Role of design consideration in GRIHA

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Abstract

High energy consumption results in the evolution of green building to maximise the use of available resources.
GRIHA is the rating system designed as per Indian scenario and its climate, consisting of sections having various criteria, including designing, and construction, energy analysis, etc.
This paper is mainly focussed on criteria of GRIHA for design considerations. This can help designers who are working in tropical - warm humid, composite, hot- dry zone to get basic guidelines to design buildings in accordance with GRIHA.

Keywords

GRIHA, Qualitative and Quantitative Assessment, Detrimental impact, Sustainable planning, Energy Efficient, Design Intrventions, COP26, Design Intervensions.

1. Introduction of GRIHA

- GRIHA is developed by TERI (The Energy and Resources Institute). it is India's National Rating System for Green buildings. It has been endorsed by the MNRE (Ministry of New and RenewableEnergy). It attempts to minimize the consumptionof building resources, waste generation, and overall ecological/ environmental impact in comparision with nationally acceptable limits / benchmarks. According to survey, construction and maintenance of buildings are responsible for 40% of energy in the world. (Source-(Chauhan, 2019)) GRIHA evaluates the performance of a buildingaccording to the environmentholistically over its entire life cycle, thereby providing a definitive standard for what constitutes a 'green building'.

- GRIHA can analyse a building's greenness using its qualitative and quantitative assessment criteria. The grading applies to both new and existing structures, and they can be of any type - residential, commercial, or institutional.

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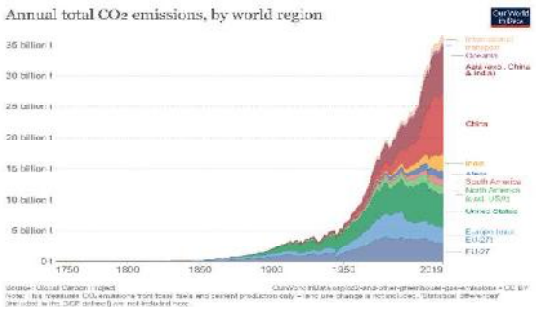
Tina Soni, student of 8th semester architecture department, NIT Raipur. She has done her 4th year B.Arch. thesis on the topic Gated Community with theme as GRIHA, which explains about the architectural design consideration led to design decision to archive GRIHA rating architecturally, and followed by some if the construction and maintenance steps on proposal level - that if followed can make it as GRIHA 4start rated community. My area of interest is in residential communities for better future.

This research examines the entire notion of green buildings in relation to the GRIHA (Indian Rating System for Green Buildings)

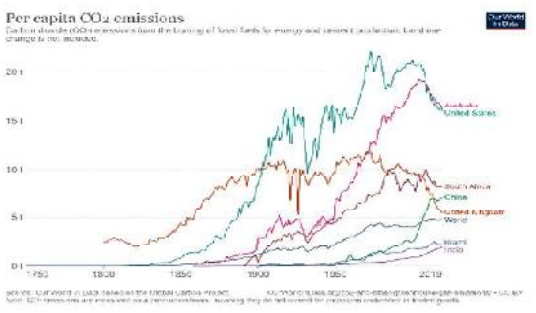
1.1.5 R rule of GRIHA-

- Refuse– foradopting international methods,materials, technologies, products, etc blindly,and use of available local substitute products.
- Reduce – the dependence on high energy merchandise, structures, tactics and so on.
- Reuse – materials, products, traditional technologies, that can help in reducing theexpenses incurred in designing and operating a building
- Recycle – of all the wastes which is generated from the building site, at some stage in creation, operation, and demolition
- Reinvent – the new, advance technology for engineering systems, designs, and practices.

2. Energy scenario in the world



Source:Global Carbon Budget - Global



Source: Global Carbon Budget – Global Carbon Project (2020)

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According to "our world in data" represented in the figure, for GHG and CO2 emission, the statistical evidence conveys that the carbonemissionis increasing day by day. For example, the CO2 emission in the year 2000 was25.13 billon ton which has increased to 35.36 billon ton in the year 2019.

3. COP26

- India has announcedrecently a new climate targets at COP26 under its 'Panchamrit strategy', has taken a bold leap towards cementing its commitment for knowing future approach towards fighting climate changetowards clean energy.

- The five-fold strategyannounced by Indian Prime Minister to fight climate change, termed as Panchamrit. COP26 meeting at Glasgow. includesthe strategy and target year for reaching Net Zero.

3.1.What are new climate targets that have been pledged by India at COP26?

India made five big-ticket announcements at the climate change meeting in Glasgow:

First– India will increase its non-fossil energy capacity to 500GW by 2030.

Second– India will meet 50% of its energy requirements from renewable energy by 2030.

Third– India will reduce the total projected carbon emissions by one billion tonnes from now onwards till 2030.

Fourth– By 2030, India will reduce the carbon intensity of its economy by 45%.

Fifth– By the year 2070, India will achieve the target of Net Zero.

Note: All new targets, except the 2070 net-zero commitment, would be put in India's updated NDC that is expected to be submitted to the UN Climate secretariat soon. Net-zero is not a part of the Paris Agreement and as such that commitment would be conveyed separately as part of India's long-term strategy.

3.2.India's New Climate Action Goals

- By 2070, India will have achieved net-zero emissions. This is significant because, until now, India has been the only major emitter that has not committed to a schedule for achieving net-zero carbon emissions and has fought against the notion of net-zero carbon objectives.

- India will make extensive use of renewable energy. By 2030, India plans to get 50 percent of its energy from renewable sources. By 2030, India wants to create 500 GW of renewable energy. This is an increase of 50 GW beyond the existing target of 450 GW..

- India also agreed to cut its carbon emissions by a billion tonnes by 2030. By 2030, India's economy will have a carbon intensity of less than 45 percent. India is on course to achieve, if not surpass, its Paris Agreement goals of reducing emissions intensity of gross domestic product (GDP) by 33 to 35 percent by 2030, compared to 2005 levels..

3.3.Way forward for India

3.3.1.Take up leadership role:

- Taking the lead in ensuring that emerging and underprivileged nations' voices are heard in climate change talks.

3.3.2.Make the set targets conditional:

- While it was becoming more impossible for India to avoid pressures to disclose a net-zero date, some analysts believe India should have

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stated that it will achieve net-zero status by 2070.

3.3.3.Adopt green growth pathways:

The green growth route might entail widespread renewable energy adoption while also avoiding the long-term lock-in impacts of fossil fuel dependency in energy generation, buildings, mobility, and other areas. India has to develop a comprehensive plan for a multi-sectoral energy transformation.

3.4.Structured approach towards net-zero:

Relies on significant reductions in emissions, broad public support for clean energy innovation, and widespread use of green technology..

Some of the major interventions that can help India move towards a net zero target include the following:

- To lessen the environmental effect of human-made activities, low-carbon and green technology must be implemented..
- Highly energy-efficient goods that last longer
- Governments must encourage and support private sector green innovation and the transition to a green economy..
- Greater use of renewable energy should be a primary goal, with equal focus on centralised and decentralised power generation..
- Green hydrogen's mainstreaming offers a great way to decarbonize the crucial power, industry, and transportation sectors.
- To reduce methane emissions from unscientific landfills, India's urban solid waste management system will need to be modernised. In addition, the adoption of electric cars and revitalised communities that promote walking and cycling will help cities reduce their GHG emissions.
- Stopping deforestation and reforestation can help avoid the release of carbon that has been stored in the environment, such as trees and soil.
- Afforestation efforts can aid in the absorption of carbon from the atmosphere.

4. Purpose of green building

Many concerns arose as a result of economic development and environmental stability, as indicated in the Brundtland report, issued by the World Commission on Environment and Development (WCED) in 1987, which included the notion of sustainable development, resulting in the idea of green building.

The goal of green construction, according to the GRIHA version 2019, is to decrease non-renewable resource consumption and promote renewable resource usage, as well as to maximise resource efficiency, reuse, and recycling. The layout of these homes focuses on the use of green building materials and construction practises by optimising the use of on-site resources with the help of bioclimatic architectural practises and specialises in the use of minimal power by making it electricity efficient to meet its lighting, air conditioning, and other requirements.

4.1.Aim of GRIHA (as stated in GRIHA 2019)

According to GRIHA, the rating system was developed with the aim of achieveing the mentioned goals:

- Minimize the harmful impact of construction and built structures on the

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environment along with providing comfort for users.

- The ecosystem need to be preserved as much as possible.
- Assess the performance of 'green' buildings.

4.2.. Objectives of GRIHA- (as stated in GRIHA (Chauhan, 2019))

- To study the impact of the life cycle of a built structure(s) on the environment
- To increase the demand for green buildings and products among the various stakeholders.
- To create recognition for buildings that considered sustainable design and construction strategies

5. Presently there are 30 criteria of GRIHA rating system under 11 sections

Table 1: 30 criteria of GRIHA rating system under 11 sections

GRIHA v.2019			
Section	Criterion No.	Criterion Name	Maximum Points
1. Sustainable Site Planning	1	Green Infrastructure	5
	2	Low Impact Design	5
	3	Design to Mitigate UHIE	2
2. Construction Management	4	Air and Soil Pollution Control	1
	5	Top Soil Preservation	1
	6	Construction Management Practices	2
3. Energy Efficiency	7	Energy Optimization	12
	8	Renewable Energy Utilization	5
	9	Low ODP and GWP Materials	1
4. Occupant Comfort	10	Visual Comfort	4
	11	Thermal and Acoustic Comfort	2
	12	Maintaining Good IAQ	6
5. Water Management	13	Water Demand Reduction	3
	14	Wastewater Treatment	3
	15	Rainwater Management	5
	16	Water Quality and Self-Sufficiency	5
6. Solid Waste Management	17	Waste Management-Post Occupancy	4
	18	Organic Waste Treatment On-Site	2
7. Sustainable Building Materials	19	Utilization of Alternative Materials in Building	5
	20	Reduction in GWP through Life Cycle Assessment	5
	21	Alternative Materials for External Site Development	2
8. Life Cycle Costing	22	Life Cycle Cost Analysis	5
9. Socio-Economic Strategies	23	Safety and Sanitation for Construction Workers	1
	24	Universal Accessibility	2
	25	Dedicated Facilities for Service Staff	2
	26	Positive Social Impact	3
10. Performance Metering and Monitoring	27	Commissioning for Final Rating	7
	28	Smart Metering and Monitoring	0
	29	Operation and Maintenance Protocol	0
Total Points			100
11. Innovation	30	Innovation	5
Grand Total Points			100 + 5

Source: (GRIHA Mannual version 2019)

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6. Role of an architect

The role of an architect is to critically evaluate the impact of every design decision and provide thefeasible design solutions to limit the negative effects and enhance the high-auality effect at the environment. In totality, the following aspects may be indicated as part of a green building design:

- Site planning.
- Building envelope design.
- Building gadget layout and control (hea ting ventilation and aircon[HVAC], lighting, electrical, and water heating).
- Integration of renewable energy sources to generate power on-web page.
- Water and waste management.
- Selection of ecologically sustainable materials (with high recycled content, rapidly renewable resources with low emission potential, and so on)
- Indoor environmental quality (maintain indoor thermal and visual comfort and air quality).

7. Design considerations for the specific criteria of the9 GRIHA.

- India has majorly three types of climates – hot dryclimate, warm humid climate and composite climate.

7.1. Hot Dry Climate-

CRITERIA 1(a)- Plan Elements Integrated - Shaded Courtyards, Fountains, water channels, wind towers/catchers, earth air tunnel, Terrace/Roof gardens, window planters.

CRITERIA 1(b)- Shaded walkways in the site (Vegetation Pattern- Usually Scanty & dry surrounding. Trees planted to cut off east west sun.)

CRITERIA 2- It is preferable to have window openings on the patios (common open area) rather than that of outer surface.

CRITERIA 3- Street Widths & Orientation should be narrow and shaded (N-S Oriented).

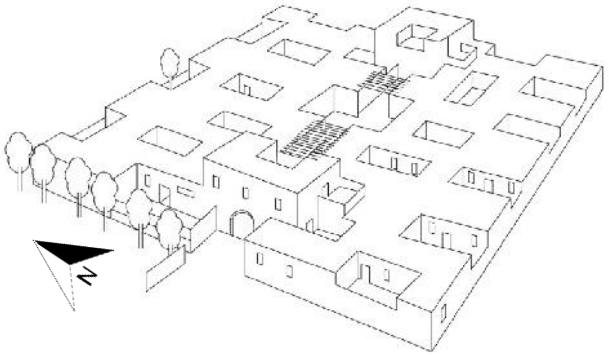
CRITERIA 8- Solar energy can be used as renewable souce of energy.

CRITERIA 11- Compact planning with minimum exposed surface area having shorter facades facing east and west.Longer facades along with windows of habitable rooms to be places on the north and

CRITERIA 13- Water Bodies Enables evaporative cooling and directs cool breeze indoors and are also used to reduce the water demand.

CRITERIA 15- Roof Form & Overhangs design can be Flat or Shaded roofs to minimize heat gain.

CRITERIA 19- Adobe construction, masonry with high thermal mass, low U, reflective insulation, green walls, AAC blocks, hollow blocks, composite masonry, stone/ tile cladding.



CRITERIA 21 – sustainable site development can be archived with the ground character- Not reflective, rough surface for diffusing radiation, more softscape, light colored paving.

7.2.Warm humid climate-

CRITERIA 1(a)- Plan Elements Integrated - Open Planning to promote air circulation.

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CRITERIA 1(b)- Vegetation Pattern- Dense vegetation,Tress placed on the east and west walls to provide shade without blocking the air movement

CRITERIA 2- Spacing between the dwelling should be as per the requirement for the proper air movement.

Narrow depth of the dwelling for better air movement inside the building.

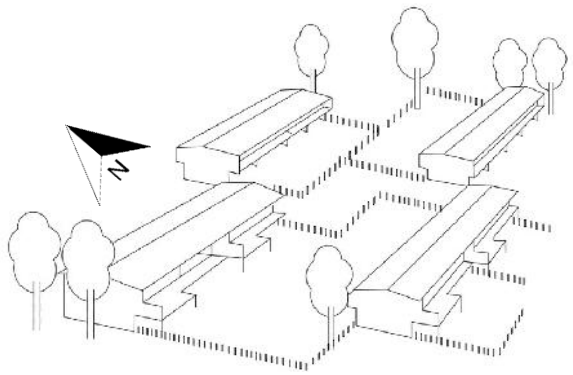
CRITERIA 3 - Street Widths & Orientation should preferably wide to promote air movement.

CRITERIA 8 - Both solar and wind energy can be used for producing renewable energy.

CRITERIA 11 - The main habitable rooms must be placed on the longer facades in the North South or more preferably oriented as per the wind direction.

Large and body level well-shaded fenestration having staggered arrangement and in the direction of airflow for cross ventilation arrangement.

CRITERIA 13 - Water Bodies are notrecommended as it adds to humidity levels



and rain water harvesting stratagies can be adopted for water demand reduction.

CRITERIA 15 -Overhanging(extended) roof in the north and the south for providing protection from the sun's glare and the rain, Pitched roofs with large overhangs.

CRITERIA 19 –Wall - Low U walls, Low thermal mass, Insulation is effective

CRITERIA 21 - sustainable site development can be archived with the ground character- not absorptive, rough, some hardscape and dry ground around building.

7.3. Composite climate-

CRITERIA 1(a)- Compact planning, low rise development is preffered with medium depth of the building to allow temporary cross ventilation in the humid season.

CRITERIA 1(b)- Planting layout should be done for the to provide protection form the hot - dry a cold wind. Vegetation patterm isseasonal deciduous vegetation to control sun.

CRITERIA 2-Minimum Perimeter to Area ratio. Mutual shading. Open to monsoon winds.

CRITERIA 3 - Street Widths & Orientation - Should be narrow (N-S Oriented) and oriented to receive monsoon winds.

CRITERIA 8 - solar energy can be used for producing renewable energy.

CRITERIA 11 - Controlled space between dwellings for the air movement in the humid season

Longer facades facing North South, primarily to minimize heat gain and to catch monsoon winds havingg the two leveled small openings, operable and shaded in the windward side.

CRITERIA 13 - Water Bodies are Preferred during summers but should be drained during monsoons and winters which can be used as a seasonal stratagy for water demand reduction.

CRITERIA 15 - Roof Form & Overhangs must beLarge eaves to shade walls and openings.

CRITERIA 19 –Massive walls at lower levels. Light structures at upper levels. Roof material - Light roofs, well insulated, low U values

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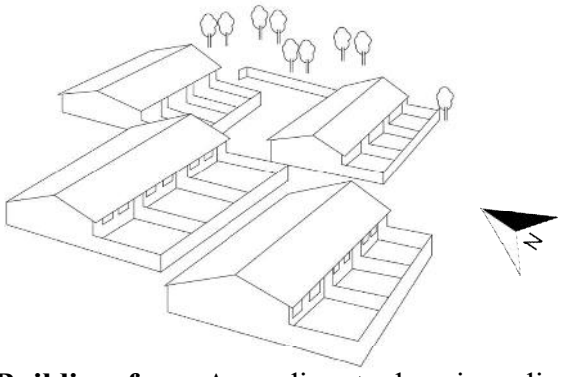
CRITERIA 21 - sustainable site development can be archived with the ground character - Green Non-reflective ground cover



Building form-According to housing climate and comfort by Martin Evans, specifications according to a particular type of climate is mentioned below (for Criteria 11) –

	Element and requirements	Purpose
Hot- dry climate	minimize south and west walls	to reduce heat gain
	minimize surface area	to reduce heat gain and loss
	maximize building depth	to increase thermal capacity
	minimize window wall	to control ventilation heat gain and light
Warm humid climate	minimizing building depth	for ventilation
	minimising west facing wall	to reduce heat gain
	maximizing north and south walls	to reduce heat gain
	maximizing surface area	for night cooling
	maximizing area of window to wall	for ventilation
Composite climate	controlled building depth	for thermal capacity
	minimize west wall	to reduce heat gain
	limited south wall	for ventilation and some winter heating
	medium area of window to wall	for controlled ventilation

8. Conclusion and discussion

The energy efficient and green buildings are reducing the energy demand a up to 40%. According to an arcticle in “the hindu”,the government of India is trying to take necessary steps
to makecertain that green building ideas are mainstreamed. For all planned Central Government and Public Sector.

This paper provided the basic guidelines aboutall those criterias of GRIHA in which design cosiderations can me done by the designers. Further provides the ways of archiving the criteria in the climate of India, basic idea of an envolope design in accordance with the specific climate type.

9. References

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