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Cost Effective Sustainable Green Building

Pravin Meghwal[1], Payal Thakore[2], Aditi Gawade[3], Ajaysingh Rajput[4], Vivek Chavan[5], Mr. Rohit Deshmukh[6]

[1]Studetnt, BE Civil, DR. D. Y. Patil Institute of Engineering Management And Research Akurdi, Pune
[2]Studetnt, BE Civil, DR. D. Y. Patil Institute of Engineering Management And Research Akurdi, Pune
[3]Studetnt, BE Civil, DR. D. Y. Patil Institute of Engineering Management And Research Akurdi, Pune
[4]Studetnt, BE Civil, DR. D. Y. Patil Institute of Engineering Management And Research Akurdi, Pune
[5]Studetnt, BE Civil, DR. D. Y. Patil Institute of Engineering Management And Research Akurdi, Pune
[6]Prof., BE Civil, DR. D. Y. Patil Institute Of Engineering Management And Research Akurdi, Pune

A B S T R A C T

Green building uses less energy, water and natural resources, creates less waste and is healthier for the people living inside compared to a standard building.

There is a rapidly expanding market for green building materials.

Green building provide suitable environment by controlling solar radiation temperature, energy efficiency, water conversation using domestic treatment plant and indoor air quality.

The main aim of green buildings is to reduce the environmental impact of new buildings.

The sustainability in the environment can be well achieved by reducing the energy emission and consumption by the buildings.

Sustainability means using the energy efficiently.

Green building refers to a structure that is environmentally responsible and resource efficient throughout the building's lifecycle.

The aim of this project is to conduct a comparative study on conventional and green residential building.

1. Introduction

India is a fast growing country. Rapid industrialization, increasing population, infrastructure development and destruction of natural resources lead to construction of green building. Green building is a structure that is environmentally responsible. Green building is also known for its sustainability and high performance.

Thermal comfort studies on traditional residential buildings of Pune that is known for its use of natural and passive methods for a comfortable indoor environment, are under progress. Passive methods of achieving thermal comfort inside the buildings are the best solution to provide a healthy and energy efficient indoor environment. This is of supreme importance for buildings in the tropics where mechanical systems with high energy consumption are used to condition the indoor environment for thermal comfort. The people are forced to depend on such systems because, majority of the buildings are designed without giving adequate importance to passive methods for controlling the indoor environment. In many cases, failure to provide the required thermal conditions has resulted in discomfort, ill health and productivity loss. Presently, there is a constant need to evaluate the thermal conditions of the indoor environments to learn further and proceed with the research in passive design.

Water is a critical and finite resource. It covers over 71% of the Earth's surface and is essential for life, playing a key role in the production of food, human health and sustaining the natural environment.However, water, particularly of drinking water quality, is becoming increasingly scarce in most of the populated regions of the planet. The pressure is on to reduce water demand by reducing wastage, to reuse or recycle as much as possible, and to look at other means of minimising our impact on the water environment. Overall we must be more efficient with our water utilization.

2. Problem Statements

House as a part of human life should be planned with a balance between physical buildings, environment, and people as the residents.

- The conventional house produces 10 to 30 tons of CO2 a year and it directly becomes one of the major factors to contribute in the global warming.
- The building produces much more amount of waste water (gray water) which is the serious issue to dispose in proper manner or reuse it.
- Wasting electricity at home not only increases our utility bills, it strains an already overtaxed power grid, which can affect your neighbours and contribute to climate change.

To avoid this problem there is need of design green building (sustainable building).

3. Objectives

The project aims at the following,

- To study the energy consumption of conventional residential buildings.
- To adopt techniques to convert the conventional building into green building.
- To compare the conventional and green residential buildings in terms of passive design, material, energy, and water use.
- To Improve air and water quality, protection of ecosystem and biodiversity.

Purpose of project is to convert the conventional residential building into green which uses less water, optimizes energy efficiency, conserves natural resources.

4. Methodology

4.1 Conventional Building

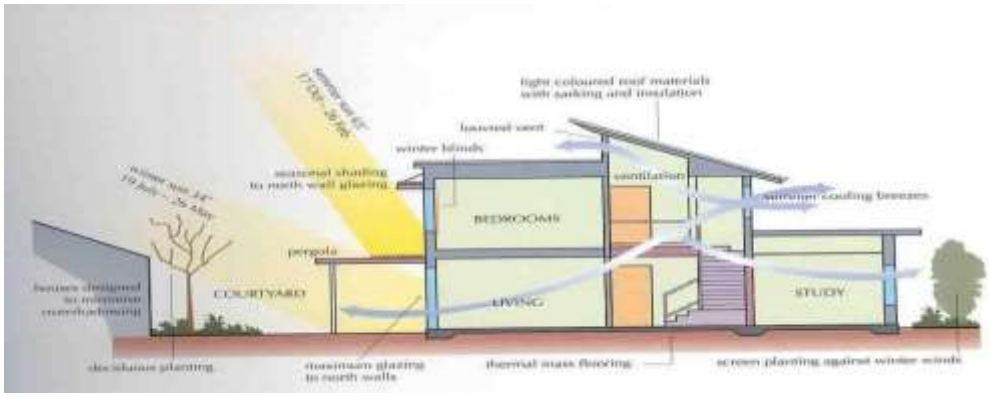
Conventional Building construction refers to the traditional method of construction where the construction knowledge is passed from one generation to the other Associated to the wet construction (in-situ) using reinforced concrete.

4.2 Energy

Efficient energy use, sometimes simply called energy efficiency, is the goal to reduce the amount of energy required to provide products and services. For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature .Installing fluorescent lights, LED lights or natural skylights reduces the amount of energy required to attain the same level of illumination compared with using traditional incandescent light bulbs. Improvements in energy efficiency are generally achieved by adopting a more efficient technology or production process or by application of commonly accepted methods to reduce energy losses.

There are many motivation to improve energy efficiency .Reducing energy use reduces energy costs and may result in a financial cost saving to consumers if the energy savings offset any additional costs of implementing an energy efficient technology. Reducing energy use is also seen as a solution to the problem of reducing greenhouse gas emissions. Energy efficiency and renewable energy are said to be the twin pillars of sustainable energy policy. Energy efficiency has proved to be a cost-effective strategy for building economies without necessarily increasing energy consumption. Thus a balanced approach to energy efficiency in buildings should be more comprehensive than simply trying to minimize energy consumed. Issues such as quality of indoor environment and efficiency of space use should be factored in. Thus the measures used to improve energy efficiency can take many different forms. Often they include passive measures that inherently reduce the need to use energy, such as better insulation. Many serve various functions improving the indoor conditions as well as reducing energy use, such as increased use of natural light.

Proper placement of windows and skylights as well as the use of architectural features that reflect light into a building can reduce the need for artificial lighting. Increased use of natural and task lighting has been shown by one study to increase productivity in schools and offices.



4.3 Building Material

Natural materials are generally lower in embodied energy and toxicity than man-made materials. They require less processing and are less damaging to the environment. Many, like wood, are theoretically renewable. When natural materials are incorporated into building products, the products become more sustainable.

Minimal construction waste during installation reduces the need for landfill space and also provides cost savings. Concrete, for example, has traditionally been pre-mixed with water and delivered to the site. An excess of material is often ordered, to prevent pouring delays should a new shipment be needed. This excess is usually disposed of in a landfill or on-site. In contrast, concrete mixed on-site, as needed, eliminates waste, and offers better quality control. Designing floor intervals to coincide with the standard lengths of lumber or steel framing members also reduces waste. Taking advantage of the standard sizes of building materials in the design phase reduces waste produced by trimming materials to fit, as well as the labor cost for installation.

Using locally produced building materials shortens transport distances, thus reducing air pollution produced by vehicles. Often, local materials are better suited to climatic conditions, and these purchases support area economies. It is not always possible to use locally available materials, but if materials must be imported they should be used selectively and in as small a volume as possible. For instance, the decorative use of marble quarried halfway around the world is not a sustainable choice. Steel, when required for structural strength and durability, is a justifiable use of a material that is generally manufactured some distance from the building site. Materials available under the area of 400 km sq are known as local materials.

Waste, or rubbish, trash, junk, garbage, depending on the type of material or the regional terminology, is an unwanted or undesired material or substance. It may consist of the unwanted materials left over from a manufacturing process (industrial, commercial, mining or agricultural operations,) or from community and household activities. The material may be discarded or accumulated, stored, or treated (physically, chemically, or biologically), prior to being discarded or recycled. It is also used to describe something we use inefficiently or inappropriately.

5. Green Building

Green building refers to both a structure and the using of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition. In other words, green building design involves finding the balance between homebuilding and the sustainable environment. This requires close cooperation of the design team, the architects, the engineers, and the client of all projects. The green Building practice expands and compliments the classical building design concerns of economy, utility, durability, and comfort.

Leadership in Energy and Environmental Design (LEED) is a set of rating systems for the design, construction, operation, and maintenance of green buildings which was Developed by the U.S. Green Building Council. Other certificates system that confirms the sustainability of buildings is the British BREEAM (Building Research Establishment Environmental Assessment Method) for buildings and large scale developments. Currently, World Green Building Council is conducting research on the effects of green buildings on the health and productivity of their users and is working with World Bank

to promote Green Buildings in Emerging Markets through EDGE Excellence in Design for Greater Efficiencies Market Transformation Program and certification.

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective of green buildings is to reduce the overall impact of the built environment on human health and the natural environment by: Efficiently using energy, water, and other resources

- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation.

5.1 GRIHA

The **Green Rating for Integrated Habitat Assessment (GRIHA)** Green Rating for Integrated Habitat Assessment (GRIHA) is India's own rating system jointly developed by TERI and the Ministry of New and Renewable Energy, Government of India. It is a green building design evaluation system where buildings are rated in a three-tier process. The process initiates with the online submission of documents as per the prescribed criteria followed by on site visit and evaluation of the building by a team of professionals and experts from GRIHA Secretariat. GRIHA rating system consists of 34 criteria categorized in four different sections. Some of them are:

- Site selection and site planning,
- Conservation and efficient utilization of resources,
- Building operation and maintenance, and
- Innovation.

Commonwealth Games Village, New Delhi, Fortis Hospital, New Delhi, CESE (Centre for Environmental Sciences & Engineering) Building, IIT Kanpur, Suzlon One Earth, Pune and many other buildings has received GRIHA rating.

5.2 Indian Green Building Council

The Leadership in Energy & Environmental Design (LEED) is the rating system developed for certifying Green Buildings. LEED is developed by the U.S. Green Building Council (USGBC), the organization promoting sustainability through Green Buildings. LEED is a framework for assessing building performance against set criteria and standard points of references. The benchmarks for the LEED Green Building Rating System were developed in year 2000 and are currently available for new and existing constructions. Confederation of Indian Industry (CII) formed the Indian Green Building Council (IGBC) in year 2001.

Sl. No	Green Buildings	Rating received
1	ABN Amro Bank N.V., Ahmedabad	LEED 'Platinum' rated
2	American Embassy School, Delhi	LEED 'Gold' rated

3	Anna Centenary Library Building, Chennai	LEED 'Gold' rated

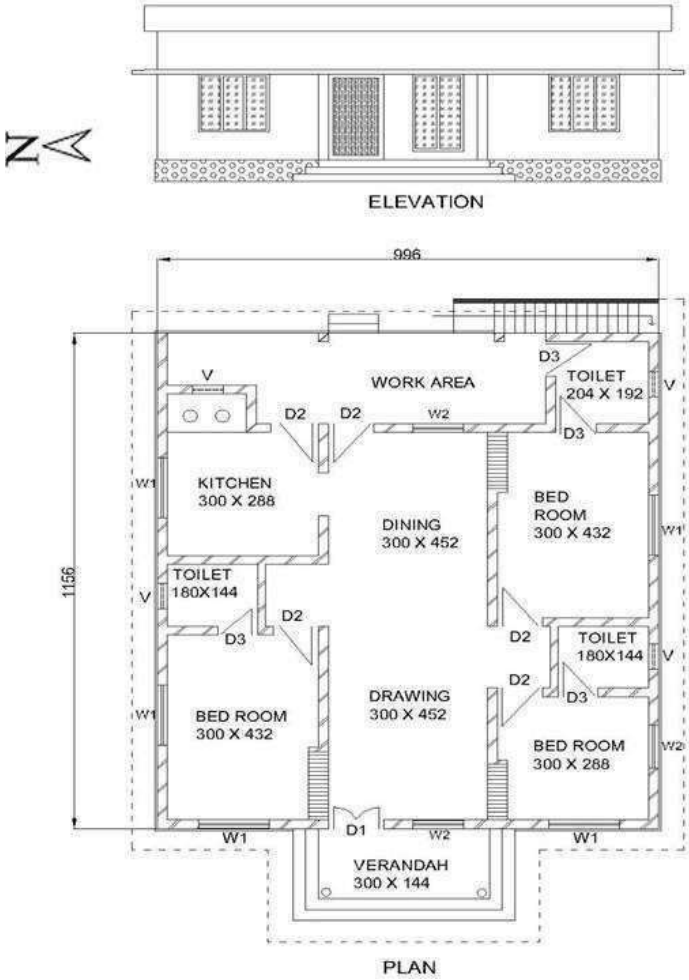
6. Conventional Residential Building

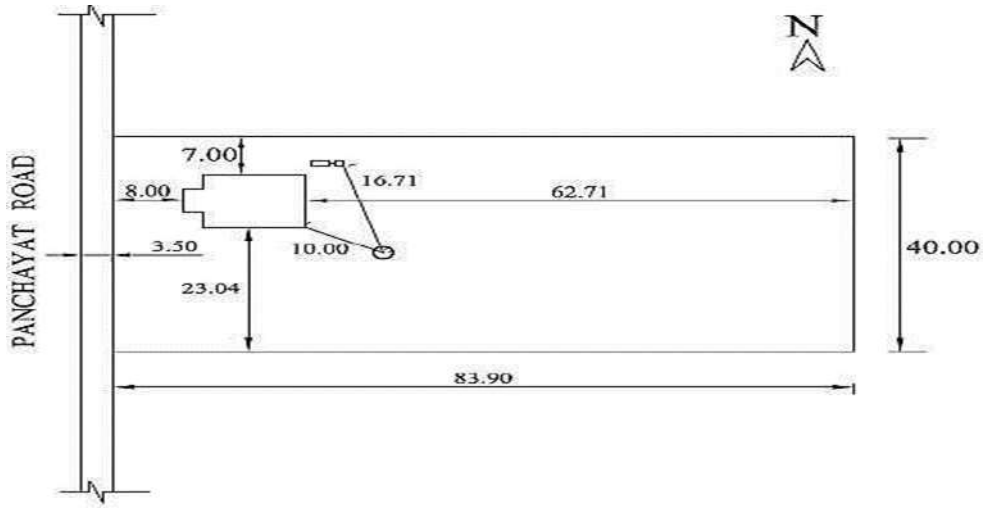
6.1 Details of Site Selected

- Samruddhi Sadan, Warje in Pune district of Maharashtra.
- City Pune is situated in the southwest of the Maharashtra state.
- Pune district borders with Ahmadnagar and Solapur district in east, Satara and some portion of Solapur district in the south and Raigad and Thane in the west.

6.2 Geography

- City lies at 560 meters above sea level.
- It lies between 18 degree 32" North latitude and 73 degree 51" East longitude.
- It is situated in east of Sahyadri (Eastern Ghat), which allows rain water to automatically drain out the city. Ponds and rivers acts as natural drainage system for the city





Plan, Elevation and Site Plan of and Selected Building

6.3 Energy Consumption

Sl. No	**Equipment**	**Power (P) (Watt)**	**Number (n)**	**Approximate working hours per day (t) (hr.)**	**Total energy consumption per day (P*n*t/1000) (KWh)**
1.	CFL	20	14	2	0.8
2.	TUBE	40	7	3	0.840
3.	CEILING FAN	75	5	7	2.625
4.	TELEVISION	100	1	5	0.5
5.	LAPTOP	65	1	2	0.130
6.	SCANNER	70	1	0.167	0.012
7.	MOTOR	370	1	0.25	0.0925
8.	IRON BOX	750	1	0.25	0.1875
9.	CELL PHONE CHARGER	2	3	1.5	0.009
10.	SETTOP BOX	8	1	5	0.04
11.	MIXER	750	1	0.167	0.125
	TOTAL				**5.361**

7. Conversion of green building

7.1 Rain water harvesting

It is the collection and distribution of rainwater for using in daily life, rather than allowing it to run off. Rainwater is generally accumulated from roof tops. Then it is deposited in a reservoir with percolation. It is used for gardening, cultivation and domestic uses. The harvested water can also be used as ground water recharge.

Water shortage is caused by climate change, lack of planning of water uses, rapidly increasing water pollution and increasing population. So, under such conditions some serious steps towards conservation of water must be taken. Rain is a natural source of water. So, if it can be collected and treated, it can be used as potable water. It is a cheap and simple technology, so it can be easily installed in normal households and a lot of water can be saved.

8. Results

Item	**Non-Green**	**Green**
Rainwater Harvesting Plant	Not Present	Present-4
Solar Energy	Not Present	Present-5
Greywater Treatment Filter	Not Present	Present-4
Passive Design Overhangs and Shading Cooling Tunnel	Not Present Not Present	Present-1 Present-1
Sustainable site	Not Present	Present-8
LEED Point	**3**	**23**

Comparison of Green and Non-green

Applications of Green Building	**Energy used by Green Building for 3 persons**	**Energy used by Ordinary Building for 3 persons**
Rainwater Harvesting	3528.0 litres per annum	4,217.0 litres per annum
Solar Energy	4,750 kWh per annum	5,100 kWh per annum

Energy Consumption

Model Representation

9. Conclusion

The study consummates that as much as 40-50% energy saving is possible in green building.

Green Buildings focus solely on the environment.

Using less energy, water, natural resources, creates less waste, and is heal there for the people lining inside compared to a standard building. High initial investment.

Unavailability of workers with experience.

Longer time to build.

Indoor air temperature may vary.

References

1. Avinash Shivajirao Pawar (2012) “Green Building” Journal of Engineering Research and Study (JERS) Vol. III/ Issue I/January-March, /87-90
2. Deepshikha Neogi (2015) “Study of Energy Efficient Building “GREEN BUILDING”International Journal of Engineering Research & Technology (IJERT)Vol. 4 Issue 06, June
3. Dr.Raaz Maheswari (2015) “Green Quotient Evaluation of existing buildings: A Case Study” Journal of Advanced Scientific Research International Journal of Advanced Research, Vol 3, Issue5
4. G.R.K.D. Satya Prasad, Dr. K. Vijaya Kumar Reddy, Dr. Ch. Saibabu (2015) “Hybrid Solar & Kitchen Waste Based Plant for Green Buildings: An Approach to meet the Standards of Zero Energy Buildings” International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 08, Nov
5. Hema.C (2012) “Green Techniques in Building Construction (Concept)” International Journal of Biotech Trends and Technology (IJBTT) Volume2 Issue 2 Number1–March
6. Oindrila Das, Priyanka Bera1, Sanjib Moulick (2015) “Water Conservation Aspects Of Green Buildings” International Journal of Research in Engineering and Technology (IJRET) Vol 04, Special Issue: 13
7. P.D. Aher, Dr. S.S.Pimplikar (2012) “Green Building Design a Sustainable Future” International Journal of Engineering Research and Applications (IJERA) Vol. 2, Issue5, September- October