

Comparative Review criteria utilization by LEED and GRIHA: Green building Rating systems for New construction in India

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Abstract- Building construction is witnessing growth at highest rate in last 10 years in India. This has an impact on available resources of material for construction also direct and indirect effect on natural environment and increase in green house Gas emissions. Green building rating systems have been contributing to assess building performance based on their efforts to minimize this impact on natural environment. This study analyze the criteria and their significance in two basic green building rating systems in India LEED and GRIHA. This is a part of research study where an attempt is made to quantify the role of each criterion in both systems as performance indicator by post occupancy evaluation. In this paper, author performs comparative analysis of assessment criteria.

Index Terms- Green Buildings, GRIHA, LEED, Rating system

Introduction:

Construction sector in India is considered to be fastest growing construction sector in world. Built floor area is almost doubled in last ten years. This is driven by rapid urbanization. About 30% of India's 221.1 million households are now in urban areas with the urban population projected to more than double by 2050. Green house Gas emissions associated with Building Material manufacturing is also likely to impact on energy use patterns of occupants, increasing the need to consider lower embodied energy approaches to construction. Along with this attempts have been made to rate the type of construction based on its direct and indirect impact on environment by green building rating systems around the globe and by their Indian versions. There are prominently two rating systems working in India. Indian green Building Council (IGBC) and The Energy Resource Institute (TERI) are executing number of rating programs throughout India since 2001. The successful delivery of green buildings requires balancing energy and resource efficiency while providing a comfortable, healthy and productive environment. This requires careful selection of criteria to rate the performance of green building assessment mechanism. IGBC has initiated and continuously upgraded its own rating program since its inception. While GRIHA have achieved considerable footprint based on incentive programs released by government of India.

1.0 Overview and Scope of rating programs for new construction

IGBC and GRIHA new building rating program covers all type of buildings based on their functional planning with both air conditioned and non air conditioned spaces either occupied by owner or by tenant Both system have updated periodically. the overall comparison of green features under various categories is shown in Table 1.1

Table 1.1: Green building assessment criteria

LEED New construction(rating points)	GRIHA(rating points)
Sustainable architecture and design(05)	Site Planning(08)
Site selection and Planning(14)	Construction management(09)
Water Conservation(18)	Energy (20)
Energy Efficiency(28)	Occupant comfort and well being(12)
Building material and resources(16)	Water(17)
Indoor Environmental Quality(12)	Sustainable building material(14)
Innovation and design(07)	Solid waste management(06)
	Socio economic strategies(06)
	Performance validation and monitoring(12)

Comparative observations of above table are promptly highlighting efforts provided by GRIHA in incorporating performance monitoring as one of governing criteria in assessment. While social economic strategies are also covered by LEED rating in sub criteria of other major heads. Analysing credit points in rating system shows efforts by both system in optimizing energy and water use in buildings. This is to be monitored for making system sustainable over its life cycle.

2.0 Site Selection and planning Guidelines

Selection of most feasible site to carry out a specific function of building is very important and challenging task which also have financial implication on feasibility of project in longer run. Ideal site selection will further assist in achieving ratings in other heads like availability of local material, energy efficiency by orientation of building and so on. The table 2.1 shows comparison of sub criteria handled by both systems in selecting green rated site for proposed project.

Table 2.1 Site selection Guidelines

LEED site selection and Planning(14)	GRIHA site Planning (08)and Construction Management(09)
Local Building regulations(mandatory)	Site Selection(01)
Soil Erosion control(mandatory)	Low Impact design(04)
Basic amenities(01)	Design to mitigate Urban heat island effect(02)
Proximity to public transport(01)	Site imperviousness factor(01)
Low emitting vehicles(01)	Preserve and protect landscape during construction(04)
Natural topography and vegetation(02)	Construction management practices(04)
Preservation or transplantation trees(01)	Air and water pollution control(01)
Heat island Reduction Roof, Non-roof (02 each)	
Outdoor light pollution reduction(01)	
Universal design(01)	
Basic facilities for construction workforce(01)	
Green building guidelines(01)	

Comparative analysis of both systems shows LEED system is with lesser credit points still covers additional domains like local building regulations and basic facilities for construction workforce. It shows site selection is a critical criteria and need to verify through maximum aspects as prescribed in LEED rating system.

3.0 Water and Energy use Guidelines

Energy efficiency and water efficiency in buildings have given highest credits in both rating program. These two criteria are governed by planning and construction aspect of buildings and need attention at design and construction phases of project .This needs further evaluation of their individual sub criteria as shown in following table 3.1

Table 3.1 Energy efficiency criteria comparison

LEED energy efficiency criteria(28)	GRIHA energy efficiency criteria(20)
Ozone depleting substances	Energy Efficiency(13)
Minimum Energy efficiency	Renewable energy utilization(07)
Commissioning plan for building equipment and systems	Zero ODP material(00)
Ecofriendly refrigerant(01)	
Enhance energy efficiency(15)	
Onsite renewable energy (06)	
Off site renewable energy(02)	
Commissioning and post installation of equipment and systems(02)	
Energy metering and management(02)	

This comparison demonstrates a clear distinction regarding consideration of role of ozone depleting material in deciding energy use in built environment. LEED considers ozone depletion substances as a mandatory requirement while GRIHA denies its contribution in system. LEED also signify importance of commissioning plan for building equipment and systems which will further assist in improving energy monitoring.

Table 3.2 Water use criteria comparison

LEED water efficiency criteria(18)	GRIHA water use criteria(17)
Rain water harvesting for roof and non roof(04)	Use of lowflow fixtures and systems(04)
Water efficient plumbing fixtures(05)	Reducing landscape water demand(04)
Landscape design(02)	Water quality(02)
Management of Irrigation systems(01)	On site water reuse(05)
Wastewater treatment and reuse(05)	Rainwater recharge(02)
Water metering(01)	

This criterion of both rating system is equally weighed at every sub criteria level.

4.0 Building material and resource guideline

Building material and resources used in buildings consumes 60 % of total project cost also it depletes the natural material availability thus this criteria is directly influencing the rating in green building assessment system.

Table 4.1 Comparison under building material and resources

LEED building material criteria(16)	GRIHA building material and solid waste management criteria(20)
Segregation of Waste Post Occupancy	Utilization of BIS recommended waste materials in building structure (6)
Sustainable building Material(08)	Reduction in Embodied energy of building structures(04)
Organic Waste Management, Post Occupancy(02)	Use of Low environmental impact material in Interior(4)
Handling of waste during construction(1)	Avoided post construction Landfills(4)
Use of certified building materials, products and equipment(5)	Treat organic waste on site(2)

Above comparison GRIHA and LEED covers common aspects with both systems taking post occupancy responsibility of rating program in sustaining its rating like Post occupancy waste management.

5.0 Occupant comfort with indoor environmental quality

Table 5.1 IAQ comparison

LEED Indoor Environment quality criteria(12)	Occupant comfort and well being(12)
Minimum fresh air ventilation	Achieving indoor comfort requirement(06)
Tobacco smoke control	Maintaining good IAQ(04)
CO2 monitoring(1)	Use of low VOC paints and other compounds in building interiors(02)
Day lighting(2)	
Outdoor Views(1)	
Minimise Indoor outdoor pollutants(1)	
Low emitting material(3)	
Occupant Well-being Facilities(1)	
Indoor Air Quality Testing, After Construction and Before Occupancy(2)	
Indoor air Quality management during construction(1)	

LEED criteria is distributed in specific requirements as shown in table 5.1 while GRIHA considers general requirements , this major head of rating system is to be evaluated under post occupancy stage.

6.0 Statistical analysis

LEED and GRIHA provide rating to buildings under new construction with distribution of points earned as detailed in Table 6.1

Table 6.1 Rating distribution for LEED and GRIHA

LEED	Points	GRIHA	Points
Certified	40-49	One Star	25-40
Silver	50-59	Two Star	41-55
Gold	60-74	Three Star	56-70
Platinum	75-89	Four Star	71-85

Super Platinum	90-100	Five Star	86 or more
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So to achieve certified level in LEED rating system for new construction minimum 40 marks are required and this may be strategically planned by claiming first 5 highest criteria, which include energy efficiency (15), Sustainable building material(8), Onsite renewable energy(6), water efficient plumbing fixtures(5), waste water treatment and reuse(5), Use of certified building material(5). While in case of GRIHA system, Energy Efficiency (13), Renewable energy Utilization (07), utilization of BIS waste (06) will satisfy requirement to achieve single star GRIHA rating.

LEED rating system has made few criteria as mandatory requirement to appear for rating which includes Local building regulations, soil erosion Control, Ozone depletion substance, Minimum energy efficiency, commissioning plan for building equipments and systems, segregation of waste-post occupancy, minimum fresh air ventilation, and Tobacco smoke control.

7.0 Comparative analysis

Comparative analysis of criteria used by both LEED and GRIHA systems indicate that LEED rating system have made mandatory requirements along with option criteria. GRIHA system is flexible in its approach where all criteria are available. This may sometime make LEED as more integrative system as compared to GRIHA as it fails to ingrate maximum number of criteria to achieve basic certification.

In both systems Energy efficiency is observed to have highest significance this is also in relation to national priority. Building material and its impact on environment is given second priority in LEED rating system while water use is second in GRIHA systems. Post occupancy energy analysis is given significance in LEED system while GRIHA demands closer monitoring of occupants feedback on comfort within built environment.

8.0 Conclusion and future scope

This study of comparison of criterion used for assigning green rating system to built environment will assist in formulating strategies and objectives to avail green rating under LEED-IGBC and GRIHA during planning phase of a new construction project.

Also careful evaluation of strategies to be adopted to achieve rating under a specific criteria need to be studied so that a particular strategy may help in availing multi criteria benefits. Also Post occupancy evaluation of each green rated project will further help in assisting impact of each strategy adopted. Future scope of the current study also expect analysis of effectiveness of rating awarded to a project on enhancement of building efficiency to handle sustainable objectives.

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