



# A critical review on Green Buildings for sustainable growth & development

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## Abstract:

The bad experience of global warming has given alarming signs to mankind and compelled them to change the way they work on the planet. In the entire construction industry, the green building concept evolved and it is now given momentum across the globe. Green Building concept involves construction of buildings which have environmental considerations on every stage of its construction. It includes objectives that protect occupant health, improve human productivity, optimum usage of natural resources and overall reduction in environmental impact. The research revealed that green buildings will provide better health conditions for building occupants due to the improved indoor quality, developing more energy efficient products and the use of less natural resources and welfare of humankind. It ultimately protects the complete ecosystem. The study on green building benefits clients, consultants and contractors to invest in green building projects.

**Keywords:** eco-friendly, efficiency, green building, recycle, reuse, resource, sustainable development.

**1. Introduction:** In India, the concept of Green Building was adopted by the Confederation of Indian Industry (CII) in 2001. They formed the Indian Green Building Council (IGBC) which is the key organization in promoting the concept in India. The vision of IGBC is to enable a built a sustainable environment for all and bring India to be one of the global leaders in the sustainable built environment by 2025. The Green Building concept in India initiated its momentum in 2003, from about 20,000 sq.ft to 450 crores sq.ft today. A green building is one which uses lesser amount of water, helps in optimising energy efficiency, conserves natural resources, generates less amount of waste and provides greener and healthier spaces for occupants, as compared to a conventional building. This system is also known as a sustainable or high-performance building. We have various systems in the form of design standards or codes throughout the world to make the use of green building design. The entire criteria mainly focus on sustainable building sites, water efficiency, energy, material and resources and indoor environmental quality.

**2.Necessity of Green Buildings:** Construction, operation and maintenance of buildings have major environmental impacts in the life of mankind. The available resources like ground cover, forests, water and energy are diminishing gradually to give way to buildings. Natural resources and materials are made use for the structure of the buildings and landscaping adds to beautify the surroundings. The energy consuming systems like lighting, air conditioning and water heating provides extra comforts for human. Water, one of the most vital

resources for the mankind, is getting exhausted during building construction and operation. Several functions of occupants generate large amount of waste, which can be recycled or can be reused directly. Thus it is observed that buildings are responsible for polluting urban air quality and responsible for climate change. Hence, there is need to design green building, to address all these issues in a scientific manner. It is observed that the cost of design and construction of green buildings is more compared ordinary conventional buildings. It is proved that the maintenance of green buildings costs less and has quantified environmental benefits and provides a better place for occupants.

**3. Green building principle:** The concept and principle of Green building is not new, but being used in a systematic and scientific way. It mainly concentrates on using less amount of water, optimizes energy efficiency, consensus with using natural resources and using environmentally friendly building materials, leading a sustainable growth, generating lesser amount of waste in all the activities, making use of renewable energy, smart growth and total reduction in toxic activities.

The researchers and scientists have opinions that building construction is one of the major causes of environmental degradation. These constructions are responsible for a huge amount of harmful and toxic emissions, totalling about 30 percent of greenhouse gases, and an additional 18 percent induced indirectly by material, exploitation and transportation. Globally, buildings are found to be responsible for about 40 percent of energy use, 40 percent of waste generated, and 40 percent of material resource use.

A green building is one which uses less amount of water, it helps in optimizes the use of energy efficiency, conserves natural resources, generates less waste and provides healthier space for occupants. They are eco-friendly structures, and help the earth and people to retain nature to a maximum extent possible in many ways to the location of the buildings. They retain the external environment at the location of the building, improve internal environment for the occupants, and preserve the environment at places far away from the building.

**4. Sustainability through Green Building:** Sustainability is the capacity and capability to last for a long time. Sustainability demands the coexistence of environmental, social and economic requirements, which are known as the basic and fundamental “three pillars” of sustainability. Sustainability in construction means to reduce or eliminate negative impacts of a building for its lifetime considering its economic viability, comfort of the people and their safety. Sustainability in construction can be achieved through green building developments.

**4.1 Environmental Aspects:** The very common theme of green building study prioritizes the environmental aspect of sustainability. The recently introduced residential buildings of new construction launched, 80% of the rating points are based on environmental sustainability. It is observed that the existing and current study on environmental sustainability of buildings deals with energy efficiency, water efficiency, Green House Gas emission, materials and resources efficiency. The structural components of the green building design is added with fly ashes for energy savings and also reduce the waste to the landfill. Also, the utilization of precast or prefabrication technologies helps reduce the construction and demolition wastage to a large extent. The Industrialised Building System (IBS) construction approach are environment friendly, minimises wastage and is energy efficient. In IBS construction technique the major components are manufactured offsite or in a factory, transported, positioned and assembled with minimal site work. In addition, prefabrication is considered by both

design and construction professionals as one of most common method to prevent injuries particularly related to hazards such as construction at height, confined places, overhead and with energized electrical system.

**4.2 Economic Aspects:** There are economic requirements of green buildings such as access, education, affordability, impacts to the local economy, economic value, cultural perception, inspiration and indoor health. The benefits of energy retrofitting initiatives in a green building reflected through cost savings due to the improved energy efficiency and a potential value added to the property. This contributes to the reduction of the payback period of investment for energy efficiency measures. Even though the initial cost of green building is expensive but due to the cost saving during the building operation, it will benefit the building owners and occupants in a long run.

**4.3 Social Aspects:** We have witnessed the growing concerns on social sustainability in buildings during the last decade. Construction activities which are part of the social process, wherein construction professionals like Architect, Engineer, Contractor and others share ideas and work together to make sure the successful completion of a project. In the construction context, social sustainability deals with health and safety of the workers, the quality of living and future of professional development. Also, social sustainability in construction means providing a healthy and safe environment to all stakeholders, including construction personnel, users, and operators. In addition, social sustainability should be taken into consideration in the construction projects right from the planning stage, design stage, construction and maintenance stage.

**5. Green Building materials:** The basic concept behind materials used in the construction of Green building is the minimum release of green house gases (CO<sub>2</sub>) during the production of those materials. These materials consume minimum quantities of water, energy and raw materials during production and conveyance. Many of these are made by re-use and recycle methods. Green building materials are reusable, energy efficient, sustainable and environmentally friendly. The following materials are generally used. Earthen materials, engineered wood, structural insulated panels, insulated concrete forms, cordwood, timbercrete, natural fibre, fiber cement and ferrok materials.

**6. Energy systems in green buildings:** In modern world, 35 to 40 percent of energy is consumed by buildings. It is predicted that this may increase upto 50 % by 2025. This warrants green buildings to achieve energy efficiency. There are many methods to improve buildings energy efficiency. The solar energy on green building is trapped to supplement the conventional energy with the help of photo voltaic cells. The natural light is allowed to enter in the intermediate floors to minimize the usage of electricity. Sunlight is restricted by the high grown trees outside the lower floors of the building. High efficiency light fixtures like LED lamps make a pleasant lighting apart from saving the energy. High efficiency windows and insulation in the walls, ceilings, and floors are used for the benefit of better temperature control. Allowing building occupants to individually control heating and cooling in their living or working spaces in an effective way to control energy use.

**7.Green building certification in India:** In our country, we have three certifications body to certify the green nature of our buildings. They are GRIHA (Green Rating for Integrated Habitat Assessment), IGBC (Indian Green Building Council, BEE( Bureau of Energy Efficiency).

**7.1. GRIHA:** This is India's own rating system jointly developed by TERI (The Energy Research Institute) and ministry of New and Renewable Energy. It's a green building design system where buildings are rated in a three tier process. GRIHA rating system consists of 34 criteria in four different sections.

- a. site selection and site planning.
- b. conservation and efficient utilization of resources.
- c. building operation and maintenance.
- d. innovation.

**7.2. IGBC:** The Indian Green Building Council is part of Confederation of Indian Industry (CII). LEED (The Leadership in Energy and Environmental Design) is the rating system developed for certifying green buildings. Indian Green Building Council has licenced the LEED Green Building Standard from USGBC.

**7.3. BEE:** The Indian Bureau of Energy Efficiency is launched by energy conservation Building Code. The certification code is set for energy efficiency standards for design and construction of building of minimum conditioned area of 1000 sq.m.

**8. Benefits of Green Building:** There are many researches and studies investigating the costs and benefits associated with green building developments. The aim of the research is to explain the importance of going green which will assist the decision-making process. In addition, there are many benefits associated with green buildings.

- 1.Green buildings consume 40 to 60% lesser electricity as compared to conventional buildings.
- 2.Green buildings used to generate renewable energy utilization to supplement its energy needs.
- 3.Green buildings consume 40 to 80% lesser water as compared to conventional buildings by utilizing dual plumbing systems, waste water recycling system and rain water harvesting system.
- 4.Green building generates lesser waste by employing waste management strategies on site. They also generate energy from waste.
5. Green buildings generate lesser pollution both during construction as well as while in use.
- 6.Green buildings offer higher image and marketability.
7. Green buildings ensure proper safety, health and sanitation facilities for occupants.

**9. Conclusion:** From the study and literature reviewed green buildings provide better health for building occupants due to the improved indoor quality, usage of more energy efficient products and services, increase in luxury, satisfaction and welfare of building tenants. It can therefore be concluded that clients, contractors and consultants need to take consideration of the benefits of green buildings and start investing in green building construction. This study will bring more alertness to the public about the benefits of Green Buildings and why we need green buildings. Also, the findings of this research point to a clear conclusion that Green building is cost-effective and makes financial sense today. When trees are cut to clear the plot for building construction, the same number of trees are expected to be planted elsewhere. Only this attitude of humankind can save the Earth from destruction.

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