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COMPARATIVE ANALYSIS FOR VARIOUS GREEN BUILDING RATING SYSTEMS FOR SUSTAINABLE AND HOLISTIC DEVELOPMENT

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ABSTRACT

The Gradual Evolution and development of the country have resulted out affect our natural resources and environment. There's various rating system broadly to examine the sustainability of construction projects [1]. The purpose of this paper is to produce a methodical & elaborate review for the development of various rating systems with their silent features Specifically, LEED (Leadership in Energy and Environmental Design), IGBC (Indian Green Building Council), GEM (Green and eco-friendly movement) Sustainability (GREEN) Certification Program and Green Rating for Integrated Habitat Assessment (GRIHA). Through This paper, a thorough study is made to understand LEED, IGBC, GRIHA, GEM rating systems to evaluate criteria that need to be considered and changes to update the existing rating systems guidelines.

Keywords: LEED, GRIHA, IGBC, GEM, Green Building Rating System, Sustainable Development.

I. INTRODUCTION

After 1960, since the energy extremity, important exploration and findings were prodded to develop energy effectiveness and dwindle environmental pollution. To explore colorful issues in the construction field facing, the picture of green structures has been periodically changed and the green structure standing system has been developed. The construction assiduity plays a pivotal part to fulfil the need of a society, contributing to the growth of the country and enhancing the class of life [1] hence green structure or construction comes into mind from planning to design and prosecution similar to construction, operation, and conservation, addition, and obliteration. The main donation of green structure practice is to deal with frugality, continuity, usefulness, and comfort. Reduction of water and energy consumption, reduction of carbon footmark and the enhancement of the quality of workspace are the benefits of green structure. Around 40 of the world's total primary energy consumption comes from constructing sectors. The current electricity consumption in the suburban sectors in India is 4-5 of the whole electricity and the demand for electricity is aggrandizing by 10-14 due to the comforts and amenities. Sustainable and holistic development is maintaining a balance between humankind and nature as well as ameliorating our life. The natural fund and ecosystem are needs important for unborn generations All these factors and reasons to maintain the ecosystem more leads to the conception of GREEN BUILDING. Reduction of water and energy consumption, reduction of carbon footmark and the enhancement of quality of workspace are the benefits of green structure A Green building, similarly, comprehended as a sustainable building, is a structure that is aimed, constructed, repaired, handled, or reused in an eco-logical and resource - effective form [3]. A structure has been made but how to decide whether a structure is green or not? For this result comes some standing systems similar as LEED, IGBC, GRIHA and GEM have been critically assayed and comparatively talked over in this paper.

GREEN BUILDING RATING SYSTEM

During this study, LEED, IGBC, GRIHA, GEM were analyzed in detail. The sense to elect these rating systems is built in the view of LEED (Leadership in Energy and Environmental Design) [1] as comprehensively well-understood leading ones together with IGBC and GRIHA Indian standing systems.

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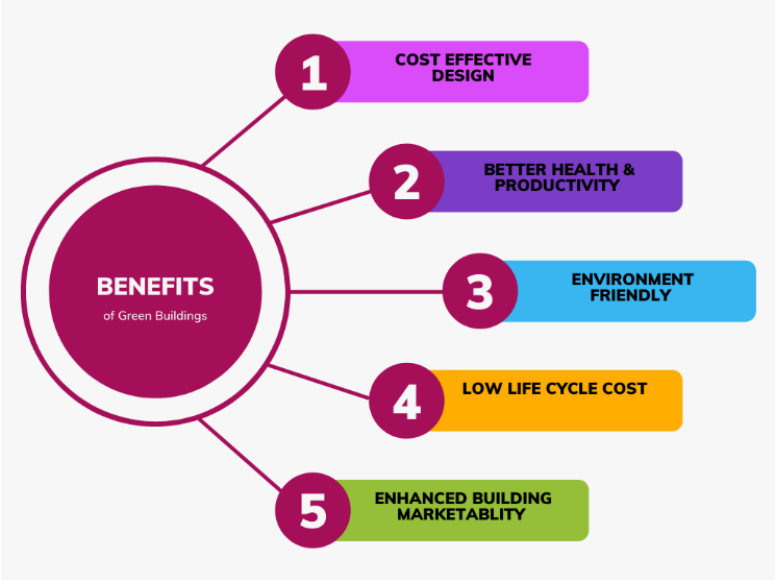

1.1 LEED

LEED is developed by USGBS (US Green Building Council). It was first introduced in 1998. It's honored as the most extensively used rating system based on the number of nations with over seventy-nine thousand projects [1]. The system is credit-established, permitting comes to earn points for environ friendly behavior taken throughout construction and purpose of a building. LEED was launched in an endeavor to develop a "consensus-established, market-driven scoring system to accelerate the event and implementation of inexperienced building practices." The program isn't bolt structured; not each project should meet identical necessities to qualify. The performance and effectiveness of LEED in two credit classification areas – energy and inner terrain quality. In one study of 953 NYC office structures, 21 LEED certified structures collectedly showed no energy savings compared with non-LEED structures, although LEED Gold structures "outperformed other NYC office structures by 20". IEQ- related studies supply two differing results-the first used habitant check results in 65 LEED structures and 79 non-LEED structures and it concluded that Occupants of LEED authenticated structures possess equal satisfaction with the structure overall and with the workspace than residents of non-LEED rated structures [5].

Table 1: LEED CERTIFICATION LEVELS

Certified Level	Earned point
Certified	40-49
Silver	50-59
Gold	60-79
Platinum	80+

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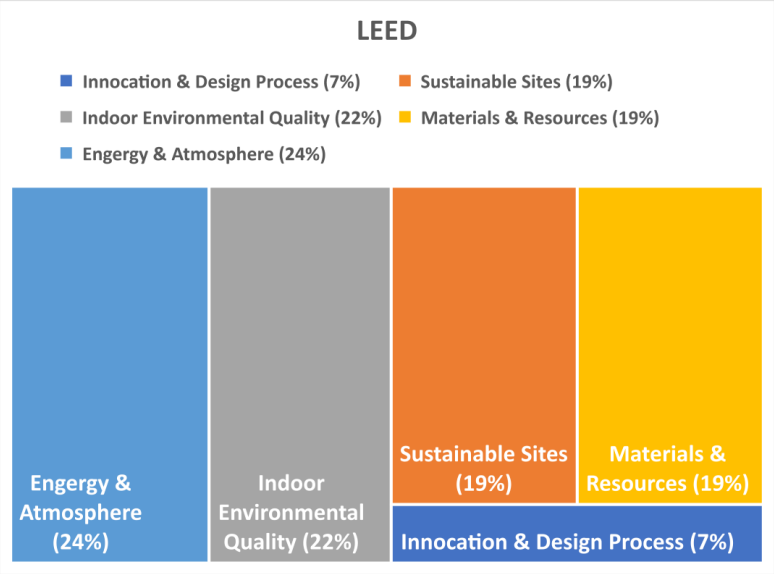

Figure 1: LEED Evaluation Criteria

1.2 GRIHA

GRIHA – Green Rating for Integrated Habitat Assessment, is India's National Rating System. It's one of the rating systems that aid people to gauge the capability of the structure as per specifications that are sustaining nationally.

The introductory of GRIHA

The system was come out to 'design and estimate' new structures & system will profit society by abating inimical effect on the atmosphere by declining greenhouse gas emissions, power consumption and inclination toward natural resources.

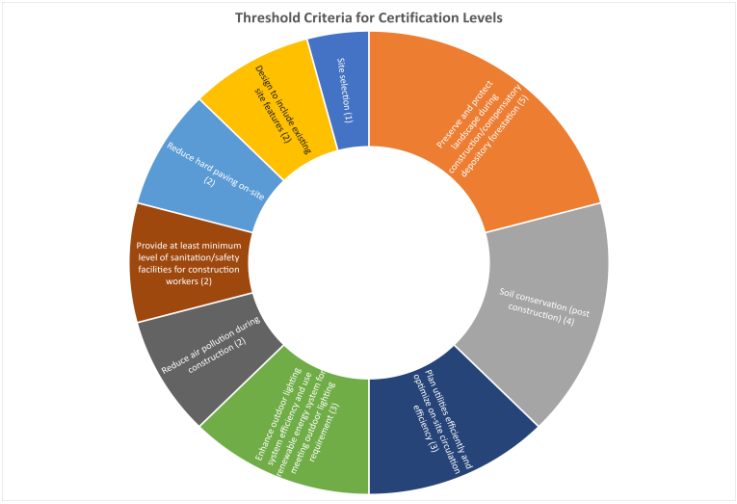

Figure 2: GRIHA Evaluation Criteria

Table 2: Point achieved for GRIHA Rating

Certification Levels	Earned point
1 STAR	25-30
2 STARS	31-35
3 STARS	36-40
4 STARS	41-45
5 STARS	46-50

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1.3 IGBC

IGBC-Indian Green Building Council is the standing system that has been constructed grounded on accoutrements and technologies that are presently accessible. The end of IGBC is to give a holistic approach to erecting environmentally friendly structures, through water effectiveness, architectural design, effective running of waste, energy effectiveness, sustainable structures, comfort, and well- being of life.

Table 3: Point achieved for IGBC Rating

Certification Levels	Point	Recognition
Certified	50-59	Good Practices
Silver	60-69	Best Practices
Gold	70-79	Outstanding Practices
Platinum	80-89	National Practices
Super Platinum	90-100	Global Practices

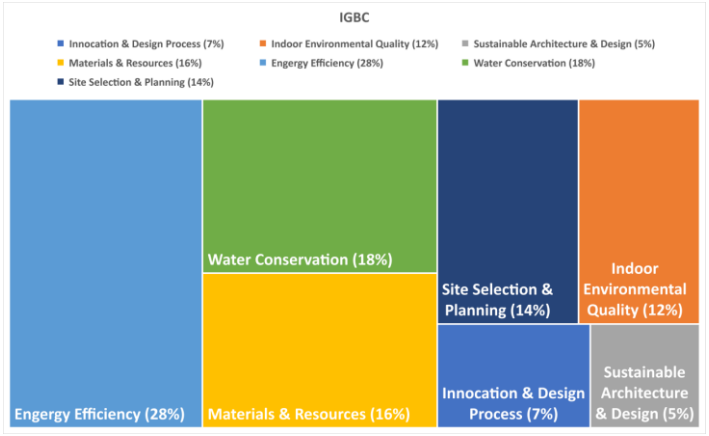

Figure 3: IGBC Evaluation Criteria

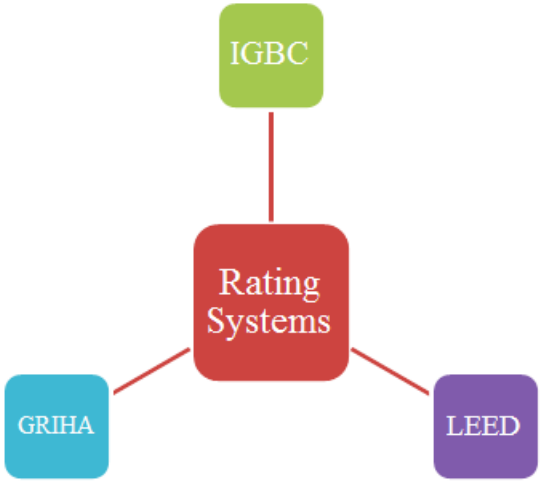

Figure 4: GRIHA Evaluation Criteria

1.4 GEM

Gem-green and eco-friendly movement, gem sustainability instrument standing program (for new structures, homes, and plant structures) gem sustainability instrument standing program aims to address the sustainability of a given development throughout its lifecycle from design through construction to operation. Gem sustainability instrument reference companion provides design guidance and detailed conditions for rating a design's implicit performance. Gem sustainability instrument standing has been organized into thirty principles that are fundamental to further sustainable development.

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Table 4: Point achieved for GEM Rating

Points Scored	GEM Levels	GEM
All essential requirements and **40 - 49 points**	GEM 1	💎
All essential requirements and **50 - 64 points**	GEM 2	💎 💎
All essential requirements and **65 - 84 points**	GEM 3	💎 💎 💎
All essential requirements and **85 - 104 points**	GEM 4	💎 💎 💎 💎
All essential requirements and **105 points or above**	GEM 5	💎 💎 💎 💎 💎

II. BACKGROUND

A Green Building Standing system is a tool that evaluates the performance of a structure and its impact on the terrain. It comprises a predefined set of criteria relating to the design, construction and operation of the green structure standing system and its comparison. This exploration attempts to formulate a perpetration strategy for developing and enhancing the Energy Category of a Green Building Rating System This perpetration strategy is grounded on a detailed review on the comparison of the major green structure guidelines encyclopedically and contextual information of specific societies collected through a check questionnaire. The results show the energy credits that should be considered obligatory within any of the Green Building Rating System and indicate the other credits that should be considered and propose weights of similar energy credits.

III. METHODOLOGY

This study first reviewed the being green structure systems used worldwide and critically anatomized them to identify the characteristics of green structure guidelines that can support their relinquishment in a country. Secondly, the focus of the exploration was to explore the sustainability criteria in the construction exertion to achieve a sustainable future. This study can be helpful for the construction sector to alleviate the features that pose walls to achieving a good sustainability standing assessment. These standing systems set the norms with the minimal conditions to achieve sustainability along with the instrument that assures this position of the greenness of assessed structures. The need of the present hour is that these developments should do in a sustainable manner causing minimum or no detriment to the terrain. This field study was accepted in order to gain a comprehensive understanding of the developing construction sector. The end was to assess the significance of educational institutions in the creation of green structures. This paper gives a exercise of colorful green structure standing systems available in India and some other countries along with their salient features.

IV. OVERVIEW OF LEED, GRIHA and IGBC

Table 5: Main features of LEED, GRIHA and IGBC

	LEED	GRIHA	IGBC
Country	US	India	India
Organization	USGBC	TERI	CII
Flexibility	160 countries	1 country	1 country
First version	1998	2000	2001
Rating Approach	Additive	Credits Point-Stars	Credit

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	credits		Points
Rating Level	Certified ≥ 40 Silver ≥ 50 Gold ≥ 60 Platinum ≥ 80	50-60 - ★ 61-70 - ★★ 71-80 - ★★★ 81-90 - ★★★★ 91-100 - ★★★★★	51-60 Certified 61-70 Silver 71-80 Gold 81-100 Platinum

V. CONCLUSION

Over the times all these standing systems have been streamlined and evolved to be more onerous with robotization. The result indicated that green standing systems have come the focal point of colorful experimenters lately. During the exploration period 1998-2016, the number of green standing papers rises sprucely from 2 to 36 on a periodic base. In addition, there are a significantly advanced number of papers agitating LEED compared to GRIHA, IGBC. Green or Sustainable assessments is a universal issue in both developed and developing countries. This paper could be precious for both green interpreters and experimenters to have an overall understanding of LEED, IGBC, GRIHA. It has been concluded from this exploration that the IGBC demonstrated and proven savings of 30 to 40 on energy cost and 20 to 30 on water Each standing systems measure is acceptable to be employed in sure a part of the country still they are not distinctive in nature.

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