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Comparative and Spatial Analysis of the Leed-India and Griha Rating Systems in Andheri Region

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***Abstract*: New Construction is developing at a rapid pace and it puts a great effort on achieving sustainable development. It has led to the emergence of Green Building Rating System worldwide. Different types rating system of has provided unique guidelines for each and every category of buildings just like, Schools, Hotels, Core & Shell, etc. Green building rating (GBR) systems are developed to simply provide best standards and assist to fulfill green building practices. Each rating system addressed key sustainable parameters: energy, water, site, indoor environmental quality and materials in order to build sustainable environment. Mumbai is economic capital of India and as one of the other cities is in need for this system, especially with poor resources and inefficient use. Therefore, this research studied international green building assessment tools such as such as LEED and GRIHA. The common aspect of all the rating system is to create a sustainable architecture in all respect so as to minimize negative environmental impact upon the environment. And the comparison is done in this paper with the help of some case studies and for the saving the energy so as to enhancing capability in the use of materials, energy, and space.**

***Keywords*: Construction, Green Building Rating System, Sustainable Development, energy efficiency.**

1. Introduction

The main aim of a green building design is to minimize the demand on non-renewable resources, maximize the utilization efficiency of these resources, when in use, and maximize the reuse, recycling, and utilization of renewable resources. It maximizes the use of efficient building materials, equipment and construction methods; optimizes the use of it on-site sources and sinks by bio-climatic architectural practices. It also utilizes the minimum energy to power itself, efficient equipment to meet its lighting, air-conditioning, and other needs; maximizes the use of renewable sources of energy; uses efficient waste and water management practices; and provides comfortable and hygienic indoor working conditions.

It is very crucial to make the decision to construct a green building as early as possible in the design process in order to maximize the green potential, minimize redesign, and assure the overall success and the green elements of the building project's economic feasibility. It will also boost the construction in fewer amounts of time; and to get the benefits of the green building within the campus. The construction industry in India is considered as one of the huge economic activities as well as is growing by an average rate of 9.5% as compared to the global average of 5%. To enable the construction industry environmentally sensitive, the Indian Green Building Council (IGBC) has been found by CII - Sohrabji Godrej Green Business Centre. IGBC is a consensus driven not-for profit Council representing the building industry, consisting of more than 1,900 committed members.

LEED India and GRIHA are the most accepted and very common rating systems in Indian green building industry. In this regard, scholarly LEED & GRIHA systems have same approach and structure to credit building sector's performance and originate grade levels for authorization. There are considerable changes in sustainability rating methodology, starting from tool rating system one to another in terms of measurement of building scope, performance and environmental criteria within the infrastructure sector within the campus.

2. Theoretical contents

A. About Study

A unified green design movement did not begin to emerge until the 1970s, when design and building practices first became a pick point of focus of environmental advocates. Once the decision to build green has been made, the first step in the green design process are to establish firm environmental goals for the project. It is important to set specific measurable goals for things like energy efficiency, water conservation, on-site treatment of rain water and storm water, efficient management of material and resource, construction waste management, and to designate responsibility for meeting these goals to specific members of the design team which also helps in increasing developer's profit.

B. Overview of Green Building Rating System

1) LEED (Leadership in Energy and Environmental Design)

LEED-India is associated with internationally known LEED

program, which is administered in India by the IGBC (Indian Green Building Council). Started in 2001 as a department of the United States Green Building Council (USGBC) LEED program, the India Green Building Council currently boasts more than 1600 IGBC members spread across 13 local chapters. The vision of the IGBC is "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in sustainable built environment by 2025". Third party validation of a project's green features and verification has offered by LEED Certification, that the building is operating exactly according to its design and it's the nationally accepted as a benchmark for the design, construction and utility of high performance green buildings. The rating system gives guidelines for specific environmental building related impacts using a whole building environmental performance approach. All of the building's lifecycle could be evaluated depending upon the criteria from Building Design and Construction, Interior Design and Construction, Building Operations and Maintenance, Neighborhoods Development manuals.

LEED serves as a tool for new and existing buildings and of all types and sizes also. LEED certification is available for all building types including new construction and major renovation; existing buildings; commercial interiors; core and shell; schools and homes. LEED systems for neighborhood development, retail and healthcare are currently pilot testing.

Table 1
Credit points for different levels of certification

Certified	40-49 points
Silver	50-59 points
Gold	60-79 points
Platinum	80 points and above

2) GRIHA- (Green Rating for Integrated Habitat Assessment)

The National Rating System will evaluate the environmental performance of a building holistically over its entire life cycle, thereby providing a definite standard for what constitutes a 'green building'. Most of the internationally devised rating systems have been tailored to suit the building industry of the country wherever they were developed. TERI, being deeply committed to every possible aspect of sustainable development, took the responsibility of acting as a driving force to carry by the organizations green buildings by implementation of measurement and rating a building's environmental performance in the context of India's varied climate and building practices. This tool, by its qualitative and quantitative assessment criteria, would be able to 'rate' a building on the degree of its 'greenness'.

Table 2
Points achieved by GRIHA rating

One Star	50-60
Two Stars	61-70
Three Stars	71-80
Four Stars	81-90
Five Stars	91 points and above

The rating system, based on accepted energy and environmental principles, will seek to strike a balance between the established practices and emerging concepts, both national and international. The guidelines/criteria appraisal may be revised every three years to take into account the latest scientific developments during this period.

GRIHA has a 100-point system consisting of some core points, which are mandatory to be met while the rest are elective points, which can be derived by keeping with the commitment of the criteria for which the point is allocated. Above 100 point system there are innovation points also available. This means

Table 3
Case studies of residential buildings

S. No.	Criteria	Details of Site 1	Details of Site 2	Details of Site 3
1	Name of Building	Kabra Metro One (G+21), Andheri (west)	Morya Enclave (G+20)	Acme Oasis (G+36+1 fire check floor)
2	Location	Near Varsova metro station, Andheri (west), Mumbai	J P road, Andheri (west)	D. N. nagar, Andheri (west), Mumbai
3	Residential Area	1400 sqft (per 16 floors) (4BHK, 3BHK, 2BHK, 2.5BHK)	1000 sqft (per 16 floors) (2BHK, 1BHK)	1260 sqft (per 16 floors) (4BHK, 3BHK, 2BHK, 1BHK)
4	Parking space	5 Floor parking for both cars and bikes with car lift	Ground+Podium parking for both cars and bikes without car lift	3 Floor parking for both cars and bikes with car lift
5	Construction	36,5000 sqft	30,000 sqft	52000 sqft
6	Estimate	100 Cr INR	20 Cr INR	120 Cr INR
7	Foundation	Raft Concrete (27°c to 29°c) = 3layers, 5podiums	Simple rectangular foundation	Pile Foundation = 3podiums
8	Air-conditioned Area	1115 sqm	800 sqm	1000 sqm
9	Non-Air-conditioned Area	4831 sqm	3500 sqm	4712 sqm
10	Construction Material Reusable	80-90%	70-75%	80-85%
11	EPI	17 kW/sqm/year	17 kW/sqm/year	15.55 kW/sqm/year
12	Occupancy hours	8 hours	5 hours	8 hours
13	Renewable energy installed on site	100 kWP	50 kWP	100 kWP
14	Developer	Rupnarayan Singh	Dev Enterprises	Acme group
15	Civil Engineer	Kaushikbhai Chandawalla	Madan Kolambekar	Saurabh Pathare
16	Rating by	Indian Green Building Council	Indian Green Building Council	Indian Green Building Council
17	Certificate	Pre-certified Platinum	Pre-certified Gold	Pre-certified Platinum

that a project can hypothetically apply for a maximum of 104 points. But the final scoring shall be done out of 100 points.

3. Comparative analysis

With some feasibility there is a similarity between the two programs that the use of credit based system for what credits or measures building developers want to proceed along, with

Table 4
Comparative analysis of LEED and GRIHA rating system

NO.	CATEGORY	LEED	GRIHA
1	MANAGEMENT/SUSTAINABLE SITE		
a)	Site selection/Reuse of land/Reclaimed land/Sustainable construction	✓	✓
b)	Preserve and protect the landscape during construction/Preserve top soil/Existing vegetation	✓	✓
c)	Soil conservation/Top soil laying & stabilization/Hard landscaping &boundary protection	×	✓
d)	Brownfield redevelopment	✓	×
e)	Design including existing site features	✓	✓
f)	Building & site operation & maintenance	×	✓
g)	Project management	×	✓
2	ENERGY/ENERGY EFFICIENCY/ENERGY USE		
a)	Renewable energy utilization	✓	✓
b)	Minimum energy performance/Optimize ozone depletion	✓	×
c)	Additional commissioning	✓	×
d)	Energy improvement/Green power	✓	✓
e)	Fundamental building commissioning/Measurement & verification/Energy monitoring/metering & monitoring	✓	✓
f)	Ozone depletion	✓	✓
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 /Artificial lighting minimization/Interior lighting normally specified.	✓	✓
c)	Minimize ozone depleting substance/HCFC & CFC free HVAC/Zero carbon technology	✓	✓
d)	Low emitting material/Indoor chemical and pollutant source control/CO2 monitoring and control/Hazardous material/Indoor air pollutants/ETS control	✓	✓
e)	Reduced heat island effects/Thermal comfort/Thermal insulation/Thermal performance of building	✓	×
f)	Acceptable indoor & outdoor noise levels/Acoustic performance/ Background noise	×	✓
4	HEALTH & WELLBEING		
a)	Minimum level of sanitation/Safety facilities for construction workers	×	✓
b)	Reduce air pollution during construction	✓	✓
5	RECYCLE, RECHARGE & REUSE OF WATER		
a)	Water consumption/Water monitoring/Water meter/Water usage Monitoring	×	✓
b)	Water recycle & reuse	×	✓
c)	Waste Water Treatment	✓	✓
d)	Minimize waste generation/Waste segregation/Storage & disposal/Recovery from waste	×	✓
e)	Innovative waste water technologies/Storm water management/Water recycling effluent discharge to foul sever.	✓	✓
6	MATERIALS		
a)	Efficient utilization and conservation of resources	✓	✓
b)	Building reuse/Reuse of façade/Reuse of structure	✓	×
c)	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	×	×
d)	Utilization of fly ash in the building structure	×	×
e)	Use low energy materials in the interiors	×	×
f)	Reduce volume, weight & time of construction by adopting an efficient technology	×	×
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	×	×
7	TRANSPORTATION		
a)	Alternative transportation /Local transport/Public transport accessibility/commuting mass transport /Green transport/Vehicular access	×	×
b)	Pedestrian route/ Local transport	×	×
c)	Proximity to amenities/Neighborhood amenities/Amenities features	×	×
d)	Alternative transportation/Cyclist facilities	×	×
e)	Alternative transportation/Travel plan /Fuel efficient transport	×	×
8	INNOVATION		
a)	Innovation in design	✓	✓

Considered	✓
Not Considered	×

mandatory requirements that must give an offset for certification. In terms of the specific rating systems, LEED has equalities and differences with GRIHA program. For rating new and existing construction design, both LEED and GRIHA also use equal rating principle's focusing on site selection, land, energy, water, safety, indoor environmental quality etc. Not only comparison shows from this analysis that there are many assessment criteria considered which have the same meaning but also they are denoted by a different wording in respective rating systems. It is clear that there is no appropriate preference given to various assessment criteria. There are sections between the two systems in terms of process, popularity, transparency, cost, and criteria.

A. Popularity

LEED is most popular in comparison to GRIHA. LEED and USGBC rating had been adopted by more than 22 countries and has a stated goal of becoming the global standard for green building rating systems. Since its introduction a dozen years ago, more than 12,000 commercial projects have been certified under LEED according to USGBC. It indicates that more than 2,000 buildings have been certified under GRIHA in India in the year 2006. Much of the growth in the India has been in the last decade, and they continue to see increasing interest in GRIHA from building owners, design professionals, and governmental agencies.

B. Transparency

GRIHA use minimum prerequisites in performance requirements. LEED primarily allocates points for achieving a certain performance level, whereas, GRIHA awards points not only for implementing strategies, but for outcomes also. As an extra factor, USGBC have come under growing criticism for keeping LEED process more compactly held and 'internal' than many stakeholders would like to come across, particularly for the adoption of LEED by governmental agencies.

C. Cost

There is a free associate membership for GRIHA, no appeal costs, and fewer registration costs. It also reduces the costs of billable hours for LEED consultants on documentation. Therefore, it is possible to certify under GRIHA for a lower cost than under LEED.

D. Criteria

The better expansion of life-cycle thinking included in GRIHA, into its rating system through sourcing of materials and the durability and adaptability of the building itself. LEED allocates comparatively more points to materials while, GRIHA emphasizes energy use above all other categories. This difference in emphasis may begin to shift somewhat, since previous versions the latest LEED vision (formerly LEED India-NC) embodied updated life cycle thinking.

4. Conclusion

Despite each rating system has its goal to achieve sustainability and to create an environmental balance in the eco-system but they largely differ with each other in their approach. To know how effective a particular project is particularly fundamental in terms of its environment friendliness. Current brief comparison would check the building on various criterions so as to give a fair idea of where it stands in being a green building. Both rating systems are good enough to be used in a part of the country but they are common in consideration. Performance of the newer products, and dissemination of technologies emphasizing costs-benefits analyses and life cycle assessment report will significantly contribute to successful commercialization of innovative processes. Since these two systems are based on different parameters of green building, there is a possibility of the both rating systems rate the same buildings differently. Also they are quite complex in nature and don't necessarily give a clear idea of the projects effectiveness. Each system has certain strong points and certain weak points but they are not specific on some assessment criteria. Due to this both systems are currently confusing the Indian developers, builders for the certification of their projects. According to above comparative study of LEED and GRIHA rating system contain some suitable points for green building which is intelligible and effectively suggested for small contractors to achieve green agenda simply and economically. This point is an integration of various points such as it carries the advantages of both system where as it overcomes the individual shortcomings.

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