

# REVIEW STUDY ON A GREEN BUILDING BASED ON THE RATING SYSTEM

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**Abstract-** Buildings are one of the biggest energy consumers and greenhouse gas producer and it has become a global issue. So, it is necessary that not only think of but implement sustainability in every new construction. Green Building is put forward to overcome the impacts of conventional buildings on the environment, society and economy. From last few years there are rapid increase in the study of Green building. This paper reports the common research on the methodology and scope of Green building and benefits of green building compared to conventional building and various aspects to achieve green building. The main aim of this study is to explore regarding the green building technology, strategies and material which help in reducing the consumption of energy and resources and to shift from harm to harmless technologies and material in building.

**Key words:** Green Building, GRIHA rating, Assessment, Eco system, Health.

## 1. Introduction

Green building which is also known as sustainable building. They are designed to meet few objectives like using energy material and resources which are harmless for the health of occupant and the environment and use the resources and energy efficiently. This results in the reduction of greenhouse gases which indirectly helps in reducing the greenhouse effect. This paper is an overview of green construction technologies which makes an impact on proper utilization of resources like land, water, air, Material, energy and also by reducing the overall cost of construction.

### 1.1 Green Building Features

- Energy efficient as it utilizes all lighting ventilation and make use of solar energy through solar passive designs.
- Efficient usage of water by recycling the water and through rain water harvesting.
- Generate energy using renewable energy resources such as photovoltaic system and solar system etc.
- Use of organic compound material or nontoxic materials.
- Use of recycle materials and utilization of waste efficiency and disposal.

### 1.2 Benefits of Green Building

Green buildings have an adverse effect on the eco system, occupant's health and the economy. Implementing a green building can minimize or reduces economic and environmental performance of the building.

- Environmental benefits: Protects the eco system, enhance the air and water quality, reduction in waste disposal and conservation of natural resources.
- Economic benefits: Reduces the overall operating costs, creates, extends market production of green materials and services.
- Social benefits: Improve the health and comfort the occupant.

## 2. Literature Review

1. The Paper published by Chen Min Ann; Hussein Mohammed Abualrejal on "Energy Efficiency In Green Building To Achieve Company Sustainability "proceedings Of Symposium On Technology Management And Logistics (Stmlgogreen),8-9 December 2015 stated that, Energy Efficiency plays a vital role to achieve sustainability in green building and it serves many advantages to human being. To accomplish this, they used energy efficient electrical fittings in lighting system, passive designs, sensor systems, and cross ventilation.
2. The Paper published by Narayan Tiadi; Ritesh Dash ;S.M Ali ;Aryadhara Pradhan on "Green Building: An Efficient use of natural resources to create a "Sustainable Environment" International Journal Of Innovative Science, Engineering & Technology, Vol. 1 Issue 5, July 2014 stated that Green building utilizes very less number of natural resources and contribute for healthy lifestyle of society and also it is eco-friendly to nature and hence reduces pollution to a large scale.
3. Paper published by Patel Jatin and Neetu Yadav on "Design techniques of green building". They identify the design technique for green building and gives design technique via case Study on center for Environmental science and Engineering Building IIT, Kanpur, India. Their concern to attempt it in the direction to make people, communities and general

public aware about the advantages of green building. They use proper material regard to health and environmental impact in a green building.

4. Paper published by K.G.A.S Waidyasekara in "Terms of water efficiency and conservation based on comparative study of green building rating System". This based on the sustainable development because the present water is insufficient resource and considered as a global issue. They introduced importance of addressing water pollution and damage to the environment. This paper is proposed to simplify how and what strategies water efficiency and conservation is addressed in existing green building rating System.
5. Paper published by Mr.Apoorva V. Kotkar and Prof. Hemant Salunkhe in a third International Conference on Emerging Trends in Engineering and Management Research held on 30<sup>th</sup> July 2017 on a "A Review On Green Building Research" by studying live case study of a small bungalow to attract researchers all over the world especially in India. The basic aim of this research is to highlight the scope of Green Building, its benefits, cost of green building and various ways to achieve perfect green building. This research paper focused on study and the development of green building for giving a helping hand to make our planet pollution free. Also most of the aspects like environmental and economic are aimed at converting homes into a green or a sustainable building.
6. Paper published by JianZuo the School of Natural and Built Environments, University of South Australia and Zhen-Yu Zhao the School of Economics and Management, North China Electric Power University, Beijing, China on "Green Building research- Current Status and Future Agenda: A review" available online from 7<sup>th</sup> November 2013. This paper made extensive studies on green building, its assessment tools, not only technical and environmental aspects but also economic and social aspects. Additionally this paper also focused their review on human aspects like thermal comfort, indoor environmental quality (IEQ), health & productivity and also life cycle assessment (LCA).

### 3. Assessment tool of Green building

A lot of assessment tools have been developed for assessing the Green building constructions. From which GRIHA (Green Rating for Integrated Habitat Assessment) is the National rating system in India for green buildings, which was adopted by ministry of new and renewable energy (MNRE), government of India in 2007. The rating system was established by keeping in mind priorities and trends of the building sectors. This tool rates the building on the basis of its energy performance.

For creating of awareness of GRIHA the MNRE formed a GRIHA secretaries. This GRIHA secretaries were assigned with a task of performing training sessions and awareness programs throughout the country. MNRE also provides incentives to minimize the obstacles of economic hurdles which required in growth in green buildings. In one of the schemes launched by MNRE the GRIHA registration fee for first 100 government buildings were relinquish. MNRE also provided subsidies for the building which adopted the renewable energy technologies, because of which the awareness of GRIHA has risen in the building sectors since 2007.

### 3.1 Overview of GRIHA rating system

GRIHA can be considered as a performance based assessment system. It assesses the impact on the environment during construction, designing and operating phase. GRIHA rates the residential, commercial as well as institute building on the basis of star ratings. GRIHA consist of 34 criteria which are consisting of total 100 points and (+4) bonuses. For the GRIHA certification a building must at least obtain minimum 50 points.

**Table 3.1:** GRIHA rating system

Points Achieved	Star rating
51-60	1
61-70	2
71-80	3
81-90	4
91-100	5

The certification process under GRIHA is distinguished in two stages.

- Pre certification
- Final certification

A building is predefined under GRIHA when the assessment of required documentation for the project is completed successfully.

Then the building has to conduct an energy audit after a year of building occupancy for verifying the building performance. Once if the building performance gets verified and relates with the documentation then the building receives the final certificate on which is valid for a span of five years.

### 3.2 GRIHA Assessment Parameters

Assessment is classified into five broad category on the basis of environment performance as follows: Site planning, energy efficiency, waste water, waste and solid waste

management, health of occupant, sustainable or recycled construction materials. Each aspect consist of several criteria.



**Pie-Graph 3.2:** Pointing system for GRIHA

GRIHA rating system it promote the adoptability of material methods and principles in practical.

#### 4. Designing Techniques via Case Study

The Gail Jubilee Tower (Noida) it is currently the fifth tallest building in Delhi NCR and tallest green building in India. It has also achieved a platinum rating certification from IGBC. It has set new standards for the high rise green buildings in India with its numerous technologies innovations and imaginative planning. It ensures that least disturbance is caused to the ecosystem due to the operation of building. The main aim was not to earn a green certification but actually to spread awareness about protecting the ecosystem by reducing the energy consumption and through energy efficient buildings.



**Fig 4:** Gail Jubilee Tower (Noida)

#### 4.1 Methodology

- To ensure the building was self-sufficient and economical viable, it was decided to generate electricity using natural gas. A cost effective cogeneration system (gas based generation and VAM) was adopted.
- To reduce the consumption of energy, the positioning of windows, rooflines was situated in the North South direction. Which maximized the wind and sunlight while blocking the Excessive heat.
- For the structure of building an aerodynamics shape was chosen which allows free flow of wind so that the exterior portions remained cool than its surrounding.
- Glass panels were fitted with double glazing so that to avoid excessive heat absorption. Occupancy sensors, lux level meter, solar power, low consumptions fittings and many such techniques were implemented to in the energy efficiency.
- A zero discharge water cycle was implemented so as to reuse the waste water for landscaping and cooling purpose.
- Intelligent plantation was conceived so that surroundings remained clean and pleasant.CO2 sensors were introduced to keep air pure.
- Building Structure:

The structure of building is made of Reinforced cement concrete. Wall were made up of bricks. Facade wall of Aluminum Composite Panel (ACP), glass and a dry cladding of granite.

- Glass facade:

It is made up of double glass unit (DGU).Louvers have been inserted between the two glasses of DGU. Louvers are effective and helps to penetrate maximum natural light into the building. The facade wad designed in such a way so as give a trendy look to the building. The main role of the glass used in facade are that it reduces the absorption of heat and allows the natural light to pass the work spaces.

- Building orientation and aerodynamic shape

An integrative design approach was adopted to ensure the energy efficiency, one of the main goals of the project. The building was placed in North-South direction ensuring maximum wind and sunlight while blocking excessive heat from the sun. An aerodynamic shape was especially adopted to allow natural wind flow at all times, not only keeping the temperature of the external surface lower but also ensuring that the surroundings also remain cooler.

- Less energy consumption

The GAIL Jubilee Tower is designed at 400 SqFt/ ton as against the customary 250 SqFt/ ton for office buildings in Delhi NCR. This helped in reducing the size of mechanical equipment by lowering the energy needs. The other innovations used to minimize the energy consumption were high performance double-layered glazing, effective insulation including that of metal parts, and highly reflective roof etc.

- More day lighting

Very low power density is ensured by designing the interior spaces in such a way as to provide sun lighting to all the work stations throughout the day. In addition, convex reflectors are sandwiched between two layers of window glass panes to ensure a deeper penetration of the day lighting. Use of dimmable light fixtures and lux level sensors etc. are some more ways for minimizing the energy needs.

- Use of clean energy

This was another innovation that gives the GAIL Jubilee Tower a different character. As GAIL is one of the largest producers of natural gas, it was decided that the building would generate its own power using natural gas instead of taking power from the state electricity board to ensure use of clean power. HVAC is also run through VAM systems that results in high indoor environmental quality, operational efficiency and waste and toxic reduction.

- Water conservation and zero-discharge facility

Zero-discharge facility is installed to ensure minimum wastage of water. Waste water is collected, treated and reused for various purposes like horticulture and cooling towers etc. Low flow water fixtures and aerators are used to minimize wastage of water. In addition, VFDs are used in pumps and motors to lower the energy consumption.

- Quality of indoor air

CO2 sensors are used to ensure good quality air indoors. This also ensures that when the building is empty or partially filled, less power is used to send in fresh air, saving precious energy while making sure that the comfort level is not compromised.

## 5. Conclusion

This paper has reported a focus on green building as India facing rapid globalization. In this era where environmental balance is a key challenge, there is need of green building to the society because it is energy-efficient, socio-economic, health conscious as well as environmentally more effective. For further development of human beings, awareness about green building in the society should be done. The moto of this paper to represent the green building is a sustainable

building for tomorrow as this system includes the eco-construction criteria, proper energy, and waste and water consumption. Also, the extensive literature review shows that the study of green building is based on environmental aspects of sustainability, it emphasizes that how much important the need of green building is in today's lifestyle of human being. Thus green building plays the tremendous role in making our planet pollution free and to make it greener.

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