Innovations in green buildings: the GRIHA approach

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Evolving landscape of sustainable habitats in India

2003: 1st LEED Platinum building

2005: TERI-GRIHA with TERI-BCSD

2007: GRIHA adopted by MNRE

2009: by TERI, MNRE & sectoral experts establish ADaRSH

CII-Sorabhji Godrej Green Business Centre, Hyderabad

Up to 2000

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Over 100 audits
Achievements- 2011: Resource use optimisation through design

GRIHA & TERI-GRIHA Projects
Centre for Environmental Science and Engineering
Kanpur

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TERI- GRIHA Rated
IIT Kanpur: Good architectural features

- Building designed according to trees on site for preserving more trees and integrating them into the design
- Longest facades face North and South
- Limited Window-Wall Ratio
- Well shaded windows coupled with good glass result in good daylighting inside the spaces
- Roof covered with China mosaic tiles along with bamboo pergolas for additional shading in order to reduce heat gains
GRIHA Performance

- Energy reduction compared to benchmarks: 43%
- Water consumption reduction compared to conventional buildings: 50%
Suzlon One Earth Campus
Pune, Maharashtra

GRIHA Rated

★ ★ ★ ★ ★
SUZLON OneEarth: Good architectural features

- Excellent site planning. Building form designed to self-shade a lot of the facades
- Thin floor plates with glazing on both sides for maximising daylight penetration
- Good interior design for better daylight penetration
- Angled louvres installed to control direct sunlight from coming inside the building
GRIHA Performance

- Energy consumption reduction compared to GRIHA benchmarks: 56%
- Reduction in water consumption compared to conventional building: 50%
- 2,50,000 units of electricity generated annually on site
Police Training School
Turuchi, Tasgaon, Maharashtra

GRIHA Rated
PTS: Good architectural features

- Site planning done according to site slope
- Low WWR and well shaded windows
- Building plans and windows designed for cross ventilation to provide thermal comfort
- Use of local stone and other low-energy materials for cladding and finishing
- Non-AC building but yet designed to be extremely comfortable
GRIHA Performance

- Energy savings compared to GRIHA benchmark: 31%
- Water saving compared to conventional building: 52%
FORTIS Hospital
Shalimar Bagh, New Delhi

TERI-GRIHA Rated
First hospital in the country to receive TERI-GRIHA Rating

32% Savings in energy
58% Savings in water
Hindustan Unilever Ltd. Development Centre
Mumbai

TERI-GRIHA Rated

12% Savings in energy

57% Savings in water

Existing trees transplanted and protected and incorporated into building design

Tree cover doubled on site
Doon School
Dehradun

GRIHA Rated

73.3% reduction in energy consumption from TERI GRIHA benchmark

50% reduction in water consumption than conventional buildings via use of low-flow plumbing fixtures
Shapoorji Pallonji Infocity
Manesar, Haryana

GRIHA Rated

45% reduction in Energy Consumption from TERI GRIHA benchmark

50% reduction in water consumption

50% reduction in landscape water requirement through native trees and shrubs, high efficiency sprinkler and drip irrigation systems
Commonwealth Games Village
New Delhi

TERI GRIHA Rated

Energy consumption reduction: 61% below TERI GRIHA benchmark

Water consumption reduction: 60% below TERI GRIHA benchmark
PCNTDA Headquaters, Pimpri Chinchwad, Maharashtra

Yet to be rated
PCNTDA: Good architectural features

- Good orientation: longest facades face North and South
- Well shaded facades on East and West
- Thin floor plates for good daylight penetration
- Air vents provided above the roof slab, a traditional architectural feature borrowed from Rajasthani Havelis. The air flows across the slab and reduces the heat gain through the roof.
- Water bodies on the podium to cool the air flowing into the building through evaporative cooling
Achievements-2011:
Implementation of good practices on site
GRIHA criteria addressed during construction

- **Criterion 2**
  Preserve and protect landscape during construction/compensatory depository forestation.
- **Criterion 3**
  Soil conservation (post construction)
- **Criterion 8**
  Provide minimum level of sanitation/safety facilities for construction workers
- **Criterion 9**
  Reduce air pollution during construction
- **Criterion 12**
  Efficient water use during construction
- **Criterion 22**
  Reduction in waste during construction
Criterion 2
Preserve and protect landscape during construction/compensatory depository forestation.
Bad Examples
Criterion 3
Soil conservation (post construction)
Criterion 8
Provide minimum level of sanitation/safety facilities for construction workers
Bad Examples
GRIHA Examples
Criterion 9
Reduce air pollution during construction
Criterion 12
Efficient water use during construction
Criterion 22
Reduction in waste during construction
Bad Examples
Achievements-2011: Influencing and implementing policy
Salient features of GRIHA

- Climate specific energy performance indices for various building typologies (defined in kWh/sqm/year)
- Mandatory compliance with Energy Code
- Separate rating criteria for air conditioned and non air conditioned spaces
- Upper limit of window wall ratio mandatory to be met
- Window solar heat gain limit specified (mandatory)
- Adaptive comfort encouraged to be followed
- Daylighting mandatory
- 1% connected load of space conditioning and lighting to be met through RE
| Ministry of New and Renewable Energy | • Solar buildings program for energy efficient buildings  
• GRIHA- national building rating system (partly mandatory)  
• Solar cities programme  
• Incentives for integration of renewable energy & GRIHA |
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| Bureau of Energy Efficiency, Ministry of Power | • Energy Conservation Building Code (voluntary)  
• Appliance labelling (partly mandatory)  
• Star rating programme for existing buildings (rates commercial buildings on energy performance) |
| Ministry of Environment & Forests | • Environmental Clearance (Mandatory)  
• Resource (energy, water) efficiency integral part of clearance  
• ECBC mandatory |
| Ministry of Urban Development | • National Mission on Sustainable Habitats  
• energy efficiency in buildings  
• management of solid waste  
• accelerating modal shift to mass transport |
| Pimpri Chinchwad Municipal Corporation, Maharashtra | • Partly mandatory to comply with GRIHA  
• Incentives for GRIHA |
| Central Public Works Department/ Thiruvananthapuram PWD | • Mandatory to comply with GRIHA  
• Revised specification, schedules and plinth area rates |
Mechanisms for GRIHA implementation: carrots, sticks & tambourines
Incentives

- For enhancing demand for GRIHA compliant projects
  - 10% property tax rebate for occupants of GRIHA compliant homes in Pimpri Chinchwad, Maharashtra
  - 30-40% reduction in operation cost with negligible impact on project cost.
  - Costs involved in registration and certification with GRIHA are about 3 to 4 lakhs lesser than other rating systems practiced in the country

- For enhancing supply for constructing GRIHA projects
  - Fast track environmental clearance for GRIHA pre-certified projects
  - Registration fee waiver for GoI & PSU projects by MNRE
  - Up to 50% rebate in ‘premium’ paid by developers in Pimpri Chinchwad, Maharashtra
Mandates and generating awareness

- **Mandates**
  - Minimum 3 Star GRIHA compliance mandatory for new buildings of GoI and PSUs
  - Mandatory for new government projects in Pimpri Chinchwad to comply with GRIHA
  - Mandatory for all new projects of CPWD across the country
  - Regular due diligence site visits by ADaRSH

- **Raising awareness**
  - GRIHA on line tool, 5 volume GRIHA Manual
  - Large scale capacity building with MNRE support through TERI, GRIHA Patrons, IIA, CREDAI, SNAs, CPWD, practicing architects, consultants and TERI-BCSD
  - Campaigns with stakeholders
    - LAUNCH OF GREEN BUILDING QUIZ ON TERI FACEBOOK
Why build GREEN buildings?
Find out. Take this quiz and win exciting prizes.

"Buildings around us are turning GREEN. But are they energy efficient? Are they cost-effective? Let's explore."
About Green building Quiz

The quiz is an attempt to create awareness about Green Buildings and encourage people to participate and join our efforts in building a sustainable future.

Come, participate, and

- Win a pen drive every week
- Flipkart gift voucher every month
- An exciting trip to TERI’s heaven in the hills (Himalaya Mukteshwar Centre)
http://www.facebook.com/TERIIN

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TERI - The Energy and Resources Institute

Information

Location:
New Delhi, India

Founded:
1974

Timeline: Journey over 3 decades
Shaping a sustainable INDIA
GRIHA: A driver to Green Economy

• Climate change mitigation
• Energy and natural resource security
  • Demand side optimisation in a cost effective manner

Cheapest Solution

Passive design of building

Use of Efficient Systems

Use of Renewable Energy

• Job creation
• Market transformation
Future landscape of sustainable habitats in India