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# Case Study on Ace Engineering College to Achieve Griha Ratings

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***Abstract***

*Conversion of an existing building into a green building takes into account the following aspects like water consumption, energy expenditure, recycling, biodegradability, environmental and sustainability concerning future demand, occupant well-being, environmental performance, and economic returns being improved. For rating an existing building or to suggest improvements, there are different sets of rules or guidelines in different rating systems. In our project, we have chosen Green Rated Integrated Habitat Assessment (GRIHA) which is India's very own green rating system that helps to create sustainable habitat and eliminate adverse impact on the environment In this project, we used the GRIHA Existing Building manual to study the existing features of ACE Engineering college under seven sections Site Parameters, Maintenance & Housekeeping, Energy, Water, Human Health & Comfort, Social Aspects, Bonus points and rated it based on theoretical parameters and suggested improvements where it is lacking, that can help in increasing the green performance of the campus and achieving better rating, if implemented.*

***Keywords:*** *Green building, Existing building, Environment, GRIHA Rating.*

## 1. Introduction

Green buildings incorporate sustainable features in their design and construction. The four main goals of green development are to create buildings that use less energy, less cost to operate and maintain, limit the impact on precious natural resources, and create places for people to work and live that promote health and productivity. Buildings can be considered green if they incorporate sustainable elements that satisfy the goals of green or sustainable development. The built environment is designed to conserve water and energy, use space, materials, and resources efficiently; minimize construction waste; create a healthy indoor environment. Design, construction, and occupancy play a vital role in creating and maintaining green buildings which incorporate sustainable practices.

### Benefits of green buildings compared to conventional buildings

- Less energy consumption.
- Less water consumption.
- On-site generation of renewable energy.
- Less waste generation and has on-site waste management strategies.
- Generate less pollution in construction and also in maintenance.
- Ensures proper health, safety, and sanitization facilities for occupants.
- Has less ODP (Ozone depletion potential).

### Green Rating for Integrated Habitat Assessment (GRIHA)

GRIHA is an organization governed by India for manipulating and monitoring the Rating of a building in India. It is a rating tool that assesses the people, performance of a building against certain Nationally acceptable benchmark.

### GRIHA for Existing Buildings

Achieving sustainability in new construction is much easier than an existing building. The existing buildings have more stakeholders than new construction. Housekeeping and maintenance staff, the occupants, and the managers are all part of the building management, with different issues and responsibilities. Thus, simplicity and flexibility must be the underlying theme of any initiative taken towards sustainability.
Keeping this as a benchmark, the GRIHA Council has developed a rating system for existing buildings. GRIHA for Existing Buildings (EB) rating is an integrated tool to assess the performance of existing buildings and provide sustainable solutions whilst augmenting the indoor comfort of the occupants. The rated buildings will enjoy enhanced energy and water performance and increased thermal and visual comfort; ultimately resulting in decreased operational

and maintenance costs. Especially the commercial buildings stand to benefit even more with the optimized value of the property cost and increased tenant retention of the rated buildings.

GRIHA for Existing Buildings rating is designed with underlining objectives, such as attaining environmental impact reduction, simplicity in execution, alignment with local and national goals, and cost-effectiveness. The rating endeavors to provide solutions to various typologies and ages of building catering to the diverse climatic zones of India, and include RWAs & users of habitats in the process. The rating would be assessed on specific sections which are imperative for a holistic improvement in the performance of the building.

**Table 1** Criteria and their weightage

| Section | Criterion Name | Max. Points |
|---|---|---|
| **Section I. Site Parameters** | **Criterion 1** Accessibility to Basic Services | 2 |
| | **Criterion 2** Microclimatic Impact | 4 |
| **Section II. Maintenance& Housekeeping** | **Criterion 3** Maintenance, Green Procurement, and Waste Management | 7 |
| | **Criterion 4** Metering &Monitoring | 10 |
| **Section III. Energy** | **Criterion 5**Energy Efficiency | 20 |
| | **Criterion 6** Renewable Energy Utilization | 15 |
| **Section IV. Water** | **Criterion 7**Water Footprint | 15 |
| | **Criterion 8**Reduction in Cumulative Water Performance | 10 |
| **Section V. Human Health & Comfort** | **Criterion 9**Achieving Indoor Comfort Requirements | 8 |
| | **Criterion 10**Maintaining Good IAQ | 4 |
| **Section VI. Social Aspects** | **Criterion 11**Universal Accessibility & Environmental Awareness | 5 |
| **Section VII. Bonus Points** | **Criterion 12**Bonus Points | 4 |

## 2. Literature Review

Aishwarya Kodnikar, Sneha Hajare, Shubham Thorat, Shantini Bokilstated in their study that implementation of green practices in existing buildings and converting existing buildings into green buildings requires monitoring of building systems, training the staff, and keeping up to date with certification requirements which will save up to 30-40% water, 40-50% energy and 20-40% of construction materials.

Research done by Dr. Mahendra Pratap Choudhary and Govind Singh Chouhanstated that green buildings reduce energy demand by 40%. So they can be a better solution to decrease energy demand in urban areas caused by urbanization.

NandishKavani and Fagun Pathak in their study have stated that Green buildings on college campuses are the purposeful construction that decreases resource usage in both building processes and future reduction of CO2 emissions, energy use, and water use while creating an atmosphere where students can be healthy and learn.

Pooja Choudhary, Jagritigupta, Dr. Bharat Nagar expressed that green building is the practice of creating structures and using environmentally responsible processes and resource-efficient from siting to design, construction, operation, maintenance, renovation, and deconstruction. The practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

Prof.Yuan-LiangCheng has undertaken renovation projects infourmajoraspects -ecology,energysaving, wastereduction, and health concerns.

Zuo. J, Zhaosummarised the existing knowledge system of green building and focuses on the environmental aspects of green buildings, however, the other dimensions of sustainability such as social sustainability and cultural sustainability are neglected to a large extent.

## 3. Methodology

We are carrying out a case study on ACE Engineering college to achieve GRIHA ratings.ACE Engineering College is located at Ghatkesar, Telangana, India. In the present project we have proposed to give credits to rate the chosen building for its various green features according to the rating system of GRIHA and suggest measures to improve the green performance of the building; thereby increasing its rating on implementation.

## 4. Scope of work

Assignment of Points:Based on GRIHA for the Existing Buildings rating system, different levels of certification (one star to five stars) are awarded based on the number of points earned by the building.

**Table 2** Points obtained after the study

| Particular | Max. Points | Obtained Points |
|---|---|---|
| Site parameters | 6 | 3 |
| Maintenance & Housekeeping | 17 | 3 |
| Energy | 35 | 12 |
| Water | 25 | 6 |
| Human Health & Comfort | 15 | - |
| Social Aspects | 5 | 3 |
| Bonus* | 4 | 2 |
| Total | 100 | 29 |

Star Rating GRIHA for Existing Buildings

The star rating for buildings obtaining the certain range of points is as follows

25–40 - *
41–55 -**
56–70 -***
71–85 -****
86 to above-*****

The building under consideration has obtained all 29 points.

Hence it is eligible to fall under the 1-star rating according to GRIHA existing building manual.

## 5. Suggestions to improve green rating

**5.1 Site Parameters**

**5.1.1 Accessibility to Basic Services**

- **Usage of Cycle** to commute to nearest transit points should be encouraged as the nearest bus stop is 1.5km. So cycle renting points can be encouraged.

**5.1.2 Microclimatic Impact**

- **Vertical gardens** are panels of plants, grown vertically using hydroponics, on structures that can be either free-standing or attached to walls. this helps in reducing the urban heat island effect and improves air quality.
- **Cool roofs** use highly reflective building material.it can help cool buildings, cities, and the planet by reducing the percentage of sunlight converted to heat by the building surface.

Ex: cool roof tiles, white roofs

- **Planting more trees** reduces the ambient temperature, which increases the efficiency of solar panels on the roof, air conditioners in the building and also improves groundwater level.

**5.2. Maintenance and Housekeeping**

**5.2.1 Maintenance, Green Procurement, and Waste Management**

- **Composting** is the natural process of decomposition and recycling of organic material into humus-rich soil. leaves, shredded twigs, and kitchen scraps, food waste produced in the institution can be shredded and this organic material can be easily decomposed into high-quality compost.
- **Segregation of wastes** by color coding dustbins will help in better recycling. Segregated wastes can be dumped in the dustbins of Green(wet and biodegradable wastes), Blue(plastic wrappers and non-biodegradable wastes), Yellow (papers and glass bottles).
- **Eco-friendly Cleaning** involves products that arenot harmful to the environment like Bioenzimes-which can be used as general surface cleaners, restroom cleaners, carpet spotters, odor eliminators.
- **Sanitary Pads Disposal**can be done by using SanEcoit's a kind of waste management system that works on a chemical and mechanical disintegration method which helps in upcycling residual materials produced.

**5.2.2 Maintenance and Monitoring**

- **Daylight harvesting systems** use daylight to offset the amount of electric lighting needed to properly light a space, to reduce energy consumption. This is accomplished using lighting control systems that can dim or switch electric lighting in response to changing daylight availability.
- **HVAC**system shall be installed to reduce energy consumption while maintaining the indoor conditions at a comfortable level to keep occupant's health and productivity.
- **Smart Water Metering** analyses water consumption data through an automated system to detect waste or inefficiencies and trigger alerts is how water can effectively be saved. By installing smart water meters college management will be empowered to decrease their water bills and contribute to water conservation
- **Rain Sensors and Soil Moisture Sensors** help in detecting moisture content of the soil to schedule watering cycles. which helps in the unnecessary usage of water.
- **Carbon dioxide, Temperature, and Humidity Level indicator** is suggested because Installing a 3 in one sensor will help in maintaining indoor air quality assessment and temperature monitoring at regular intervals

**5.3 Energy**

**5.3.1 Energy Efficiency**

- **Energy Star** is the simple choice for energy efficiency. Appliances carrying the Energy Star rating typically are 10 to 20 percent more energy efficient than non-rated models.LED bulbs and 3-5 star rated products are recommended. It saves moneyand also protects the environment.
- **Energy Efficient Interiors** reduces the amount of energy needed for heating, lighting, running appliances, etc., and by providing renewable, non-carbon-based energy to the building.
- **Photo Sensor**s are used to adjust electric lighting based on the available daylight in the space.

**5.3.2 Renewable energy utilization**

- **Solar panels**if increased in number and capacity will help in meeting the increasing energy requirements in the campus.
- **Food Waste Biogas** leftover food from mess and canteen can be utilized in preparing biogas.

**5.4 Water**

**5.4.1 Water footprint**

- **Rooftop Rainwater harvesting** is suggested to increase the collection capacity of rainwater. Collected rainwater on the rooftop of each block is let to runoff and drain into the drainage pipeline. This water can be diverted to the garden, toilets through separate pipelines and can be stored for further usage.
- **RainGardens**consists of native plant species whichfilter stormwater runoff, pollution and improves overall water quality also enhances the look and site aesthetics.
- **Greywater** refers to water sourced from the kitchen, laundry and bathroom drains, but not from toilets. About 60% of potable water can be replaced by greywater in a building.

**5.4.2 Reduction in cumulative water performance**

- **Installing dual-flush toilets** helps conserve water with controlled water outlet options, where the user can choose either of two flush modes depending on the use of the toilet

- **Automatic plumbing Fixtures**use very little water by limiting the flow rate and fixture time operations, frequency checking and maintenance should be done.

**5.5 Human Health and Comfort**

**5.5.1 Achieving Indoor Comfort Requirements**

- **Acoustic comfort** can be improved by installingartistic acoustic panels, acoustic insulation boards, panel extenders, sound baffles.

**5.5.2 Maintaining Good Indoor Air Quality and Quantity**

- **Air purifying plants**purify and renew stale indoor air by filtering out toxins, pollutants, and the $CO_2$ we exhale - replacing them with oxygen. Eg: Peace Lily, Spider plant, Money plant**,** etc.
- **Eco-friendly paints** are classified into Zero-VOC paints, Low-VOC paints, Natural paints. These have low volatile organic compounds (VOC) to No – VOC,which has a minimal impact on the environment and human health.

**5.6 Social Aspects**

**5.6.1 Universal Accessibility & Environmental Awareness**

- **Portable wheelchair ramps**are more affordable, they're also shorter, lightweight, and can often fold up for easier transport.which makes easy movement for the disabled.
- **Restroom/Toilets for persons with special needs should be**provided on every floor to assist students with mobility or aging staff,also amenities should be installed at convenient height along with the provision of grab bars and handrails.
- **Special Parking for Disabled**should be allocated with standard car parking spaces(3500mm wide x 5000mm long)at a convenient place near the office entrance or reception with international symbols of accessibility.
- **Raising Awareness**should beamong the student community and faculty about their social responsibility regarding the environment and properly guiding them about the advancements of a green building and energy-saving will help in better functioning of a green building.

**5.7 Bonus**

**5.7.1 Creative Adaptations**

- **Urban Farming** can be done by Vegetable Landscaping, Hydrophonic Farming, Vertical Farming methods. It can be useful in producing fresh food requirements of college mess and canteen. It also encourages giving a healthy and organic diet to occupants. Students can be involved in farming to plan and maintain the farm. Since the harvest does not need any long-distance transportation, also energy saving.

## Conclusion

After examining different criteria of GRIHA rating, the comparison between the points obtained by the ACE engineering college existing building and points which will beobtained after implementing the suggestions is given below:

**Table 3** Total points after suggestions

| PARTICULAR | MAX. POINTS | OBTAINED POINTS | POINTS (if suggestions are implemented) |
|---|---|---|---|
| Site parameters | 6 | 3 | 3+0= 3 |
| Maintenance & Housekeeping | 17 | 3 | 3+9=12 |
| Energy | 35 | 12 | 12+16=28 |
| Water | 25 | 6 | 6+4=10 |
| Human Health & Comfort | 15 | - | 0+4=4 |
| SocialAspects | 5 | 3 | 3+2=5 |
| Bonus* | 4 | 2 | 2+2=4 |
| TOTAL | 100 | 29 | 29+37=66 |

If the suggestions are implemented, then ACE engineering college can obtain 3 Star rating.

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