

Sustainable Construction in the Indian Context: A Review on Green Rating Systems

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Abstract: Due to rapid urbanization and industrialization, India has become a global construction centre. Construction industry of India is concerned with improving the social, economic and environmental indicators of sustainability. There is huge misunderstanding between the project members about the sustainable construction like lack of interest, cost inefficient, etc. Buildings are the prime energy consumers in modern cities accounting up to 40 to 45% energy consumption. The sectors consume a lot of energy throughout the life cycle of buildings thus becoming a major contributor to greenhouse gas emissions. The importance of sustainable construction discusses role of energy efficiency in green buildings in Indian context to reduce the energy consumption and environmental degradation through Green House Gas emission (GHG). Also, green rating system GRIHA (TERI) points out to be beneficial for sustainable construction as well as the incentives from govt. and municipal bodies for certified green building.

Keywords: Energy Efficiency, Green rating system, Indian Construction, Sustainable Construction.

1. Introduction

As a major sector contributing to economic development, the construction industry also has significant impacts on the environment and society. There are various environmental issues derived from construction activities such as outdoor and indoor environmental pollution, greenhouse gas emission, and impacts on the ecological environment. As a response to these challenges, the shift of the construction industry from the traditional paradigm towards more balanced development among the economic, social and environmental dimensions, i.e. sustainable development, has received global attentions.

In order to achieve a sustainable future in the building industry, multi-disciplinary approach covering a number of features are adopted such as: energy saving, improved use of materials, material waste minimization, pollution and emissions control etc. There are many ways in which the current nature of building activity can be controlled and improved to make it less environmentally damaging, without reducing the useful output of building activities. To create a competitive advantage using environment-friendly construction practices, the whole life-cycle of buildings should, therefore, be the context. Green rating systems like Leadership in Energy and Environmental Design (LEED) rating system and Green Rating for Integrated Habitat Assessment (GRIHA) majorly deals with sustainability

at building to cluster level.

Table 1
 Most widely used green rating system

System	Year established	Country Origin	Certification level
BREEAM	1990	United Kingdom	Pass Good Very Good Excellent Outstanding
LEED	1998	United States	Certified Silver Gold Platinum
Green Globes	2000	Canada	1 Globes 2 Globes 3 Globes 4 Globes
Green Star	2002	Australia	4 Star 5 Star 6 Star for design & as-built communities & interiors 1-6 Star for performance

2. Sustainability context in India

India, the seventh largest country in the world, is a leading economy and home to over one billion people living in various climatic zones. Construction plays a very important role in its economy contributing on an average 7.8% of the GDP. The sectors consume a lot of energy throughout the life cycle of buildings thus becoming a major contributor to greenhouse gas emissions. Energy consumption in Indian buildings is expected to increase substantially due to economic growth, construction growth and human development.

India has made number one position of the top ten spending nations on construction in the world. We manufacture more than 250 million tons of cement and are second only to China. A recent report "Global Construction 2020", estimates that India will be the third largest global construction market after China and USA.

Till 2006 developers in India were reluctant towards the concepts of green buildings. They saw it as an added expense. They hardly were aware of the benefits and the enhanced marketability that the green construction was able to offer. Green buildings and their acceptance has been a relatively

recent trend in the developing countries as compared to the developed world. Though, there have been several initiatives by the governments and other bodies in the developing countries to address sustainability in the construction sector, these initiatives have either faced economic and social problems or did not have a proper implementation strategy to ensure their successful adoption in the society. But, the recent trend in India suggests a rapid adoption of green buildings in construction. By 2018 in India, over 5 billion sq.ft of green buildings is registered. A report from Indian Green Building Council (IGBC) stated that currently there are more than 4800 projects under green building guidelines.

3. Incorporation of sustainable construction

In considering sustainable practices that construction industry must adopt, an analysis is required for each stage of construction. And for this we need to have a grade based certification system or a comprehensive plan for sustainable construction of every structure in country. This can be done by considering sustainability at aspects as:

- A. Planning, design and specifications
- B. Current Practices in Construction Industry
- C. Material Conservation and Selection
- D. Use of Construction Demolition and recycled Material
- E. Energy Conservation
- F. Innovation
- G. People

Also it may be noted that cost-effective construction technologies do not compromise with the safety and security of the buildings and mostly follow the prevailing building codes. Careful selection of materials and technologies should be done in order to reduce consumption; it is possible to significantly reduce emissions.

4. Role of ratings and certification in Sustainable Development

The green building movement in India started with the establishment of the IGBC in 2001, which was an initiative of the Confederation of Indian Industries (CII) along with the World Green Building Council and the USGBC. Motivated by a desire to be environmentally conscious, many commercial and other facilities have adopted—Green technologies in order to earn—Green and Sustainable certifications. The Green Buildings Ratings and Certification process has gained tremendous momentum over the last few years. Particularly, growth in the number of projects certified by rating systems such as Energy Star and LEED has nearly doubled in size during this period.

In India, the Indian Green Building Council (IGBC) provides LEED ratings to structures and aims to make the country one of the leaders in green buildings 2035. The Green rating for Integrated Habitat Assessment (GRIHA) is the National Rating System of India. It has been conceived by The Energy and Resources Institute (TERI) and developed jointly with the

Ministry of New and Renewable Energy, India. It is a design evaluation system for green building and is intended for all kinds of buildings across every climatic zone in India. Because of the gradual spread of awareness about eco-friendly buildings, there has been a considerable rise in the number of registered green buildings all over India.

5. Green Building Certification Processes in India

A. GRIHA

Green Star Rating System Formed by The energy And Resources Institute (TERI), INDIA, it identifies projects that have demonstrated a commitment to sustainability by designing, constructing or owning a building to a determined standard. It attempts to minimize a building's resource consumption, waste generation, and overall ecological/environmental impact by comparing them to certain nationally acceptable limits/benchmarks. By adopting the five 'R' philosophy of sustainable development, namely

- Refuse: to blindly adopt international trends, materials, technologies, products, etc. Especially in areas where local substitutes/equivalents are available.
- Reduce: the dependence on high energy products, systems, processes, etc.
- Reuse: materials, products, traditional technologies, so as to reduce the costs incurred in designing buildings as well as in operating them.
- Recycle: all possible wastes generated from the building site, during construction, operation and demolition.
- Reinvent: engineering systems, designs, and practices such that India creates global examples that the world

TERI (GRIHA) certification system consists of 34 criteria of the rating under 4 categories namely site selection and planning, building planning and construction, building operation and maintenance, innovation. Within each category, the credits awarded have an effective weight-age by virtue of the numbers of credits awarded versus the total credits available. Different levels of certification (one star to five stars) are awarded based on the number of points earned. The minimum points required for certification is 50.

- 50-60 points is certified as a 1 star GRIHA
- 61-70 is a 2 star GRIHA rated building,
- 71-80 is a 3 star GRIHA rating building,
- 81-90 is a 4 star GRIHA rated building and
- 91-100 is a 5 star GRIHA rated building

The project evaluation is done by the GRIHA officials-ADaRSH. ADaRSH officials can examine your project documents to help you establish whether your project is eligible for GRIHA rating and render requisite assistance for registration. ADaRSH is a non-profit, independent society registered under the Societies Act and is the body responsible

for administering and giving GRIHA rating to the projects that register under the system.

Table 2
GRIHA registration scheme

Built-up Area	Registration Fees*
<5000m ²	Rs. 3,14,000
>5000m ²	Rs. 3,14,000 + (Rs. 3.75 per m ² above 5000)
*Excluding Basement	

SVA GRIHA (Simple Versatile Affordable GRIHA) has been developed by ADaRSH in collaboration with TERI and is currently under pilot stage. This variant of GRIHA is meant to simplify, and make the greening of small buildings (less than 2500 sq.m built-up area) affordable.

B. Bureau of Energy Efficiency (BEE)

BEE Star rating the scheme is based on actual performance of the buildings in terms of energy performance index (EPI, kWh/m²/yr), in which air-conditioned and non- air-conditioned buildings are rated on 1 to 5 scale targeting three climate zones (hot and dry, warm and humid, composite). The Star Rating Program for buildings will create a demand in the market for energy efficient buildings based on actual performance of the building in terms of specific energy usage. This program will rate buildings having a connected load of 100 kW and above on a 1-5 Star scale with 5 Star labeled buildings being the most efficient.

Five categories of buildings - office buildings, hotels, hospitals, retail malls, and IT Parks in five climate zones in the country have been identified for this program. The energy Performance Index (EPI) in kWh/m²/year will be considered for rating the building. The Indian Bureau of Energy Efficiency (BEE) had launched the Energy Conservation Building Code (ECBC) on February 2007. The code is set for energy efficiency standards for design and construction with any building of minimum conditioned area of 1000 Sq. mts and a connected demand of power of 500 KW or 600 KVA. The energy performance index of the code is set from 90 kW·h/sq./year to 200 kW·h/sqm/year where any buildings that fall under the index can be termed as "ECBC Compliant Building".

C. Leadership in Energy and Environmental Design Rating System (LEED)

INDIA LEED, a product of the U.S. Green Building Council (USGBC), provides a complete framework for assessing building performance and meeting sustainability goals within 6 category rating system. The categories are: sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality and innovation & design. LEED Certification is based on point system. The amount of points achieved will determine which level of LEED certification the project is awarded. There are 69 possible points and four certification levels. Basic LEED Certification requires 26 to 32 points; LEED certified silver level requires 33 to 38 points; LEED certified Gold level requires 39 to 51 points; and LEED

certified platinum level requires 52 to 69 points.

The maximum possible points are based on:

- Sustainable sites (14 possible point’s total)
- Water efficiency (5 possible point’s total)
- Energy and atmosphere (17 possible point’s total)
- Material and resources (13 possible point’s total)
- Indoor environmental quality (15 possible point’s total)
- Innovation and design process (5 possible points total)

Table 3

GRIHA Certified buildings in India

Name of the Project	Location	Star Rating
New Interim Terminal Building (Domestic), Vijayawada Airport	Krishna District, Vijayawada, Andhra Pradesh	3
Milestone Experion Centre	Gurgaon	5
New Government Medical College	Baripada, Odisha	4

Table 4

LEED Certified green buildings in India

Name of the Project	Location	LEED rating	Annual Energy Savings (Rs. in Lakhs)
CII Sorabji Godrej GBC	Hyderabad	Platinum	102
Wipro	Gurgaon	Platinum	90
Palais Royale	Worli, Mumbai	Platinum	60

6. Conclusion

1. India is a rapidly growing economy and hence the pressure on the use of natural resources is very heavy. There is an awakening about the words durability and then sustainability. Though the durability is understood to a point the real meaning and importance of sustainability is not fully comprehended by engineering fraternity as well as planners.
2. Uncurbed consumption of these high embodied energy materials is a reason for environmental degradation. In today’s era where energy crisis is a major problem, green buildings gives a brilliant and promising solution. These are designed to use minimum energy.
3. The IGBC has adopted the GRIHA rating system for evaluating green building performance in India. The payback period for existing green buildings range from two to seven years, depending upon their certification level.
4. Green building is a boon to the society where energy and water consumption can be reduced while still maintaining an increase in productivity for occupants, their health, safety and well-being.
5. In today’s era green buildings are essential as environmental balance is important for survival and further development of human beings, but first people have to be made aware not to see green buildings as an extra monetary burden. Green buildings are only way to a sustainable tomorrow.

References

- [1] P. Architect, M. State, M. State, E. Union, S. Technologies, and L. Cycle, "Sustainable Construction Materials & Technology in Context with Sustainable Development," vol. 10, no. 1, pp. 112–117, 2017.
- [2] R. Energy, G. Rating, and I. H. Assessment, "The Little Book of GRIHA rating."
- [3] S. Haq, N. A. Mir, and Z. I. Buhroo, "Green Building Development for Sustainable Environment with Special Reference to India," no. July 2016, 2012.
- [4] B. M. Kataria and V. B. Pathak, "Sustainable development A Rethinking of Construction Industry in India," vol. 2, no. 10, pp. 5182–5186, 2013.
- [5] D. Tathagat and R. D. Dod, "Role of Green Buildings in Sustainable Construction- Need, Challenges and Scope in the Indian Scenario," vol. 12, no. 2, pp. 1–9, 2015.
- [6] S. H. G. Series, "Facility Managers: Learn how to impact."
- [7] R. D. Chang et al., "Sustainability attitude and performance of construction enterprises: A China study," *Journal of Cleaner Production*, vol. 172, pp. 1440–1451, 2018.