

Comparative Review of Indian Green Building Rating Systems

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Abstract—Indian construction industry is witnessing highest growth rate from last 10-15 years, which is having a negative impact on the environment and natural resources available for construction. Following this problem of carbon imprint, concept of sustainable development in construction industry is the need of an hour. With increase in demand of sustainable buildings or Green buildings, demand of Green rating and assessment tools is also increasing. Rating tools set benchmark for green building measurement, which are helpful in reducing negative impact on environment by promoting quality green buildings. India has two main building environment assessment tools i.e. Indian Green Building Council (IGBC) and Green Rating for Integrated Habitat Assessment (GRIHA). The former is benchmarked with global standards while later is indigenously developed.

This paper aims to focus on comparative study of IGBC (LEED India) and GRIHA rating system and compare both with regards to their certification-cost, influence and popularity, performance criteria and benchmarks (rating score). Through this study, an attempt is made to make clear understanding of IGBC and GRIHA rating system assessment criteria that need to be considered before certification.

1. Introduction

Due to rapid urbanization and increased population there is a huge demand of residential and commercial buildings. Traditional materials and methods of construction are harmful for our environment and society because they emit greenhouse gases (GHGs), dust, consumes more energy and water. A green building is one which utilizes less water, improves vitality productivity, saves common assets, creates less waste and gives more advantageous spaces to tenants when contrasted with a regular building.

Use of Innovative materials and nonrenewable energy resources in green or sustainable building reduces environmental impact. A Green Building advances productive utilization of natural assets and reused or recyclable materials. Sustainable building has three fundamental measurements: ecological, cultural and economic sustainability [1]. It Depend upon the kind of nation, due to regional differences expectation of people also changes, likewise culture is also

essential angle in accomplishing sustainability. The traditional buildings satisfy the necessities of well-being, but utilizes excess energy and other natural assets, but Green Buildings adopts variety of eco-friendly concepts and provide same comfort with healthy environment. The sustainable building demand has expanded quickly worldwide in recent decades. With increase in green building demand assessment and benchmarking tools were needed [2]. In view of the extent of green measures embraced, credits are granted to a project and, after applying required weightage; a final score is a calculated to determine the certification Level of the building. This helps to know the range of utilization of green practices in building development. The BREEAM (Building Research Establishment's Environmental Assessment Method) was launched in UK in 1990 and first guide was published in 1996, after BREEAM every country started developing their own rating system, the Hong Kong Building Environmental Assessment Method (HK-BEAM) was introduced in the same year in Hong Kong in 1996. In the year 1998, the Leadership in Energy and Environmental Design green building rating system was introduced in US. In year 2002 Green building council of Australia introduced Green Star rating system. In year 2003 the Indian Green Building Council was introduced BY CII. In year 2005, the Green Mark rating system was introduced by the building and Construction Authority of Singapore. In year 2005 TERI developed Green Rating for Integrated Habitat Assessment in India which was adopted as national rating system for green building in November 2007.

2. An overview of Green Building Rating System

Building Research Establishment's Environmental Assessment Method

The Building Research Establishment's Environmental Assessment Method (BREEAM) was launched in UK in 1990 and first guide was published in 1996, it was the first sustainability assessment method developed. It was having some predefined rating points which a building must comply to get certified. Over 2263000 buildings have been registered

for certification since it was launched in 1990; it is present in 78 countries.

BREEAM rating system is divided in 10 categories, namely Energy, Health and wellbeing, Innovation, Transportation, Material, Waste, Land use and Ecology, Water, Pollution, Management [3].

Leadership in Energy and Environmental Design

LEED was developed by US green Building Council in year 1998, since then it is most widely used successful rating system worldwide. Project may win one of four levels of LEED certification (Certified, Silver, Gold or Platinum) by accomplishing a given number of point-based credits inside the rating framework [4]. Projects may acquire one of four levels of LEED certification (Certified, Silver, Gold or Platinum) by securing a given number of credits according to the norms in the rating system. LEED has 7 basic criteria, namely Sustainable site, Water Efficiency, Energy & Atmosphere, Material & Resources, Indoor Environment Quality, Innovation & Design Process and Regional Priority [4].

Green Star

Green Star is a sustainability rating system for buildings developed by Green Building Council of Australia (GBCA) in year 2003. Green Star rating tool has been developed on existing tools in global markets, including the UK's (United Kingdom) BREEAM and the USGBC LEED (Leadership in Energy and Environmental Design) system, by establishing discrete environmental evaluation criteria appropriate to the Australian marketplace and environmental background [5]

Comprehensive Assessment System for Building Environmental Efficiency

Comprehensive Assessment System for Building Environmental Efficiency (CASBEE) is developed in Japan in 2001 by a committee established through the participation of academia, industry and government and supported by Japanese ministry of land, Infrastructure, Transportation and Tourism. CASBEE is basically an Architectural design tool. It uses five Quality performers to rate the building namely Quality of services, Outdoor environment on site, Indoor Environment energy, Off-sits Environment, Resources and Materials [6]. It released CASBEE for cities on December 2nd, 2015.

Green Building Rating Tools in India

A green or sustainable building rating system is a developed tool that measures the performance of a building and its effect on the environment. It contains a predefined set of criteria

identifying with the design, development, and operations of green structures.

Basically, India has two green building rating systems namely LEED-Indian Green Building Council (IGBC) and the Green Rating for Integrated Habitat Assessment (GRIHA). There are also several codes which provide guidelines regarding energy use and rating system, the Energy Consumption Building Code (ECBC) and the National Building Code (NBC) are few of them. Every building needs to satisfy the pre-set norms and accomplish an accurate number of points to be certified and be stamped as a green building.

Indian Green Building Council

It is an Indian version of USGBC LEED (Leadership of Energy and Environmental Design) started in 2003 by CII. Indian Green Building Council is a part of CII-Godrej Green Business Centre. The vision of the IGBC is to serve as main solution provider and be a key institution to facilitate all Green Building activities in India [7], the association spreading and promoting sustainability through sustainable construction. IGBC is most popular rating system in India with over 2000 building registered for rating. IGBC is a rating tool for surveying building performance according set criteria and standard norms. In the year 2000 the benchmarks for the IGBC (LEED India) Green Building Rating System were created and final rating was released in 2003 and is as of now accessible for new and existing developments.

Green Rating for Integrated Habitat Assessment

Green Rating for Integrated Habitat Assessment was developed by TERI (The Energy and Resources Institute) and supported by Indian government's MNRE ((Ministry of New and Renewable Energy). It is also declared as India's National Rating System for Green buildings in 2007. GRIHA adopts the five 'R' (Refuse, Reduce, Reuse, Recycle and Reinvent) philosophy of sustainable development [8]. More than 330 projects throughout country of various scale and use are being built on GRIHA guidelines [8].

3. Comparative Analysis

Cost

For nonmembers and 5000 m² or less built up area.

Table 1: Total Cost of Certification

IGBC		GRIHA	
Membership fee	30000	Membership fee	N.A.
Precertification	185000	Precertification	-
Certification	160000	Certification	314000
Total	375000	Total	314000

IGBC charges membership fee results in increased cost, on the other hand GRIHA do not charge such membership cost.

Popularity and Influence

Popularity is measured in terms of number of projects registered under each rating system and their contribution towards green footprint.

Table 2: Influence

	IGBC	GRIHA
Inception Year	2001	2005
Number of projects Registered	4077	900
Green Footprint	4.53 Billion sq. ft.	387.501 million sq. ft. (approx.)

IGBC is more popular both in terms of numbers of project and green footprint. IGBC follow LEED rating system, which has higher publicity toward the West, making it more adequate to multinationals who are prime purchasers/investors of properties

Assessment Criteria for New Construction

IGBC has divided its whole rating system into 7 basic criteria [6] and GRIHA has divided its rating system into 4 main groups which are further divided into 34 criteria [5]. To compare both the rating systems 34 criteria of GRIHA has been summarized in 9 group criteria.

Table 3: Assessment Criteria

IGBC		GRIHA	
Criteria	Points allotted	Grouped Criteria	Point allotted
Sustainable architecture and design	05	Site Planning	17
Site selection and Planning	14	Water Management	13
Water Conservation	18	Energy Optimization	35
Energy Efficiency	28	Sustainable Building Materials	14
Building material and resources	16	Waste Management	05
Indoor Environmental Quality	12	Health and Wellbeing	14
Innovation and development	07	Building Operation and Maintenance	02
Total	100	Total	100

LEED allot 10 extra points, 6 for Innovation in Design and 4 for Regional Priority respectively therefore there are 110 maximum number of points that can be achieved. Meanwhile GRIHA allots 4 points for Innovation in Design, so maximum 104 points can be achieved under GRIHA ratings.

Table 4: Comparison Table

No.	Category	IGBC	GRIHA
1	MANAGEMENT/SUSTAINABLE SITE		
a	Site selection/Land reuse/Reclaimed land/Sustainable construction	✓	✓
b	Safeguard and protect the landscape during construction / Preserve top soil / Existing vegetation	✓	✓
c	Soil conservation/Top soil laying & stabilization/Hard landscaping & boundary protection	X	✓
d	Brownfield redevelopment	✓	X
e	Design to include existing site features	✓	✓
f	Building & site operation & maintenance	X	✓
g	Project management	X	✓
2	ENERGY/ENERGY EFFICIENCY/ENERGY USE		
a	Renewable energy utilization	✓	✓
b	Minimum energy performance/Optimize ozone depletion	✓	X
c	Fundamental building commissioning/Measurement & verification/ Energy monitoring/metering & monitoring	✓	✓
d	Ozone depletion	✓	✓
e	Additional commissioning	✓	X
f	Energy improvement/Green power	✓	✓
3	INDOOR ENVIRONMENTAL QUALITY		
a	Optimize building design to reduce the conventional energy demand/Naturally ventilated design/Localized ventilation	✓	✓
b	Day lighting & views / Visual comfort / Day lighting / External views / Artificial lighting minimization / Interior lighting normally specified.	✓	✓
c	Reduced heat island effects/Thermal comfort/Thermal insulation/Thermal performance of building	✓	X
d	Low emitting material/Indoor chemical and pollutant source control/CO2 monitoring and control / Hazardous material / Indoor air pollutants/ETS control	✓	✓
e	Minimize ozone depleting substance/HCFC & CFC free HVAC/Low & Zero carbon technology	✓	✓
f	Acceptable indoor & outdoor noise levels / Acoustic performance /Background noise	X	✓
4	HEALTH & WELL BEING		
a	Minimum level of sanitation/Safety facilities for construction workers	X	✓

b	Reduce air pollution during construction	✓	✓
5	RECYCLE, RECHARGE & REUSE OF WATER		
a	Water consumption/Water monitoring/Water meter/Water usage monitoring	X	✓
b	Waste Water Treatment	✓	✓
c	Water recycle & reuse	X	✓
d	Minimize waste generation/Waste segregation/ Storage & disposal/Recovery from waste	X	✓
e	Innovative waste water technologies/ Storm water management / Water recycling effluent discharge to foul sewer.	✓	✓
6	MATERIALS		
a	Building reuse/Reuse of façade/Reuse of structure	✓	X
b	Conservation and efficient utilization of resources	✓	✓
c	Utilization of fly ash in the building structure	X	✓
d	Storage and collection of recyclables/Construction water management / Resource reuse / Recycled content / Construction waste management / Recycled aggregates / Recycled content of concrete / Recycled content of steel / Recycled content of reused products& materials	✓	✓
e	Reduce volume, weight & time of construction by adopting an efficient technology	X	✓
f	Use low energy materials in the interiors	✓	✓
g	Sustainable procurement/Recycling waste storage / Sustainable construction/Sustainable products / Adaptability & Deconstruction / Sustainable forest products / Waste recycling facilities / Waste management	✓	✓
h	Local or regional materials	✓	X
7	TRANSPORTATION		
a	Alternative transportation / Public transport accessibility / commuting mass transport / Green transport / Local transport / Vehicular access	✓	✓
b	Alternative transportation/Cyclist facilities	✓	X
c	Alternative transportation / Travel plan / Fuel efficient transport	✓	X
d	Pedestrian route/ Local transport	✓	✓
e	Proximity to amenities/ Neighborhood amenities/ amenities features	✓	X
8	INNOVATION		
a	Innovation in design	✓	✓

✓: Considered

Source: Sande (2015)

X: Not Considered

GRIHA rating framework is more suited for Indian conditions and it is more elaborated rating system.

Benchmarking (Rating Score)

Benchmark is a set of norms, utilized as a perspective for assessing performance.

Benchmarks for both the rating systems are given below.

Table 5: Certification Level

IGBC		GRIHA	
Rating	points	Rating	% Points scored
Certified	40-49	One star	50–60
Silver	50-59	Two stars	61-70
Gold	60-79	Three stars	71–80
Platinum	80 and above	Four stars	81–90
		Five stars	91–100

4. Conclusion

To rate the green building both the rating systems IGBC and GRIHA are prominently used in India, where former is according to international standards while later is indigenously developed.

IGBC is backed by Confederation of Indian Industry and uses global standards norms of LEED. Meanwhile GRIHA is especially developed according to Indian Condition and supported by Ministry of New and Renewable Energy.

GRIHA is easy but detailed rating system while IGBC uses per capita energy consumption which is not a reliable factor for rating as India's per capita energy consumption is very low.

Over all GRIHA suits and fits in Indian Conditions while good market strategy and International standard are helping IGBC in maintaining their position of most preferred rating systems in India.

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