Ministry of New and
Renewable Energy, GoI

ADaRSH
(ASSOCIATION FOR DEVELOPMENT AND RESEARCH OF SUSTAINABLE HABITATS)

PRESENTS

GRIHA

(Green Rating for Integrated Habitat Assessment)

"The National Rating System for Green Buildings"

The Little Book of

GRIHA rating

"Bridging Buildings, Business and the Bio-climate"

GRIHA

Getting GRIHA rated

MNRE

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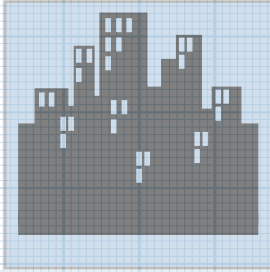Fax: 91-11-2436 1298

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Buildings and the environment

Introduction

Did you know?

Across the globe, the areas valued highest for Real Estate sale or purchase, are the greenest parts of a city.

These offer the best quality of life in terms of clean air, cooler climates, ample ground water, rich flora and fauna, natural lighting, ample wind-flow, recreation areas for children and adults, etc.

With unrestricted glass facades and extensive air-conditioned spaces, today we design buildings that work towards isolating the internal from the external environment, thereby resulting in very high energy consumption.

It is imperative we alter that trend to minimize the detrimental impact on the environment and to create a new future for our children, our towns, cities and our country.

Below: A typical office building in Gurgaon - One can see how all the window blinds (curtains) are rolled down / closed.

The sunlight in our country is very harsh and brings with it heat and glare, which people try to battle by rolling the blinds down and using lots of air-conditioning respectively.
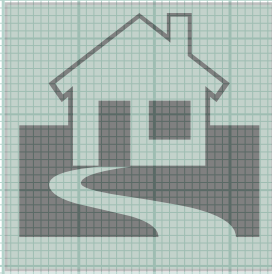
Broad functions of a building

Apart from the basic function as a shelter, a building should provide **two fundamental physiological 'comforts'** to its occupants; they are:

- ☕ **Visual comfort** (the ability to allow occupants to see clearly for carrying out their daily domestic/official tasks), and

- ☕ **Thermal comfort** (the ability to keep occupants cool in the summers and warm in the winters)

These 'comforts' can be provided

1. **Naturally** (using sun-light, natural winds, evaporation, trees, etc.) while saving energy, and

2. **Artificially** (using electric lighting, ACs, etc.) involving large-scale energy generation leading to pollution and green-house gas emissions

Additionally, these 'comforts' can respond to

1. **Local conditions** (since local conditions vary from place to place, and give us lots of flexibility in designing local buildings) or

2. **Global conditions** (which cater to "international" requirements which may drastically vary from our local conditions, and may require a lot of energy to provide / recreate)

Lack of appropriate information and tendencies to follow fashionable trends that are short-lived often lead us to provide 'international' comfort conditions in our buildings, at the cost of very high energy consumption.

It should be our endeavour to help secure the energy and resource future of our country through green buildings and habitats suitable to our country and people.
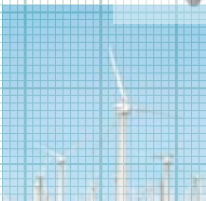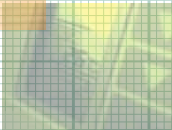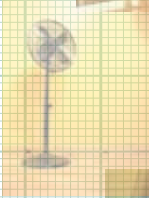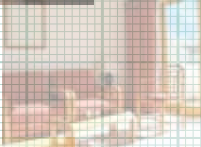
How do buildings impact the environment?

To provide all the comforts that are listed above, a building needs to consume resources for construction and operation. In our country, a well designed building is built out of concrete and bricks, and may have a design life of up to one hundred years. During such a period, a building can consume unimaginable quantities of resources.

Buildings* consume resources such as

Land	Farms, forests, fertile land, marshes, etc.
Soil	Earth, clay, stone, lime, sand, silica, etc.
Trees	Wood, ply, board, shuttering, etc.
Metals	Steel, iron, aluminium, copper, lead, etc.
Plastics	PVC, UPVC, PU, etc.
Water	Construction, landscape, cooling, washing/ drinking / flushing, etc.
Electricity	Cooling / heating, lighting, pumping, entertainment / working, etc.

And buildings* generate waste

Site waste	cut trees and vegetation, excavated soil, blasted stone, rubble, etc.
Construction waste	metals, boxes/cans, broken bricks, shuttering oils, etc.
Sewage/sullage	black water, grey water, etc.
Organic waste	peels, vegetables, fruits, etc.
Inorganic waste i. Recyclable waste	paper, glass, metals, etc.
ii. Non-recyclable waste	demolition debris, all plastics, synthetic fibres, etc.
E waste	CDs, electronics, hardware, etc.
Chemical waste	adhesives, paints, etc.

Buildings mean the building systems and the people who design, build, and occupy them.

India generates approximately 150,000 to 200,000 tons of waste per day. This waste has now become unmanageable and requires a lot of energy and land to get rid of, through toxic processes such as incineration or land filling.

Additionally, since most municipal solid waste in not segregated at source, it becomes tougher to introduce it into the recycling stream and thus the contamination from the same is worse still.

It is critical that buildings reduce their resource consumption and waste generation. And also to ensure that the waste generation is managed in a manner as to reduce the impact of the waste on the environment.

Cities today are cesspools of disease and epidemic. With waste materials contaminating our ground-water, farm lands, forests, and the air we breathe. We have to turn the situation around before it is too late.
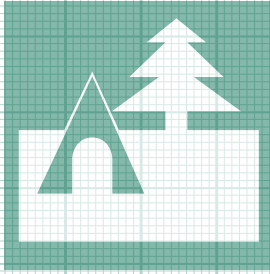
What is a green building?

The greenest possible habitat would strive to achieve the following:

- **Optimize demand for electricity, water and other natural resources** (in construction, operation and demolition)
- **Generate all its electricity on site** through renewable means
- Cater to all its **water demands through sustainable processes** such as rain water harvesting
- **Grow its own food on site**
- **Recycle and reuse all its waste on site** and burden the environment to the minimum.

We often refer to this process of design as "closing the loop". In other words, striving to generate and utilize on-site resources to construct and operate the building and then ensuring that all the waste material is managed on-site itself, thereby leaving nothing (if possible) to be put into the municipal systems.

**In the Indian context,** a building is 'green' when

- It is designed using an integrated approach (as mentioned in NBC, Part 0)
- It provides its users with an "optimal" level of comfort catering to local needs (as per NBC-Part 8)
- It uses minimum resources, sourced locally (as per various IS codes and other local materials)
- It consumes minimum energy and water (as per ECBC and NBC)
- It generates optimum waste, processed locally (as per CPCB, and MoEF norms)

... during its construction, operation and demolition (i.e., over its entire life cycle)

We built our first green building about 9000 years back, in Mehergarh (part of Harappa) now in Pakistan.

Traditionally we have always designed using local materials, responding to local climate, and displaying architectural and engineering talent which the whole world still holds in awe.

But today we mostly build forgettable buildings, where buildings in one city look exactly like ones in other cities.
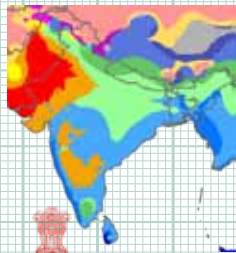
*Remember - Sustainability is ALWAYS local (context specific). The minute we start **importing designs, technologies, products or materials, the environmental impact increases multi-fold,** defeating the very purpose of designing a green building.*
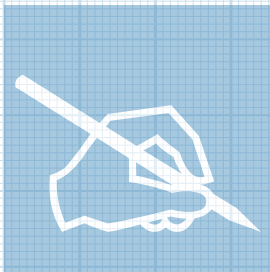
Can you design a green building? Does it cost more than a conventional building?

Yes, you can easily design a green building, by integrating resource-efficient features into a building's design from the pre-design stage itself, and by ensuring that the architects, engineers and contractors follow established environmental principles addressing local needs, designing a green building is easy and fun, and *may cost lesser than a conventional building*.

Steps

1. By **adopting the integrated design approach** such that the client, architect, engineers, and consultants design the building in a coordinated manner with a common goal – sustainability.

2. By **following regional development plans** (such as the UDPFI guidelines, master plans) and local building by-laws

3. By **following India's national codes and standards**

4. By **optimizing site conditions** (trees, water bodies, wind-flow, orientation, etc.) and harnessing them to cater to the thermal / visual comfort requirements of the building

5. By **adopting sound architectural practices** and taking examples from India's traditional architecture

6. By **adopting locally available construction materials** and giving impetus to local arts, crafts, architecture and artisans

7. By **designing precisely-sized energy systems** and not basing them on broad thumb-rules

8. By **reducing the resource consumption of the building** and its inhabitants so that the waste generating there-from is reduced

9. By **adopting energy efficient technologies (EETs)** and equipment

10. By **adopting renewable energy technology (RETs) applications** to reduce the demand on conventional energy

The emphasis of the design team must be on following **steps 1 to 8,** so that the requirement for steps 9 and 10 (EETs & RETs) can be significantly reduced, thereby **lowering the initial capital investment required for the project.**

But how do you know which step needs to be applied by who, how, and to what degree to get the desired outcome?

In case the requirements for technological interventions does surface, you may rest assured that the investment shall payback in a relatively short period of time.

One can expect enough savings in the energy bills of a building as to payback the initial investment within a span of half a year to five years. Of course the length of the payback period depends on the size and nature of the technology deployed.

For instance, lighting technologies such as CFL (compact fluorescent lamps), T5 / T8 / T12 Tubular Fluorescent Lamps (Tube lights), and timers can payback within a period of six months to one year (see image on left)

On the other hand, ventilation and air-conditioning technologies tend to payback over three to five years. In other words, the more energy intensive the technology (in terms of manufacturing energy consumption as well as operational energy consumption) the longer the payback period.


LCC of 60W-GLS & 15W-GLS for 12hrs/day operation

Right: The Life Cycle Cost (LCC) of a green building is much lower than that of a conventional building.

In other words, the money spent on energy and resource consumption over the entire life of a green building, is much lesser than that spent on a conventional building.

Even though initial investments in air conditioned green buildings may be marginally higher than conventional buildings.

Life Cycle Cost of Conventional & Green buildings
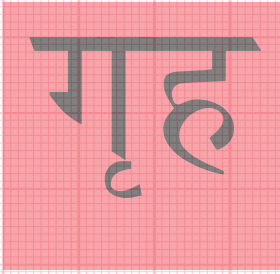
GRIHA - Green Rating for Integrated Habitat Assessment

GRIHA is India's National Rating System for Green buildings. It has been developed by TERI (The Energy and Resources Institute) and is endorsed by the MNRE (Ministry of New and Renewable Energy).

It is based on nationally accepted energy and environmental principles, and seeks to strike a balance between established practices and emerging concepts, both national and international.

GRIHA attempts to minimize a building's resource consumption, waste generation, and overall ecological/environmental impact by comparing them to certain nationally acceptable limits / benchmarks.

It does so, adopting the five 'R' philosophy of sustainable development, namely

GRIHA is a Sanskrit word, literally meaning 'A house as containing several rooms'.

It is taken from an ancient Indian document which is among the oldest extant texts of any language in the world – the Rig Veda.

1. **Refuse** – to blindly adopt international trends, materials, technologies, products, etc. Specially in areas where local substitutes/equivalents are available
2. **Reduce** – the dependence on high energy products, systems, processes, etc.
3. **Reuse** – materials, products, traditional technologies, so as to reduce the costs incurred in designing buildings as well as in operating them
4. **Recycle** – all possible wastes generated from the building site, during construction, operation and demolition
5. **Reinvent** – engineering systems, designs, and practices *such that India creates global examples that the world can follow* rather than us following international examples

Going by the old adage **'What gets measured, gets managed,** GRIHA attempts to quantify aspects, such as:
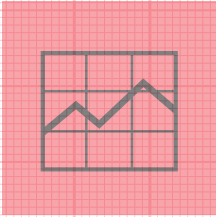
- **Energy / power consumption** (in terms of electricity consumed in kWh per square meter per year)
- **Water consumption** (in terms of litres per person per day)
- **Waste generation** (in terms of kilograms per day, or litres per day)
- **Renewable energy integration** (in terms of kW of connected load)

- So as to manage, control and reduce /optimize the same to the best possible extent

GRIHA assesses a building out of 34 criteria and awards points on a scale of 100. In order to qualify for GRIHA certification, a project must achieve at least 50 points.

Certain criteria / sub-criteria are mandatory and have to be complied for the project to be at all eligible for rating.

Project scoring
1. 50-60 points is certified as a 1 star GRIHA rated building,
2. 61-70 is a 2 star GRIHA rated building,
3. 71-80 is a 3 star GRIHA rating building,
4. 81-90 is a 4 star GRIHA rated building and
5. 91-100 is a 5 star GRIHA rated building
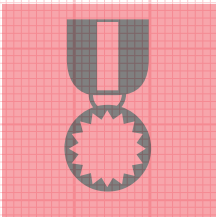
The guidelines/criteria and appraisal norms is revised every three years or sooner to take into account the latest innovations/best practices happening during this period.

SVA GRIHA (Simple Versatile Affordable GRIHA) has been developed by ADaRSH in collaboration with TERI and is currently under pilot stage. This variant of GRIHA is meant to simplify, and make the greening of small buildings (less than 2500 sqm built-up area) affordable.

For the particular and features SVA GRIHA, please go to GRIHA Website: **<www.grihaindia.org>**

Why should you get your building rated?

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

1. **Reduced energy consumption without sacrificing the comfort levels (lower operational costs)**
2. Reduced water consumption
3. Reduced system sizes (HVAC, transformers, cabling, etc.) for optimal performance at local conditions.
4. **Reduced investment (lifecycle cost)**
5. Reduced destruction of natural areas, habitats, biodiversity, reduced soil loss from erosion etc.
6. Reduced air and water pollution (with direct health benefits)
7. Limited waste generation due to recycling and reuse
8. Reduced pollution loads
9. Increased user productivity
10. Enhanced image and marketability
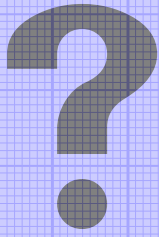
How can you get your building rated?

Eligibility

Except for industrial complexes, all buildings – offices, retail malls, institutions, hotels, hospitals, health-care facilities, residences, and multi-family high-rise buildings – in the pre-design/design stage are eligible for certification under GRIHA.

ADaRSH officials can examine your project documents to help you establish whether your project is eligible for GRIHA rating and render requisite assistance for registration.

Registration

Building project may register through the GRIHA website (http://www.grihaindia.org)
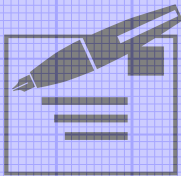
- For ease of adoption, registration should be completed at the onset of the project cycle, as there are several important issues that need to be addressed at this stage.
- The registration process allows for access to essential information such as
    - o Application forms
    - o List of required submissions
    - o Score points
    - o The weightage system and
   - o Online documentation

Evaluation

Project evaluation happens at two broad stages

1. Pre documentation stage – a team from ADaRSH along with the client's Integrated Design Team meet and determine the points being targeted by the project, *as soon as the building project is registered,* during the orientation workshop.
2. Post documentation stage – all necessary proof through documents for the points targeted under various criteria is submitted and then evaluated by third party regional evaluators, to determine final rating that shall be awarded to the project.

During the construction phase of the project, members of the ADaRSH team carry out three due diligence visits, to check on-site compliance of relevant GRIHA criteria.

Once the necessary documentation is uploaded, and systems commissioned on site, the building is evaluated and rated in a three-tier process.
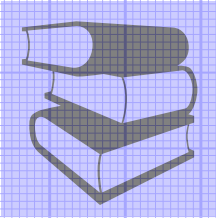
- The preliminary evaluation is done by a team of experts from ADaRSH.
  - o The team reviews the mandatory points and checks for compliance. The project is rejected if mandatory criteria are not complied with.
  - o The team then evaluates the optional criteria and estimates the total number of achievable points.
  - o All compliance documents are vetted through the appraisal process as outlined by GRIHA.
- The evaluation report is given to members of an evaluation committee, comprising renowned external experts in building and landscape design, lighting and HVAC design, renewable energy, water and waste management, and building materials
- The members independently review and award points
- A provisional GRIHA rating is awarded after evaluation of documents submitted

Rating

The final score is presented to the National Advisory Committee comprising eminent personalities and renowned professionals in the field, for approval and award of the final rating.

- The final GRIHA rating is awarded after receipt and evaluation of the post occupancy performance audit reports. The audit is conducted after 1 year of building occupancy.
- The rating awarded is valid for a period of five years from the commissioning of the building.
- GRIHA reserves rights to conduct random audits of any criteria for which points have been awarded
- Queries on rating may be sent to <admin@grihaindia.org>, and will be responded to within two working days

The registration fee can be calculated based on the following formula

Built-up area*	Registration fee (excluding tax)
<5000 m²	Rs.3,14,000 [Rupees three lakh and fourteen thousand only]
>5000 m²	(Rs.3,14,000) + (Rs.3.75 per m² above 5000) Rupees three lakh and fourteen thousand, plus Rupees three and seventy five paise per square meter over 5000
(*Excluding basements)	

Example

If your building area is 1,50,000 m² (One lakh and fifty thousand meter square), then the registration fee shall be calculated as follows:
First 5000 m² = Rs.3,14,000/-

Remaining area
1,50,000 – 5,000 = 1,45,000 @ 3.75 per m² = Rs.5,43,750/-

So the total registration fee shall be
(Rs.5,43,750/- + Rs.3,14,000/-) = Rs.8,57,750/-

Cost Break-up

The registration fee includes the following:

1. A one-day workshop for the project team to explain the rating system and allocate roles and responsibilities for the consultants involved. *If the workshop is outside NCR of Delhi, the cost of travel, board and lodging is borne by the client.*

2. Evaluation fee which is paid to the external evaluators who assess the project submittals.

Due diligence visits related expenditure

The travel and stay cost of two members of GRIHA team for three visits to site is to be borne / reimbursed by the client.
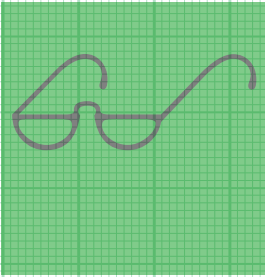
Who rates your buildings?

Regional Evaluators

We are of the firm belief that 'sustainability is always local' and thus also believe that the people of a specific region of our country know their local requirements best. This puts them in the best position to evaluate buildings built in their region.

We have thus developed a pool of evaluators, who are experts in the fields of:

1. Public Health
2. Landscape design
3. Solar Passive design and architecture
4. Building Energy systems
5. Renewable energy
6. Plumbing engineering

The relevant categories of criteria are entrusted to these people as external evaluators, who then evaluate the project and provide their inputs as to how the project fares and how it could be made better in terms of its commitments to sustainable design (if required).
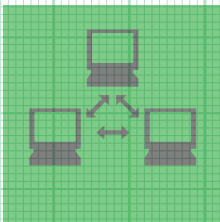
Becoming an Evaluator or Trainer

Becoming an Evaluator or Trainer is easy and anyone with adequate experience of working on green building projects can hope to qualify for it.

ADaRSH with assistance of MNRE conducts Evaluator and Trainer programs periodically, across the country. These training programs are three-days long and culminate in an optional examination based on which a person can qualify and become a GRIHA certified evaluator or trainer.

Please note that while the training programs are open to all, for Trainer/Evaluator certification the professional needs to be a graduate in architecture / engineering disciplines.
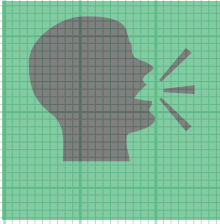
Role of a trainer

A trainer can help spread awareness on sustainable habitats by organizing training programs with MNRE support. The MNRE offers financial support of up to Rs.2,00,000/- (Two Lakh only) for conducting training programs on green buildings, renewable energy, passive solar architecture, and energy efficiency across India.

A trainer can also

- Be a consultant for GRIHA rated projects
- Advise proponents on obtaining GRIHA rating
- Facilitate the rating process for projects in his/her region
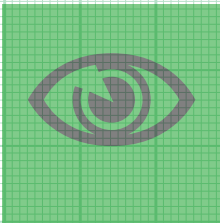
Role of an evaluator

Evaluators assess project documents for their correctness and appropriateness. They are given project documents specific to their region and area of expertise (an evaluator could have multiple areas of expertise, depending on examinations cleared by him/her). Evaluators are paid for every criterion they assess and for every time they assess a criterion.

The E&T programs

Information regarding the evaluator and trainer program can be obtained from the GRIHA website: **<www.grihaindia.org>**

GRIHA and local modifications

GRIHA acknowledges the diverse, multi-cultural, multi-ethnic country that is India. It thus acknowledges that regions within our great nation vary in terms of climate conditions and geology, and thus resources, and the problems that result due to their shortage.

Thus, it permits assessment on a percentage rather than an absolute basis.

- ☯ Checks applicability of points as per actual site conditions
- ☯ Retains contextual points and discards others
- ☯ Significant proof required to ascertain inapplicability

GRIHA and thresholds

In some projects (especially smaller size ones) – Systems required are considerably small, such as

- ☯ Hot water requirement <500 litres per day
- ☯ Waste water recycling and reuse (<10 KL per day)
- ☯ Solid waste recycling and reuse, particularly organic waste <100 kg per day

In such cases, investing in technology intensive solutions may unnecessarily lead to cost increments with poor returns.

At a smaller scale it may be judicious to adopt conventional systems / small-scale resource-efficient systems and technologies. GRIHA acknowledges this requirement.

GRIHA awards points to significant effort and interventions, since we believe that the solutions need to complement the scale of the problem.

For instance, hot-water may not be required in an office complex, especially if it is in a hotter climate such as Chennai. So installing a small solar hot water system in a project in Chennai will not get you points. However, the project will not be marked on those points either.

In such cases, the points will be removed from the denominator itself, so the project shall be marked on a percentage basis out of a lower denominator, maintaining the integrity of the system and awarding points for the significant criteria.
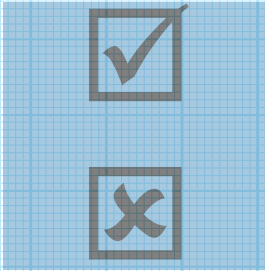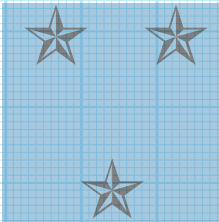
Roadmap to achieve 3*/4* star rating

The regular bullet points are to achieve a 3 star rating.
Items in brackets are additional steps to achieve 4 star rating.

Site planning

- Select appropriate site
- Ensure sedimentation / erosion control / save trees (if there) / plant more trees
- Design as per site conditions
- Air pollution control
- Ensure safety and health of construction workers
- Control hard paving / run off / manage utilities efficiently
- Use energy efficient outdoor lighting *(use RE based lighting)*
- Use trees and native species for landscaping to reduce landscape water demand over GRIHA benchmark by 40% *(reduce by 50%)*

Energy / water / waste
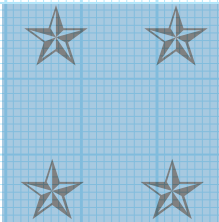
- Save 25% water demand on GRIHA benchmarks (developed based on National Building Code) *(by 50%)*
- Save water in construction
- Follow mandatory provisions of ECBC (In case of A/C buildings)
- Meet prescriptive shading norms of ECBC, provide daylight, avoid over design of artificial lighting
- Reduce energy performance index from GRIHA benchmark by 10% *(by 30%)*
- Provide 1% equivalent connected load of lighting and HVAC through RE power *(meet 10% lighting consumption through RE power)*
- Use fly ash / other industrial waste based products in minimum two of the following three areas: (structure/walling/finishing)
- Recycle water water and reuse 25% of treated waste water (if waste water quantity is higher than 10kL/day)
- Segregate and store waste appropriately

GRIHA pre-certification

Fast track environmental clearance through GRIHA pre-certification

In accordance with the Office Memorandum by Ministry of Environment and Forest (MoEF), government of India, Association for Development and Research of Sustainable Habitats (ADaRSH) has proposed a procedure that will enable fast track environmental clearance through GRIHA pre-certification.
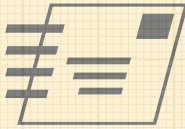
## How can you get your building GRIHA pre-certified?

Eligibility

Except for industrial complexes, all buildings – offices, retail malls, institutions, hotels, hospitals, health-care facilities, residences and multifamily high rise buildings- in the pre-design/design stage are eligible for pre – certification under GRIHA.

1) **For built up area greater than 20,000 m²**

   Projects applying for Environmental Clearance from MoEF can apply. Its mandatory for registering the project under GRIHA rating after pre-certification has been awarded.

2) **For built up area less than 20,000 m²**

   Projects can register for GRIHA pre-certification and GRIHA rating at the same time. The fees for both the process has to be submitted upfront.
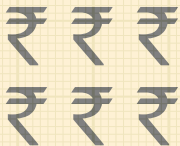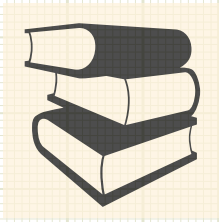
Registration

Building project may register through the GRIHA website - http://www.grihaindia.org/evaluation_tool/public/index/register

Fees

Registration cum pre-certification fees for all the projects is INR 1, 00,000 (Rupees one lakh only) + service taxes.

Documentation

Upload all documents under respective categories as mention in the "Checklist "of GRIHA Documents required. A pdf copy of each document needs to be submitted with the word/dwg file. The documents must be uploaded in the folders mentioned below.

1) Narratives
1) Declaration/certificates
2) Drawings
3) Test reports
4) Other documentation
5) GRIHA checklist
6) Presentation for MoEF(summary of the project)
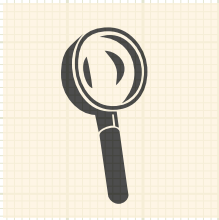
Evaluation

ADaRSH shall revert with comments on the submitted documents within two weeks of submission. Revised documents may be submitted by the clients within two weeks of receiving comments from ADaRSH. In case the project is falling short of compliance, a report on non-compliance with necessary corrective actions to be taken will be provided to the project proponent/SEIAC.

SVA GRIHA – background note

Eligibility

SVAGRIHA (Small Versatile Affordable GRIHA) was jointly developed by ADaRSH and TERI. SVAGRIHA is a significantly simplified, faster, easier and more affordable green building rating system and functions as a design-cum-rating tool. SVAGRIHA has been designed as a variant of GRIHA specifically developed for projects with built-up area less than 2500 sqm. SVAGRIHA can help in design and rating of individual residences, small offices, commercial and institutional buildings.

The rating comprises only 14 criteria analyzed using software tool, comprising simplified calculators. These calculators can be filled using information from construction drawings like areas and quantities of materials. This can be done easily by the architect/consultant of the project. Once completed, the tool will inform the architect/consultant the number of points that they are able to achieve in that particular criterion as well as the overall points.

Process:

- Registration of project with ADaRSH
- Submission of completed software tool and documentation to ADaRSH
- Internal review of documentation
- Site visit and post construction due diligence check (mandatory)
- External evaluation of project
- Award of Rating
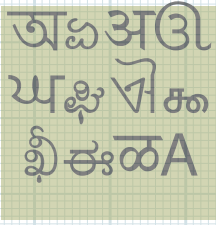
Evaluation

SVAGRIHA evaluates projects on the following 14 criteria:

Criterion number	Criterion name	Points
1	Reduce UHIE and maintain native vegetation cover on site	6
2	Passive architectural design and systems	4
3	Good fenestration design for reducing direct heat gain and glare while maximising daylight penetration	6
4	Efficient artificial lighting system	2
5	Thermal efficiency of building envelope	2
6	Use of energy efficient appliances	3
7	Use of renewable energy on site	4
8	Reduction in building and landscape water demand	5
9	Rainwater harvesting	4
10	Generate resource from waste	2
11	Reduce embodied energy of building	4
12	Use of low-energy materials in interiors	4
13	Adoption of green Lifestyle	4
14	Innovation	2
Total		50
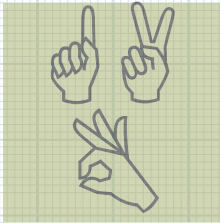
In order to achieve a SVAGRIHA rating each project must achieve a certain number of points in each category as mentioned below. This is to ensure that each project reduces its overall environmental impact and not just the impact through energy and water. Based on the number of points the project attempts, the rating shall be provided as mentioned in the table:

Category	Maximum points	Threshold points
Landscape	6	3
Energy	21	11
Water & waste	11	6
Materials	8	4
Others	4	1
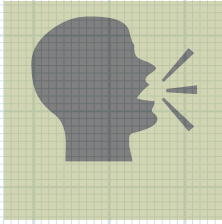
Project scoring

Points	Rating
25-30	★
31-35	★ ★
36-40	★ ★ ★
41-45	★ ★ ★ ★
46-50	★ ★ ★ ★ ★

For more information and registration costs, please contact:
info@grihaindia.org / apoorv.vij@grihaindia.org
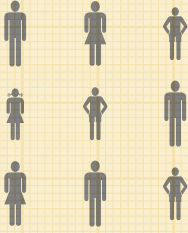
Associating with ADaRSH

ADaRSH is a non-profit, independent society registered under the Societies Act and is the body responsible for administering and giving GRIHA rating to the projects that register under the system.

ADaRSH offers membership opportunities to various individual and collective stakeholder groups that are associated with the building industry, whether it be directly (developers, contractors, designers, engineers, consultants etc.) or indirectly (product manufacturers, students, or the general public.)

Please join the league of 'Developers of a Green Nation', an ADaRSH initiative and become an Associate Member.

For an update of various initiatives and activities of ADaRSH, please visit our website: **<www. grihaindia. org>**

Ministry of New and
Renewable Energy, GoI

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Contact Details

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