Green Rating for Integrated Habitat Assessment (GRIHA)

National Rating System for Green Buildings

Ministry of New & Renewable Energy
Government of India

GRIHA – green building 'design evaluation system'– A tool to design, operate, evaluate and maintain resource efficient 'healthy' and 'intelligent' building

What is a green building?

Buildings have major environmental impacts over their entire life cycle. Resources such as ground cover, forests, water, and energy are depleted to give way to buildings.

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. In sum, the following aspects of the building design are looked into in an integrated way in a green building.

- Site planning
- Building envelope design
- Building system design ((HVAC) heating ventilation and air conditioning, lighting, electrical, and water heating)
- Integration of renewable energy sources to generate energy onsite.
- Water and waste management
- Selection of ecologically sustainable materials (with high recycled content, rapidly renewable resources with low emission potential, etc.).
- Indoor environmental quality (maintain indoor thermal and visual comfort, and air quality)

1.0 GRIHA- the green building rating system

1.0.1 The context

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. In India a US based LEED 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

building in different climatic zones of the country. 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. 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. 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.

1.0.2 The benefits

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. 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.

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

- Reduced energy consumption without sacrificing the comfort levels
- Reduced destruction of natural areas, habitats, and biodiversity, and reduced soil loss from erosion, etc.
- Reduced air and water pollution (with direct health benefits)
- Reduced water consumption
- Limited waste generation due to recycling and reuse
- Reduced pollution loads
- Increased user productivity
- Enhanced image and marketability

1.0.3 The basic features

Currently the system has been developed to help 'design and evaluate' new buildings (buildings that are still at the inception stages). A building is assessed based on its predicted performance over its entire life cycle – inception through operation. The stages of the life cycle that have been identified for evaluation are the pre-construction, building design and construction, and building operation and maintenance stages. The issues that get addressed in these stages are as follows:

- Pre-construction stage (intra- and inter-site issues)
- Building planning and construction stages (issues of resource conservation and reduction in resource demand, resource utilization efficiency, resource recovery and reuse, and provisions for occupant health and well being). The prime

resources that are considered in this section are land, water, energy, air, and green cover.

- Building operation and maintenance stage (issues of operation and maintenance of building systems and processes, monitoring and recording of consumption, and occupant health and well being, and also issues that affect the global and local environment).

1.1 Synopsis of the criteria for rating

The criteria have been categorised as follows:

1.1.1 Site planning

Conservation and efficient utilization of resources

Objective: To maximize the conservation and utilisation of resources (land, water, natural habitat, avi fauna, and energy) conservation and enhance efficiency of the systems and operations.

Criteria 1 Site Selection:
Commitment: Site plan should be in conformity to the Development Plan/Master Plan/UDPFI guidelines (mandatory). Site should be located within ½ km radius of an existing or planned and funded bus stops, commuter rail, light rail or metro station or the proposed site is a brownfield site (to rehabilitate damaged sites where development is complicated by environmental contamination, reducing pressure on undeveloped land).

Criteria 2 Preserve and protect the landscape during construction/compensatory depository forestation.
*Commitment P*roper timing of construction, preserve top soil and existing vegetation, staging and spill prevention, and erosion and sedimentation control. Replant, on-site, trees in the ratio 1:3 to those removed during construction.

Criteria 3 Soil conservation (till post-construction).
Commitment Proper top soil laying and stabilization of the soil and maintenance of adequate fertility of the soil to support vegetative growth.

Criteria 4 Design to include existing site features.
Commitment Minimize the disruption of natural ecosystem and design to harness maximum benefits of the prevailing micro-climate.

Criteria 5 Reduce hard paving on-site and /or provide shaded hard- paved surfaces.
Commitment Minimize storm water run-off from site by reducing hard paving on site.

Criteria 6 Enhance outdoor lighting system efficiency.
Commitment Meet minimum allowable luminous efficacy (as per lamp type) and make progressive use of a renewable energy -based lighting system.

Criteria 7 Plan utilities efficiently and optimize on-site circulation efficiency.
Commitment Minimize road and pedestrian walkway length by appropriate planning and provide aggregate corridors for utility lines.

Health and well being

Objectives To protect the health of construction workers and prevent pollution.

Criterion 8 Provide at least, the minimum level of sanitation/safety facilities for construction workers.
Commitment Ensure cleanliness of workplace with regard to the disposal of waste and effluent, provide clean drinking water and latrines and urinals as per applicable standard.

Criterion 9 Reduce air pollution during construction.
Commitment Ensure proper screening, covering stockpiles, covering brick and loads of dusty materials, wheel-washing facility, water spraying.

1.1.2 Building planning and construction stage

Conservation and efficient utilization of resources

Objective To maximize resource (water, energy, and materials) conservation and enhance efficiency of the system and operations.

Water

Criterion 10 Reduce landscape water requirement.
Commitment Landscape using native species and reduce lawn areas while enhancing the irrigation efficiency, reduction in water requirement for landscaping purposes.

Criterion 11 Reduce building water use.
Commitment Reduce building water use by applying low-flow fixtures, etc.

Criterion 12 Efficient water use during construction.
Commitment Use materials such as pre-mixed concrete for preventing loss during mixing. Use recycled treated water and control the waste of curing water.

Energy: end use

Criterion 13 Optimise building design to reduce the conventional energy demand.
Commitment Plan appropriately to reflect climate responsiveness, adopt an adequate comfort range, less air-conditioned areas, daylighting, avoid over-design of the lighting and air-conditioning systems.

Criterion 14 Optimise the energy performance of the building within specified comfort limits.
Commitment Ensure that energy consumption in building under a specified category is 10%–40% less than that benchmarked through a simulation exercise. Ensure that thermal comfort in non air conditioned spaces are within specified limits.

Energy: embodied and construction

Criterion 15 Utilization of fly ash in the building structure.
Commitment Use of fly ash for RCC (reinforced cement concrete) structures with in-fill walls and load bearing structures, mortar, and binders.

Criterion 16 Reduce volume, weight, and time of construction by adopting an efficient technology (e.g. pre-cast systems, ready-mix concrete, etc.).
Commitment Replace a part of the energy-intensive materials with less energy-intensive materials and/or utilize regionally available materials, which use low-energy/energy-efficient technologies.

Criterion 17 Use low-energy material in the interiors.
Commitment Minimum 70% in each of the three categories of interiors (internal partitions, panelling/false ceiling/interior wood finishes/ in-built furniture door/window frames, flooring) from low-energy materials/finishes to minimize the usage of wood.

Energy: renewable

Criterion 18 Renewable energy utilization.
Commitment Mandatory provide renewable energy system with capacity equivalent to 1% of connected load for lighting and space conditioning. Meet energy requirements for a minimum of 5% of the internal lighting load (for general lighting) or its equivalent from renewable energy sources (solar, wind, biomass, fuel cells, etc). Energy requirements will be calculated based on realistic assumptions which will be subject to verification during appraisal.

Criterion 19 Renewable energy - based hot- water system.
Commitment Meet 20% or more of the annual energy required for heating water through renewable energy based water-heating systems.

Recycle, recharge, and reuse of water

Objective: To promote the recycle and reuse of water.

Criterion 20 Waste- water treatment
Commitment Provide necessary treatment of water for achieving the desired concentration of effluents.

Criterion 21 Water recycle and reuse (including rainwater).
Commitment Provide wastewater treatment on-site for achieving prescribed concentration, rainwater harvesting, reuse of treated waste water and rainwater for meeting the building's water and irrigation demand.

Waste management

Criterion 22
Commitment: To minimize waste generation, streamline waste segregation, storage, and disposal, and promote resource recovery from waste.

Criterion 23 Reduction in waste during construction.
Commitment Ensure maximum resource recovery and safe disposal of wastes generated during construction and reduce the burden on landfill.

Criterion 24 Efficient waste segregation.
*Commitmen*t Use different coloured bins for collecting different categories of waste from the building.

Criterion 25 Storage and disposal of waste.
Commitment Allocate separate space for the collected waste before transferring it to the recycling/disposal stations.

Criterion 26 Resource recovery from waste.
Commitment Employ resource recovery systems for biodegradable waste as per the *Solid Waste Management and handling Rules, 2000 of the MoEF*. Make arrangements for recycling of waste through local dealers.

Health and well-being

Objective To ensure healthy indoor air quality, water quality, and noise levels, and reduce the global warming potential.

Use of low-VOC (volatile organic compounds) paints/ adhesives / sealants.

Commitment Use only low VOC paints in the interior of the building. Use water – based rather than solvent based sealants and adhesives.

Criterion 27 Minimize ozone depleting substances.

Commitment Employ 100% zero ODP (ozone depletion potential) insulation; HCFC (hydrochlorofluorocarbon)/ and CFC (chlorofluorocarbon) free HVAC and refrigeration equipments and/halon-free fire suppression and fire extinguishing systems.

Criterion 28 Ensure water quality.
Commitment Ensure groundwater and municipal water meet the water quality norms as prescribed in the Indian Standards for various applications (*Indian Standards for drinking [IS 10500-1991], irrigation applications [IS 11624-1986]*. In case the water quality cannot be ensured, provide necessary treatment of raw water for achieving the desired concentration for various applications.

Criterion 29 Acceptable outdoor and indoor noise levels.
Commitment Ensure outdoor noise level conforms to the Central Pollution Control Board–Environmental Standards–Noise (ambient standards) and indoor noise level conforms to the *National Building Code of India, 2005, Bureau of Indian Standards, Part 8–Building Services; Section 4–Acoustics, sound insulation, and noise control.*

Criterion 30 Tobacco and smoke control.
Zero exposure to tobacco smoke for non-smokers, and exclusive ventilation for smoking rooms.

Criterion 31 Universal accessibility
Commitment: To ensure accessibility and usability of the building and its facilities by employees, visitors and clients with disabilities

1.1.3 Building operation and maintenance

Objective Validate and maintain 'green' performance levels/adopt and propagate green practices and concepts.

Criterion 32 Energy audit and validation.

Commitment Energy audit report to be prepared by approved auditors of the Bureau of Energy Efficiency, Government of India.

Criterion 33 Operation and maintenance protocol for electrical and mechanical equipment.

Commitment Ensure the inclusion of a specific clause in the contract document for the commissioning of all electrical and mechanical systems to be maintained by the owner, supplier, or operator. Provide a core facility/service management group, if applicable, which will be responsible for the operation and maintenance of the building and the electrical and mechanical systems after the commissioning. Owner/ builder/ occupants/ service or facility management group to prepare a fully documented operations and maintenance manual, CD, multimedia or an information brochure listing the best practices/do's and don'ts/maintenance requirements for the building and the electrical and mechanical systems along with the names and addresses of the manufacturers/suppliers of the respective system.

1.1.4 Innovation

Criterion 34 Innovation points.

Four innovation points are available under the rating system for adopting criteria which enhance the green intent of a project, and the applicant can apply for the bonus points Some of the probable points, not restricted to the ones enumerated below, could be

1. Alternative transportation
2. Environmental education
3. Company policy on green supply chain
4. Life cycle cost analysis
5. Any other criteria proposed by applicant

1.2 Scoring points for GRIHA

GRIHA is a guiding and performance-oriented system where points are earned for meeting the design and performance intent of the criteria. Each criterion has a number of points assigned to it. It means that a project intending to meet the criterion would qualify for the points. Compliances, as specified in the relevant criterion, have to be submitted in the prescribed format. The points related to these criteria (specified under the relevant sections) are awarded provisionally while certifying and are converted to firm points through monitoring, validation, and documents/photographs to support the award of point. GRIHA has a 100 point system consisting of some core points, which are mandatory to be met while the rest are optional points, which can be earned by complying with the commitment of the criterion for which the point is allocated. The innovation points are available over and above the 100 point system. This means that a project can hypothetically apply for a maximum of 104 points. But the final scoring shall be done out of 100 points. Different levels of certification (one star to five star) are awarded based on the number of points earned. The minimum points required for certification is 50. Buildings scoring 50 to 60 points, 61 to 70 points, 71 to 80 points, and 81 to 90 points shall get one star, 'two stars', 'three stars' and 'four stars' respectively. A building scoring 91 to 100 points will get the maximum rating viz. five stars.

Points scored	Rating
50–60	One star
61–70	Two stars
71–80	Three stars
81–90	Four stars
91–100	Five stars

The details of the points are given below:

1.3 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	Mandatory
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	Plan utilities efficiently and optimise on site circulation efficiency	3	
Criteria 8	Provide ,at least, minimum level of sanitation/safety facilities for construction workers	2	Mandatory
Criteria 9	Reduce air pollution during construction	2	Mandatory
Criteria 10	Reduce landscape water requirement	3	
Criteria 11	Reduce building water use	2	
Criteria 12	Efficient water use during construction	1	
Criteria 13	Optimise building design to reduce conventional energy demand	6	Mandatory
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 technology (e.g. pre-cast systems, ready-mix concrete, etc.)	4	
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	Mandatory
Criteria 28	Ensure water quality	2	Mandatory
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	Operations and Maintenance protocol for electrical and mechanical equipment	2	Mandatory
	Total score	100	
Criteria 34	Innovation(beyond 100)	4	
		104	

2.0 Operationalisation of GRIHA –the NRS

2.1 National Advisory Council (NAC)

A National Advisory Council (NAC) has been constituted by the MNRE and shall be convened by the Advisor, MNRE. The NAC shall comprise eminent architects, senior government officials from the Central Ministry, Bureau of Energy Efficiency, Central Public Works Department and select state nodal agencies; representatives from the IT sector, real estate sector and developers; and representatives from the GRIHA secretariat, TERI. The NAC shall be chaired by the Secretary, MNRE and co-chaired by the Director General, TERI.

The NAC shall provide advice and direction to the National Rating System and shall be the interface between MNRE and the rating secretariat, which will be located within TERI. Its broad functions will be as below:

i) Guide the administrative structure for GRIHA
ii) Decide fee structure
iii) Endorse the rating
iv) Recommend incentives, awards etc. by GOI /State Governments
v) Endorse modifications / upgrades from time to time.

2.1.1 Technical Advisory Committee (TAC)

A Technical Advisory Committee has been be constituted by the MNRE for providing technical advice to the GRIHA team on modifications and up gradation of the GRIHA framework to a National Rating System. The technical advisory team shall comprise eminent architects and experts well versed with design and construction of green buildings . Three meetings of TAC have been held .

2.1.2 The Ministry proposes to incentivise the National Rating System with a view to promote large scale design and construction of green buildings in the country.

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