to alleviate the negative effects that buildings have on the surrounding environment. This idea, which is also known as sustainable or green design, emphasizes the utilization of resources like materials and energy in a manner that is both responsible and efficient. Because of the challenges that are being posed on a worldwide scale by climate change and the shortage of resources, the significance of this ideology is becoming more and more apparent. When it comes to environmental concerns, the situation is more critical in a nation like India, which is experiencing fast urbanisation and population expansion. Green design offers a means of fostering development while simultaneously reducing the negative effects that buildings have on the surrounding environment. This strategy is becoming increasingly popular as a result of the growing demand for environmentally responsible building practices that are also economical and efficient in terms of energy use. According to research, green buildings in India have the potential to save between 20 and 30 percent of energy when compared to traditional built structures.

This impressive ranking, which places India in third place on the list of countries that will be awarded Leadership in Energy and Environmental Design (LEED) certification in 2023 by the United States Green Building Council, demonstrates the country's progress in environmentally responsible building techniques. The Indian government is demonstrating its commitment to sustainability by approving 248 projects that cover a total area of more than 7.23 million gross square meters (GSM). An article that was published not too long ago by the Economic Times throws light on the growing acceptance of environmentally friendly building practices in India. The article mentions that more than sixty-five percent of office buildings in the country now have green certifications. The country of India is currently in a position of leadership in the promotion of environmentally friendly building practices, which is paving the way for a resilient and sustainable urban landscape.

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Characteristics of a green building

When we talk about green building, we are referring to the design, construction, and operation of structures in a manner that is environmentally responsible. Green building is also known as sustainable building and resilient building. The goal of green buildings is to reduce the negative impact that the built environment has on the health and well-being of people and the natural environment. Green buildings make use of the following construction techniques:

- **Using renewable and sustainable resources:** The use of materials and resources that are renewable, sustainable, and economical for the environment should be given priority.
- **Conserving energy:** The implementation of energy-efficient systems and appliances can help reduce emissions of greenhouse gases (GHG) and minimize the amount of energy that is consumed.
- **Reducing water usage:** Utilizing water-saving appliances and fixtures to save on water consumption.
- **Improving indoor air quality:** Natural ventilation, air filtration systems, and low-emitting materials are incorporated into the design of a building in order to reduce the amount of pollutants that are present in the air inside the building.
- **Enhancing biodiversity:** Features like as green roofs, living walls, and other elements that are beneficial to the local flora and animals are implemented.

In India, the LEED accreditation is widely recognized as a standard for environmentally responsible construction projects. Due to the fact that it is the organization in India that is responsible for distributing LEED certification, Green Business Certification Inc. (GBCI) plays an important role. Performance Excellence in Electricity Renewal (PEER), Total Resource Use and Efficiency (TRUE), Excellence in Design for Greater Efficiencies (EDGE), and Sites are some of the certifications that GBCI manages in India in addition to the Leadership in Energy and Environmental Design (LEED) accreditation. Others include SITES. These certifications place an emphasis on sustainable practices, such as water conservation, energy efficiency, and waste management.

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II. THE RISE OF GREEN ARCHITECTURE IN INDIA: A PATH TOWARDS SUSTAINABILITY

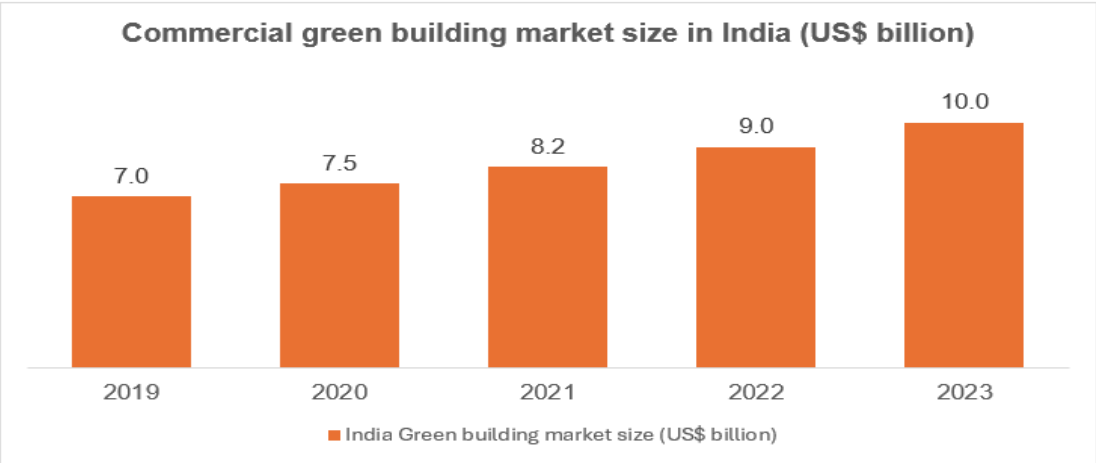
Concerns about the environment are becoming an increasingly urgent issue affecting India. The idea of green architecture, which entails the construction of structures that have a low impact on the environment, is becoming increasingly recognized as a potentially fruitful strategy for addressing these difficulties.

- **Government policies and incentives: Leading the way**

In an effort to encourage environmentally responsible building techniques and LEED certifications, the government of India has implemented a number of regulations and programs. India's position as one of the world's leaders in green building certifications is significantly impacted by these efforts, which have a significant impact. It has been estimated by the United States Green Building Council (USGBC) that India will have more than 7 billion square feet of green building spaces by the year 2023, making it the leading country in this sector.

- **Green building policy**

This effort was launched in 2006 with the purpose of encouraging the use of environmentally responsible building practices across the country. This document establishes lofty goals for the development of environmentally friendly buildings, with the intention of ensuring that all newly constructed buildings comply with requirements by the year 2030.



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- **Tax benefits**

In accordance with the Income Tax Act, the government of India offers financial incentives to developers who construct buildings that have earned the LEED certification. When it comes to expenses associated with building elements such as solar panels, rainwater harvesting systems, and waste management infrastructure, developers are able to earn a depreciation allowance of up to one hundred percent.

- **Loans**

Through the Indian Renewable Energy Development Agency (IREDA), the government of India provides loans with significantly reduced interest rates for the purpose of financing the construction of projects that have been certified as environmentally friendly.

- **State-level incentives**

The many states in India have developed their own strategies and activities to promote green building certification. These strategies and initiatives include providing financial incentives and tax breaks to help energy-efficient structures and initiatives to promote renewable energy. For example, the state of Gujarat offers a financial incentive of Rs. 10,00,000 (about US$ 11,943).

- **Fast-track approvals**

Buildings that have been certified as environmentally friendly are eligible for a variety of advantages, including faster inspections, accelerated approval processes, and reduced building fees.

- **Promotion of renewable energy**

The government also offers financial incentives and tax breaks to encourage the use of renewable energy sources throughout the nation, which indirectly encourages the construction of LEED-certified buildings.

- **Technological advancements: Paving the way for innovation**

In India, the proliferation of environmentally friendly buildings is significantly influenced by the development of technology. People are beginning to use materials that are more environmentally

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friendly, such as bamboo and reclaimed concrete. In addition, solar panels and wind turbines are included into the design of buildings in order to achieve the goal of using renewable energy. These innovative concepts contribute to the construction of locations that are both inexpensive and environmentally friendly. For the year 2025, the Economic Times predicts that the value of India's construction market will be approximately 39 billion US dollars. The commercial developments will provide 11 billion dollars, while the residential projects will contribute 28 billion dollars.

- **Growing public demand: A shift in consumer preferences**

A shift in consumer preferences is being brought about as a result of the growing public understanding of the advantages of environmentally friendly design. A growing number of consumers are becoming environmentally concerned and are willing to pay a higher price for environmentally friendly buildings. As a result of the growing demand for environmentally friendly structures, developers are being compelled to adopt green building principles, which is hastening the development of environmentally friendly architecture in India. The findings of a study conducted by Business Standard indicate that environmentally friendly buildings have the ability to reduce emissions by 35 percent and reduce maintenance expenses by twenty percent. This economic benefit, in conjunction with the growing awareness, is driving the need for environmentally friendly buildings in India, making them an appealing and practical alternative for both customers and developers alike when it comes to building construction.

III. GREEN BUILDING ADOPTION – A SHARED RESPONSIBILITY

The expansion of India's green and net zero building movement is not the responsibility of a single body; rather, it is the result of a collaborative effort that involves a number of different players. Development professionals, architects, civil engineers, MEP (Mechanical, Electrical, and Plumbing) experts, green building consultants, urban planners, suppliers, and policymakers all play an important part in ensuring that environmentally friendly techniques are adopted on a large scale. The Confederation of Real Estate Developers Associations of India (CREDAI) and the National Real Estate Development Council (NAREDCO) are two examples of organizations that play a significant role in the building business. Real estate builders also play a role. Building certification for environmentally friendly buildings is becoming increasingly popular among leading corporations and

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builders. This trend has been bolstered by the incentives offered by state governments and local bodies in a number of locations.

The IGBC's grading system, which has been built via the combined wisdom of industry specialists, is at the heart of this organization's decision-making process. Due to the fact that it is voluntary, based on consensus, and driven by the market, it gives stakeholders the opportunity to actively engage in determining the future of sustainable construction in India. This method has resulted in tremendous growth, with over 15,040 green building projects registered around the country, spanning a total footprint of over 13 billion square feet. This expansion has happened across the country. In today's world, buildings are not able to function in isolation and are instead intricately connected to the constructed environment that surrounds them.

Over 32 ratings were produced by the International Green Building Council (IGBC) for all asset classes of buildings and built environment that correspond to infrastructure. These asset classes include campus buildings, townships, trains, factories, metro rails, green cities, and more. In addition to having a variety of grading systems that cover all categories of buildings and built environments, it also contains well defined criteria and principles that are intended to direct businesses and communities toward environmentally responsible activities. Each and every one of the grading systems is founded on the five components of nature, which are referred to as Pancha Bhutas. This is a great combination of traditional architectural methods and contemporary technical advancements. The rating systems are applicable to each of India's five distinct climate zones.

Considering that by the year 2070, over 70 percent of India's buildings and built environment will have been constructed, there is a tremendous opportunity to include sustainability into the development of future buildings. To guide developers on how every building typology, whether it be residential, commercial, industrial, or public infrastructure, can be designed and constructed in a sustainable manner, the International Green Building Council (IGBC) has taken the lead in this endeavor. Furthermore, it has implemented Green Cities and Township Ratings, which are designed to guarantee that both greenfield and brownfield developments incorporate environmentally responsible methods. These grading systems assist entire urban ecosystems in making the shift to

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greener and more habitable areas by putting an emphasis on energy efficiency, water conservation, sustainable mobility, and waste management.

Digha Science Centre in West Bengal has installed a rainwater harvesting system.

IV. GREEN BUILDINGS AND NET ZERO FUTURE

The Indian Green Building Council (IGBC) is leading the charge to promote Net Zero buildings, which are structures that are designed to achieve a balance in energy, water, and waste consumption through the utilization of renewable energy and resource-efficient technology. This transformation is taking place as India advances toward reaching Net Zero carbon emissions by the year 2070.

As part of this effort, over three hundred and fifty organizations operating in the real estate sector in India have committed to transforming their operations in order to earn the title of Net Zero. As a result of this objective, energy-efficient designs, carbon-neutral materials, and the integration of renewable energy sources are becoming increasingly popular. This mission assists developers in

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decarbonizing the construction process while simultaneously reducing operational emissions by a large amount. It is imperative that all governments, including those at the central, state, and local levels, construction departments, builders, developers, corporations, construction entities, and building material manufacturers and product developers, as well as all professionals and service providing agencies, fall in line with immediate, short-term, and long-term goals beginning in 2025. This is because India has made a global commitment to achieve Net Zero Carbon by the year 2070. In order to raise awareness, appreciation, and application efforts at all levels and across all sectors, it is necessary to implement phenomenal capacity and capability building programs.

In order to power its buildings, the Pimpri Chinchwad Municipal Corporation leverages solar energy.

Through its Net Zero Rating System, the International Green Building Council (IGBC) offers a complete framework for sustainability in four essential areas:

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1. Net Zero Energy – ensuring that buildings create the same amount of energy as they consume through the use of renewable sources such as solar, wind, and other sources.

2. Net Zero Water – Water neutrality can be accomplished through the collection of rainwater, the recycling of greywater, and the installation of water-efficient fixtures.

3. Net Zero Waste to Landfill – By encouraging trash segregation, composting, and recycling activities, we can lessen our reliance on landfills.

4. Net Zero Carbon – To compensate for carbon footprints, afforestation, carbon trading, and environmentally responsible transportation alternatives are all viable options.

By engaging policymakers, corporations, and academic institutions, sharing knowledge with stakeholders, and building professional capacity to drive large-scale carbon reduction, India's green building rating systems are creating a national movement on Net Zero. This is being done with the clear vision of positioning India's construction or building sector as a global leader in sustainability by the year 2050. For this lofty objective to be accomplished, the use of technologies that are both environmentally friendly and energy-efficient will be of the utmost importance. Many states have come up with many incentives at the state and city level for the purpose of encouraging everyone to adopt the green path. These incentives include providing additions to built up area for FAR/FSI, a faster processing for Environmental Impact Assessment (EIA), a reduction in development charges, a reduction in tariffs for water and energy, and a reduction in stamp duty and property tax. These incentives are in recognition of the benefits that accrue to the built environment and larger ecological systems. In addition, financial institutions have proposed lowering the interest rates on loans for housing and construction that are intended for environmentally friendly projects.

Even if there has been an increase in the number of green buildings in India, there is still a significant distance to travel before sustainability becomes the standard. Through the consistent efforts of the International Green Building Council (IGBC) in education, legislative advocacy, and the development of GreenPro-certified goods, the original issues of awareness and material availability have been largely addressed. Through the provision of defined rules for developers, the

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green building chapter of the National Building Code (NBC) has further enhanced current sustainable practices.

On the other hand, the task of increasing the number of environmentally friendly buildings is being shared. Participation is required from each and every stakeholder representing the buildings and built environment industry. Due to the fact that India is currently in the process of constructing a significant portion of its future infrastructure, incorporating sustainability into new developments is not just an opportunity but also a vital requirement.

It is imperative that India's cities and towns embrace environmentally friendly practices and make progress towards achieving Net Zero in order to guarantee that the process of urbanization does not come at the expense of the environment.

V. CONCLUSION

The implementation of environmentally friendly design in India is an essential step toward more sustainable urban growth and the preservation of the natural environment. As a result of increased urbanization and rising energy needs, it is crucial for the construction industry to incorporate energy-efficient designs, renewable energy sources, and resource conservation strategies. This is necessary in order to reduce carbon footprints and promote long-term economic and environmental benefits. The progress that India has made in obtaining LEED certification for buildings and its status as a global leader in green construction draw attention to the country's dedication to preserving the environment.

The expansion of environmentally friendly buildings has been considerably aided by a number of factors, including government policies, financial incentives, technology breakthroughs, and an increase in consumer awareness. On the other hand, there are still obstacles to overcome, such as high starting expenditures, limited awareness, and the requirement for improved infrastructure. In order to ensure the widespread adoption of sustainable building methods, it will be essential to address these concerns through the implementation of governmental reforms, industry cooperation, and public-private partnerships.

Green buildings will play a vital role in defining a resilient, energy-efficient, and environmentally friendly urban future throughout India as the country works toward its goal of reaching Net Zero carbon emissions by the year 2070. For the purpose of ensuring that urbanization does not come at the expense of the environment, it is vital for residents, construction businesses, government agencies, and developers to work together in order to push the transition toward ecologically responsible and sustainable architecture.

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