



Green Building: A Review

Chetan Sonvane

chetansonvane1@gmail.com

Datta Meghe College of Engineering, Mumbai,
Maharashtra

Ompriya Kale

ompriya.2007@gmail.com

Pimpri Chinchwad College of Engineering and Research
(PCCOER), Pune, Maharashtra

ABSTRACT

Green Building is a technology which has been developed and put forward in recent years, so as to lead our world towards economic, global as well as social sustainability. Green buildings are quite related to sustainable buildings and they are interchangeable. Green buildings are helpful considering several factors like reduction of carbon footprint, usage renewable energies, use of less energy, usage of smart materials and so on. In recent times, world is facing a major problem of drastic climate change. A major contributor to climate change is the construction industry. Buildings are responsible for an estimated 33% global greenhouse gas emission. Between 1971 and 2004, Carbon dioxide (CO₂) grew 2.5% for commercial buildings and 1.7% for residential buildings. This puts the concept of green building in light. Government all around the globe have started to take this concept solemnly. Few organizations are in place for rating green buildings. LEED also known as Leadership in Energy and Environmental design is one of the leading organization. Green building rating system in India are Green Rating for Integrated Habitat Assessment (GRIHA), Indian Green Building Council (IGBC). These organizations rate the buildings on various factors like operation, cost, maintenance, etc. The intention of writing this paper is to acquaint everyone with green building.

Keywords—Green Building, Sustainable buildings, Greenhouse Gas Emission, Green Features.

1. INTRODUCTION

Tremendous growth in industrial sector back from the industrial revolution, which started in 1854, and the advancements in all sectors, has now introduced the world with a challenge of global warming. Global warming compared to last few decades has increased exponentially. According to the center of climate and energy solutions, global CO₂ emission has increased dramatically. With 5000 Million Metric Tons of CO₂ emission in 1950 it has gone up to almost 33000 Million Metric Tons. The building sector also consumes 40% of total energy and energy consumption is directly proportional to greenhouse gas emissions.

In developed nations like United States of America, Russia, United Kingdom, Australia; there are strict measures taken to lead their country sustainability. However developing countries like India, China, Sri Lanka, etc. have not totally implemented the idea and the people in such countries still have very less idea. The

greenhouse gas emission will increase by 100% by 2050 if no proper precautions are taken. Fig. 1 shows greenhouse gas emissions [4] if no precautions are taken.

Green building [4] is the technique of constructing buildings by which we can reduce negative impacts on environment and increase positive impacts on climate and environment. Green buildings use less resource. These structures are energy efficient, water efficient, cost efficient. These buildings follow the rule of 3R's i.e. Reduce, Reuse, Recycle. Thus, these structures play a major role in reducing carbon footprint and as a result it also improves human health. According to IGBC [4], green buildings results in energy savings of 40 - 50% and water savings of 20 - 30% compared to conventional buildings in India.

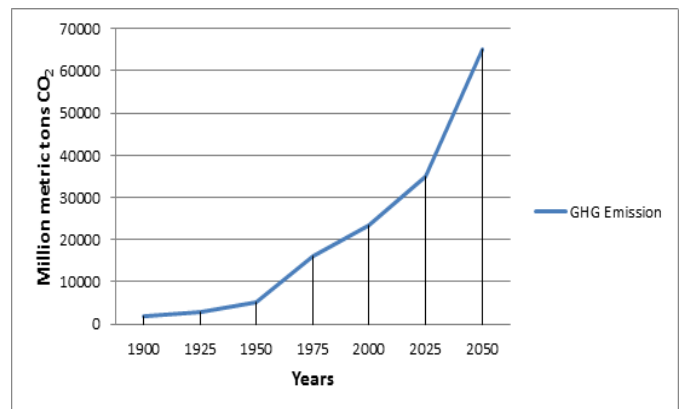


Fig. 1: Greenhouse Gas Emissions with no precautions

1.1 Aspects of Green Building

The most important aspects of green building are as follows:

1.1.1 Sustainable site: It involves retaining the site features [6] to minimize negative impacts on environment. Preserve 75% of existing trees by integrating trees with new development. Features like green cover, water bodies should not be destroyed. Minimum 50% of natural rocks should be retained.

1.1.2 Water efficiency: The principle of green building is to harvest water, use water, purify water, and then reuse water. Green buildings can save almost 30% of water [1] compared to traditional buildings. Design rainwater harvesting pits to collect all rainwater from the site.

1.1.3 Energy efficiency: The primary focus is to increase the use of renewable energies [1] [5] like solar energy, wind energy. Energy wastage has to be reduced. Building should be designed in such a way that maximum use of natural light is done. Installation of various methods should be done like that of solar panels. Use of CFC free AC's and fridges should be done.

1.1.4 Indoor Environmental Quality (IEQ): It refers to the quality of building's environment. IEQ [4] is determined by several factors like lighting, air quality and damp conditions. Indoor environment should be healthy, comfortable and productive. A proper provision of cross ventilation should be provided.

1.1.5 Conservation of materials and resources: Minimize the use of water energy and non-renewable resources construction materials. Materials with recycled contents should be used. Bio based materials that are renewable and re-usable should be used. Strawbale, earthen bags are few examples of bio based materials. Smart materials or advance materials which are resource efficient should be used.

2. FEATURES OF GREEN BUILDING

2.1 Air tightness and vapor barrier in building walls and surfaces:

If walls are able to keep humidity and moisture out of the house then rooms will become naturally cooler. Use of AC's can be prevented and thus not releasing CFC gases.

2.2 Day light controlled lighting system

This type of lighting system can easily identify daylight. Only when the natural light reduces to a level that it becomes difficult to see through lights will turn on. With the help of this unnecessary use of light will be reduced

2.3 Water-efficient fittings

The latest faucets and flush mechanism should be used. Latest faucets use low sprinkle and thus water is saved.

2.4 Rainwater harvesting

Structures should be building where rainwater is collected. Later this water is used for multiple purposes. This will be a great step towards water efficiency.

3. BENEFITS OF SUSTAINABLE BUILDINGS

The design and construction of green building will not only improve the quality of environment but also improve only improve quality of environment but also improve the quality of human life. Green building offers sustainable construction [10]. Green building [8] addresses major problem of water efficiency, energy efficiency, and resource efficiency. It stresses on 3R (Reduce, Reuse, Recycle) rule [7]. Some of the advantages of green building are:

- Reduction in operation costs
- Reduction in GHG emission
- Reduced air and water pollution
- Reduced water consumption
- Increased comforts
- Healthier indoor environment
- Enhanced durability
- Less maintenance costs
- Reduced strain on local resources

4. GREEN BUILDING RATING SYSTEM

Buildings have a long lasting impact on environment. Green buildings help in reducing negative impacts thereby increasing

positive impacts. The quality of green building depends on several factors like design, operation, cost of building, etc. The green building concept has led to the establishment of several agencies which rate green building based on these factors. The green building rating system in India are:

- a) GRIHA: Green Rating for Integrated Habitat Assessment [11] is the rating system jointly developed by TERI and the Ministry of New and Renewable Energy, Government of India.
- b) LEED: Leadership in Energy & Environmental Design [2], administered by Indian Green Building Council (IGBC) [5]
- c) BEE: Bureau of Energy Efficiency [3].

GRIHA [11] is the most popular rating system and is widely used in India. GRIHA rating system is based on a 100-points such as Site Planning, Construction Management, Occupant Comfort and Wellbeing, Sustainable Building Materials, Performance Monitoring and Validation, and Innovation, some of it are mandetory while some are optional. Different levels of certification (one star to five stars) are awarded based on the number of points earned. The minimum points required for certification are 25. The threshold of achieving GRIHA [] ratings of 2015 are given in TABLE 1.

Table 1: Rating Criteria

GRIHA V 2015 Rating Thresholds	GRIHA Rating
25-40	★
41-55	★★
56-70	★★★
71-85	★★★★
86 or more	★★★★★

5. CONVERSION OF TRADITIONAL BUILDINGS INTO SUSTAINABLE BUILDINGS

Traditional buildings can also be converted into sustainable buildings [8] [9], thereby reducing carbon footprints or negative impacts to the greatest extent. This will seem like an impossible task but is not impossible at all. Even with small changes buildings can be transformed into sustainable buildings [9]. It requires considerable investment but the result would be extraordinary.

Start with recycling the waste. Equipment's should be fixed on time. If there is leak in any pipe it should be fixed so that there is no water wastage. Keep all artificial lights closed if not necessary. Solar panels should be installed to take additional burden off the electricity. LED's should be used instead of regular bulbs. It helps us decrease power usage. Start using AC's and fridge which do not emit CFC's. In short replace everything which increases water consumption or energy consumption.

6. COST OF GREEN BUILDING

The issue of green building cost arises frequently in developing countries than in developed countries. The development cost is almost 4% higher than that of conventional building. Several efforts are been taken to reduce the cost of green buildings. The cost of green building depends upon eco-friendly features used. If the base line features have been considered then the incremental cost would seem small otherwise huge if green principles are ignored.

7. CHALLENGES IN GREEN BUILDING

7.1 Other major problems

In recent times our world is going through some major problems other than global warming, so various countries just neglect the topic. Countries have to deal with development in science or diplomatic relation with countries or the financial crisis that may

be going on within the country, all these issues in contribution. Thus many a time's green buildings are ignored.

7.2 High capital costs

Many developers are concerned that adopting green features into their buildings will involve high costs significantly. As explained above green buildings do increase the production cost of building but the occupants will get the returns as savings.

7.3 Market awareness

Another problem for promoting green building movement is lack of awareness, education and information on the benefits of green building construction. Here government has a bigger role to play to motivate the developers to build green building and also to promote the idea of green building among the common people.

7.4 Resource and skill gap

A shortage of green skills has become major constraint to green building industry. Skill gaps are often found in energy efficiency maintenance for HVAC (heating, ventilation, and air conditioning) systems. The skill gaps are because of the training of technologies that have been outdated and no new knowledge has been given. Revolution of training of skills should happen.

8. CONCLUSION

The benefits of green building are huge. Only thing where green building lacks is its cost. Everyone needs to understand that even though the cost is high, it will be paid back to them in significant amount of time. Green building encourages the 3R rule. Green buildings will thus assist countries to reduce energy consumption, water consumption, recycle waste. The recycling of waste will thereby increase production of green materials. The future of Earth will start looking bright as soon as the idea of green building is implemented at large scale. Strict enforcement by governments and green building rating system will improve the standards of building.

9. REFERENCES

[1] N. H. Julayhe, M. M. Rahman, "A BRIEF OVERVIEW OF GREENING EXISTING BUILDINGS", 7th Brunei International Conference on Engineering and Technology

- 2018 (BICET 2018), Electronic ISBN: 978-1-83953-002-9, 10.1049/cp.2018.1550.
- [2] Nils K. Larsson & Raymond J. Cole, "Green Building Challenge: the development of an idea", Building Research & Information ISSN 0961-3218 print/ISSN 1466-4321 online © 2001 Taylor & Francis Ltd.
- [3] Mao Xiaoping, Lu Huimin, "A comparison study of mainstream sustainable/green building rating tools in the world", Conference: Management and Service Science, 2009. MASS '09, DOI: 10.1109/ICMSS.2009.5303546.
- [4] Kambam Gireeshma, K. Leledhar Rao, "A Conceptual Review of Green Buildings in Energy Saving", IOSR Journal of Electrical and Electronics Engineering (IOSR-JEEE), e-ISSN: 2278-1676, p-ISSN: 2320-3331.
- [5] Dibas Manna, Sulagno Banerjee, "A Review on Green Building Movement in India", INTERNATIONAL JOURNAL OF SCIENTIFIC & TECHNOLOGY RESEARCH VOLUME 8, ISSUE 10, OCTOBER 2019, ISSN 2277-8616.
- [6] Amr, F., Abdelfattah, "RELATION BETWEEN GREEN BUILDINGS AND SUSTAINABLE DEVELOPMENT PRACTICES", The 1st International Conference: Towards A Better Quality of Life 24 - 26 November 2017, Technische Universität Berlin Campus El Gouna, Egypt.
- [7] Priyanka Rajiv Parikh, "DEVELOPING GREEN BUILDING CONCEPT IN INDIA", International Journal of Technical Research and Applications e-ISSN: 2320-8163, www.ijtra.com Volume 4, Issue 1 (January-February, 2016), PP. 77-80.
- [8] Mohd Yasir Laeeq, Dr. Syed khursheed Ahmad, Khubaib Altamash, "GREEN BUILDING: CONCEPTS AND AWARENESS", International Research Journal of Engineering and Technology (IRJET), Volume: 04 Issue: 07 | July -2017, e-ISSN: 2395-0056.
- [9] Pooja Choudhary, Jagriti gupta, Dr. Bharat Nagar, "Conversion of existing building into green building", International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 09 | Sep 2018, e-ISSN: 2395-0056.
- [10] Behnam Neyestani, "A Review on Sustainable Building (Green Building)", Electronic copy available at: <https://ssrn.com/abstract=2968885>.
- [11] Griha Rating: <https://www.grihaindia.org/griha-rating> .