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Review of GRIHA Rating System

Mrs. P. D. Patil, Prasanna Deore, Vikrant Mate, Krushnank Jagtap, Aryan Shinde, RakshakThokal
Pimpri Chinchwad Polytechnic, Pune, Maharashtra, India

Abstract: *A green building depletes the natural resources to the minimum during its construction and operation. The 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 and construction practices; optimizes the use of on-site sources and sinks by bio-climatic architectural practices; uses minimum energy to power itself; uses 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.*

Keywords: Systems Green Buildings Assessment Tool, Relative Priority Values.

I. INTRODUCTION

a. green building rating systems are utilized by both developed and developing countries based on their local context. This paper aims to develop an assessment tool that considers the triple bottom line sustainability of buildings.

b. In Ethiopia, buildings of various types and purposes are constructed at an alarming rate with inadequate resources and wasteful uses, so this tool is in urgent need. Developing such a tool is highly appreciated due to the diversified and complicated ecological and socio-economic issues in the building construction sector.

c. This research has developed new green building assessment categories and criteria depending upon consensus reached with 93 experienced experts working on the construction sectors. This research reviewed a total of 10 widely and repeatedly used tools that were critically studied, for instance, Leadership in Energy and Environmental Design, Building Research Establishment Environmental Assessment Method, Comprehensive Assessment System for Building Environmental Efficiency, Deutsche Gesellschaft für NachhaltigesBauen, Sustainable Building Tool, and so on.

d. The Analytic Hierarchy Process technique was applied for weighting and prioritizing after selecting these assessment categories and criteria. The outcomes of the research with the relative priority values were materials and resources (18.66%), sustainable sites and ecology (16.92%), energy efficiency (16.78%), indoor environmental quality (12.60%), economic aspects (10.41%), management (10.30%), water efficiency (8.06%) and location and transportation (6.27%). Thus, the proposed sustainable building assessment tool that best suits Ethiopian settings was developed.

1) Green Building:

a. Internationally, voluntary building rating systems have been instrumental in raising awareness and popularizing green design. However, most of the internationally devised rating systems have been tailored to suit the building industry of the country where they were developed.

b. In India a US based LE-ED rating system is under promotion by CII Green Business Centre, Hyderabad which is more on energy efficiency measures in AC buildings. Keeping in view of the Indian agro-climatic conditions and in particular the preponderance of non-AC buildings, a National Rating System - GRIHA has been developed which is suitable for all kinds of 3 building in different climatic zones of the country.

c. The system was initially conceived and developed by TERI (The Energy & Resource Institute) as TERI-GRIHA which has been modified to GRIHA as National Rating System after incorporating various modifications suggested by a group of architects and experts.

d. It takes into account the provisions of the National Building Code 2005, the Energy Conservation Building Code 2007 announced by BEE and other IS codes, local bye-laws, other local standards and laws.

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e. The system, by its qualitative and quantitative assessment criteria, would be able to 'rate' a building on the degree of its 'greenness'. The rating would be applied to new and existing building stock of varied functions – commercial, institutional, and residential.

f. GRIHA- the National Rating System will evaluate the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'. 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.

g. The guidelines/criteria appraisal may be revised every three years to take into account the latest scientific developments during this period. On a broader scale, this system, along with the activities and processes that lead up to it, will benefit the community at large with the improvement in the environment by reducing GHG (greenhouse gas) emissions, improving energy security, and reducing the stress on natural resources.

h. Some of the benefits of a green design to a building owner, user, and the society as a whole are as follows:

I. Reduced energy consumption without sacrificing the comfort levels.
II. Reduced destruction of natural areas, habitats, and biodiversity, and reduced soil loss from erosion, etc.
III. Reduced air and water pollution (with direct health benefits).
IV. Reduced water consumption Limited waste generation due to recycling and reuse.
V. Reduced pollution loads

2) Evaluation Procedure of Criterion of GRIHA

List of criteria and points for GRIHA		
Criteria		**Points**
Criteria 1	Site Selection	1 partly mandatory
Criteria 2	Preserve and protect landscape during construction /compensatory depository forestation.	5 partly mandatory
Criteria 3	Soil conservation (post construction)	4
Criteria 4	Design to include existing site features	2 mandatories
Criteria 5	Reduce hard paving on site	2 partly mandatory
Criteria 6	Enhance outdoor lighting system efficiency and use RE system for meeting outdoor lighting requirement	3
Criteria 7	Provide,at least, minimum level of sanitation/safety facilities for construction workers	3
Criteria 8	Plan utilities efficiently and optimise on site circulation efficiency	2 mandatories
Criteria 9	Reduce air pollution during construction	2 mandatories
Criteria 10	Reduce landscape water requirement	3
Criteria 11	Reduce building water use	2 mandatories
Criteria 12	Efficient water use during construction	1
Criteria 13	Optimise building design to reduce conventional energy demand	6 mandatories
Criteria 14	Optimise energy performance of building within specified comfort	12
Criteria 15	Utilisation of fly ash in building structure	6
Criteria 16	Reduce volume, weight and time of construction by adopting efficient	4

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	technology (e.g., pre-cast systems, ready-mix concrete, etc.)	
Criteria 17	Use low-energy material in interiors	4
Criteria 18	Renewable energy utilization	5 partly mandatory
Criteria 19	Renewable energy based hot water system	3
Criteria 20	Waste water treatment	2
Criteria 21	Water re-cycle and re-use (including rainwater)	5
Criteria 22	Reduction in waste during construction	2
Criteria 23	Efficient waste segregation	2
Criteria 24	Storage and disposal of waste	2
Criteria 25	Resource recovery from waste	2
Criteria 26	Use of low VOC paints/ adhesives/ sealants.	4
Criteria 27	Minimize Ozone depleting substances	3 mandatories
Criteria 28	Ensure water quality	2 mandatories
Criteria 29	Acceptable outdoor and indoor noise levels	2
Criteria 30	Tobacco and smoke control	1
Criteria 31	Universal Accessibility	1
Criteria 32	Energy audit and validation	Mandatory
Criteria 33	Energy audit and validation	2 mandatories
	Total Score	100
Criteria 34	Innovation site to design, construction, operation, maintenance, renewal and deconstruction.	4
		104

3) Reducing Environmental Impact

a. Buildings represent a large part of energy, electricity, water and materials consumption. As of 2020, they account for 37% of global energy use and energy-related CO2 emissions, which the United Nations estimate contributed to 33% of overall worldwide emissions. Including the manufacturing of building materials, the global CO2 emissions were 39%. If new technologies in construction are not adopted during this time of rapid growth, emissions could double by 2050, according to the United Nations Environment Program.

b. Green building practices aim to reduce the environmental impact of building as the building sector has the greatest potential to deliver significant cuts in emissions at little or no cost. .

c. General guidelines can be summarized as follows: Every building should be as small as possible. Avoid contributing to sprawl, even if the most energy-efficient, environmentally sound methods are used in design and construction. Bioclimatic design principles are able to reduce energy expenditure and by extension, carbon emissions.

d. Bioclimatic design is a method of designing infrastructure within the context of their respective environment while using the surroundings to advantage whenever possible. This could be as simple as constructing a different shape for the building envelope or facing the building towards the south to maximize solar exposure for energy or lighting purposes.

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e. Given the limitations of city planned construction, bioclimatic principles may be employed on a lesser scale, however it is still an effective passive method to reduce environmental impact.

II. OBJECTIVE OF GRIHA

1. To maximize the conservation and utilization of resources (land, water, natural habitat, avid fauna, and energy) and enhance efficiency of the systems and operations.
2. Keep the demand for electricity, water, and other natural resources as minimal as possible in all phases of construction, operation, and demolition.
3. Use renewable energy to generate on-site electricity.
4. Meet all of its water requirements using environmentally friendly ways such as rainwater harvesting.
5. Recycle and reuse all of its waste on-site, resulting in a minimal environmental effect.
6. Minimize a building's resource consumption, waste generation, and overall ecological impact.
7. Evaluates the environmental performance of a building holistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'.
8. Based on accepted energy and environmental principles, seeks to strike a balance between the established practices and emerging concepts.
9. Reduced energy consumption without sacrificing the comfort level.
10. Reduced destruction of natural areas, habitats, and biodiversity, and reduced soil loss from erosion etc.

1) Importance of Green Building

1. Nowadays, we should make a way to maximize our natural resources to get some relief since pollution is everywhere plus the Global warming that we are all experiencing. The lot of service being taken around the world, which says the temperature is been increasing from point .89 degree Celsius or 1 degree Celsius throughout some for the pass for two, three decades.
2. Which is all due to what we are impacting from the building sector as well. So, we have to start reacting to it from now. So we have to depend more and renewable energy resources available abundant in nature and Non-renewable energy is expensive and unsafe but did you know that through 4 green building we can save a lot of energy actually. We have to make our buildings more dependent on renewable energy sources.
3. The importance of this is to lessen the consumption of energy and pollution as well because the more we use non-renewable energy the higher the risk of pollution. For school buildings daylighting is very essential and we have to make it so that the desk level is being lit at least to minimum of 300 lux level to reduce the usage of conventional electric sources.

III. METHODOLOGY

1. Study the report on green building & various rating system which evaluate performance of green building over a conventional building through various components.
2. Study of different rating system.
3. Finding the various Categories of criteria & rating points to those criteria.
4. Collection of data through questionaries' survey.
5. Analyze the collected data through Greenship Rating Tool.
6. Evaluate Greenship rating of building.
7. Finding the suitable measures in context of implementation of Greenship rating tool.

IV. CASE STUDY

I. SUZLON ONE EARTH, Hadapsar, Pune - 5 stars
II. KIRLOSKAR BROTHERS LTD. Baner, Pune - 3 stars
III. IRICEN, Koregaon Park, Pune-4 stars

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1) Project Description Location:

Hadapsar, Pune

a)Site Area: 45392 m²

b)Built-Up Area: 70865 m² Air-Conditioned Area: 40418 m²

c)Non-Air-Conditioned Area: 24582 m

d)Energy Consumption Reduction: 47%Reduction from GRIHA Benchmark

e)Water Consumption Reduction: 65% Reduction from GRIHA Benchmark EPI: 55.86 KWh m/Year.

f)Occupancy Hours: 2640 Hrs: Year Renewable Energy Installed on Site: 154.83 KW

V. GRIHA RATING

Five stars Suzlon One Earth is corporate headquarters located in Pune, India. The campus stands as a testimony to the organizational philosophy of pursuing sustainable development. Built in-line with its vision of powering a greener tomorrow, the expansive, environment-friendly campus is spread over 10 acres. Divided into inter-connected, individual buildings named after the elements of nature, the campus houses employees, members of senior management and the Board of Directors in its Sun, Aqua, Sky. Tree and SEA (Suzlon Excellence Academy) lounges. One Farth is self-sufficient, employing effective controls and building management systems for minimum disturbance to the natural ecology of the site." A LEED Platinum and GRIHA 5 star certified building, One Earth is one of greenest corporate campuses in the world and the place where the team of Suzlon comes together from across the globe to work in harmony with nature and build a greener tomorrow, today.A million S.F. of ground plus two levels in a 10.4 acre urban setting achieved a I FED Platinum and TERI GRIHA 5 Star certification with 8 percent of its annual energy generated on-site through photovoltaic panels and windmills with a total incremental cost of about 11%. There are no other LEED certified buildings with this level of certification and on-site renewable energy that have achieved this kind of cost efficiency. 154 KW of electricity is produced on site (80% wind and 20% photovoltaic). All other energy (4MW) is produced in the client's wind mill farms. With 92% (4 MW) being consumed by the project is 'sustainable energy' making this a Zero Energy Project. [To reduce the impact of proposed buildings on nature they have adopted some implementations in their buildings which,

are as follows

1. **Sustainable Site Planning,** Dust screens provided around construction area to prevent air pollution. Soil erosion control measures adopted on site.Utility corridors designed along roads and pathways on site.
2. **Reduction in Water Consumption (Compared to GRIHA Benchmark),** 65% reduction in building water consumption by use of low-flow fixtures. 55% water recycled and reused within the complex. 50% reduction in landscape water consumption by planting native species of trees and shrubs and by using efficient imagation systems.

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3. **Passive Architectural Design Strategies Adopted in the Building,** Orientation: Facades of the building face north, south, north-west and south-east 100% shading by external louvers on first and second floor. Partly self-shading blocks. Small terraces created in all blocks to promote interaction with external environment.
4. Reduction in Energy Consumption (Compared to GRIHA Benchmark) while Maintaining Occupant For achieving visual comfort Adequate day lighting and glare control measures adopted. 100% desks equipped with LED lights governed by motion sensors.
5. For Achieving Thermal Comfort Pre-cooling of fresh air Heat recovery/exchanger mechanisms to minimize energy consumption High efficiency mechanical systems to reduce energy consumption.
6. Renewable Energy Technologies Installed on Site Installed capacity of solar energy: 13.44 KW. Installed capacity of wind energy: 18 windmills of 4.75 kW cach. 250000 units of electricity generated annually.
7. Use of Low-Energy/Green Materials 37% reduction in quantity of structural concrete by using Post Tension slab.50% reduction in quantity of structural steel by using Post Tension slabs. Use of siporex fly-ash blocks for better insulation

VI. CONCLUSION

- The finding of this study provides valuable insight for perceptions of contractors toward Greenship rating tools on apartment building in Chikhali, Ravet. Punawale, Pimpri-Chinchwad. Since contractors such as primary project stakeholders play an important role in the Greenship building.
- It is therefore essential to know their perceptions toward eight aspects of Greenship rating tools. As a results, the aim of this study can be identified by obtaining the factors that would easily.
- According to the contractor's perceptions; some factors that would easily to be applied are accessibility to public area, daylight, rain water usage, local material. visual comfort, operating and maintenance cost, soil conservation. Then, based on the perceptions consultants, these factors are sate landscaping, daylight, reduce water usage, local material, smoke monitoring system, CO, pollution, protect health occupant Starting with the project first step that we took was we prepared one questionary survey form.
- For the purpose of project related survey, we had visited about 30 buildings, from which 20 of them supported the concept and also help us by giving us the information in short and also filled the form that we had prepared from this survey we also got to know that how many buildings are implementing for GRIHA certification, and also about how much energy is consumed.
- A green building depletes very little of the natural resources during to its construction and operation. The aim of a green building design is to minimize the demand on non-renewable resources and maximize the utilization efficiency of these resources when in use and maximize utilization of renewable resources.

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