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A CASE STUDY - ORANGE COUNTY, PHASE 2 GREEN BUILDING

Priyanka P Nangare
Department of Civil Engineering,
Shri Chhatrapati Shivaji Maharaj College of Engineering,
Nepti, Ahmednagar, India
priyankanangare1990@gmail.com

Swati B Gagare
Department of Civil Engineering,
Shri Chhatrapati Shivaji Maharaj College of Engineering,
Nepti, Ahmednagar, India
swatigagare9@gmail.com

Abstract— Nowadays, due to effects of global warming, green building concept will be proved the key to encountered the problems of global warming and to enhance the human life. Green building is the part of global response to increasing awareness of role of human activity in the global climate change. The Green building is a system which deals with the various factors such as environment, water conservation, economical use of electricity, energy efficient material and its planning. As well as "Green building" is defined as "a building constructed with design and construction processes which significantly reduce or eliminate negative impact of buildings on the environment and occupants."

It is necessary to study the impact of green building on environment in comparison with conventional building, in this paper we are going for the same. For that purpose we make the study of green building with respect to parameters like energy saving, water conservation, waste control etc. and further calculation were made and its proved that green building system not only enhance the environmental property but also saves money in the conservation of above parameters.

Keywords— Energy, Green Building, Renewable resources, LEED, Green building.

I. INTRODUCTION

A "Green building" is "a building constructed with design and construction processes which significantly reduce or eliminate negative impact of buildings on the environment and occupants." The term essentially refers to a building which is energy efficient and environment friendly in terms of minimal disturbance to environment during construction and service. Therefore, it encompasses the planning, construction processes and service performance aspects of the building. Green buildings result from integrated design and construction processes which reduce the negative impact of building on the environment and the occupants. Green Buildings are considered to be important component of any model for sustainable urban development. Most of the construction material are obtained from the nature and subsequently processed. The manufacturing of building materials and the construction processes disturb the environment and consume energy. The disturbance to environment includes depletion of ground cover, cutting of trees and soil erosion due to change in land use and excavation. It is necessary to reduce green house gas emissions, save energy and to use more renewable resources.

The Green Building movement started in 1990 with the establishment of the first Green Building rating system in the UK. This was followed by the formation of the US Green Building Council in 1993. The Indian Green Building Council was instituted in 2001. India got its first USGBC LEED Certified Platinum Rated Green Building - CII Sohrabji Godrej Green Building Centre in Hyderabad in 2004.

II. OBJECTIVES OF GREEN BUILDING

i) To conserve natural resources and increase energy efficiency.
ii) To reducing damage to ecology due to construction activity.
iii) Increasing energy efficiency involves harnessing nature to minimize need for electricity for operation and maintenance of the building.
iv) To improve indoor air quality.
v) The green buildings aim at minimizing this damage by adopting appropriate designs and construction procedures. Buildings consume about 31% of global energy. This figure is likely to go up to 38% by 2050. In India, the present consumption of energy in buildings is about 25% of total energy consumption.

III. BENEFITS OF GREEN BUILDING

1) Environment Benefits.

- Reduces environmental impact through energy efficiency and waste recycling.
- Reduction in energy requirements and carbon footprint.
- Green buildings reduce construction waste by approximately 50% compared with that of similar conventional buildings.
- Helps in saving natural resources.

2) Economic benefits.

- Lower operational cost resulting from efficient resource use through reduction in energy and water requirements.
- Green buildings are around 25–30% more energy efficient.
- 70–100% of used water is treated and reused for landscaping and air conditioning. This reduces the load on an area's sewage system.
- Maximizes owner's interest on investment and bottom line of firms.

- Reduces liability & improved risk management for the buildings.
- Additional Revenue through carbon trading.

3) Health & Safety Benefits.

- Increases occupier retention, productivity and satisfaction.
- Improves health through better indoor air quality.

IV. DISADVANTAGES OF GREEN BUILDING

- Initial cost of construction of a green building is high.
- No locally availability of materials.
- Requires advanced technology.
- Requirement of skilled labours.

V. PARAMETERS OF BUILDING

1. ENERGY CONSERVATION

Conservation of electricity by consumers is an easier way, involving no cost, to fill gap. Conservation of electricity is becoming a vital element of economic growth .Conservation of electricity is more essential due to the concern for fast depletion of non-renewable sources of energy in the country. Conservation of electricity necessary to save the environment and the earth from global warming. Switching off electricity when not needed, maximum use of natural light and air, use of energy efficient equipments of correct size etc. are some of the simple methods which save electricity.

2. RENEWABLE ENERGY SOURCES

- Wind energy
- Solar hot water heating (also called solar thermal)
- Solar electricity
- Ground or air source heat pumps
- Biomass and Bio fuels

3. DETAILS OF CASE STUDY

Name of the Green Building project:-Orange County, Phase 2.

Location : Baner-Pashan Link Road, Pune.

Owner : 1) Mr. Sandip Sonigra

2) Mr. Aanand Chhaged.

3) Mr. Tanaji Nimhan.

Purpose of project: Residential purpose.
Consultant: Viraj Envirozing India Pvt Ltd.
Total Area of construction : 21780 sq. ft.

Project highlights: 100% Green energy, STP Plant, Efficient natural light and ventilation.

Cost of the project: 13 crore.

3.1 FEATURES OF ORANGE COUNTY

3.1.1 Innovative Design

India's First of its Kind 100% Self Sufficient Multi Storied Residential Building-Orange County. Orange county is a residential project which is in true sense self sufficient building in terms of electricity, water, sewage and garbage processing. The maximum demand of electricity is 83kvA as against theoretical required capacity of transformer of 630kvA (which is just 18%).The steps taken in innovative design are stated below.

3.1.2 Architectural Planning

Architectural planning of Orange County-phase II is such a that each flat is three sided open which helps to get maximum light and ventilation which ultimately reduces the load on electricity.

Building is planned to have maximum Natural light, Natural ventilation considering local wind data and solar path analysis, which has been confirmed later on by computer simulation. No common wall in between any of the flat which achieves very good cross ventilation. Total area of opening (inlet and outlet) is more than 30% of floor area.

3.1.3 Analysis Of Case Study

1. Water Savings through:- STP by Root Zone Cleaning System.
2. Energy Saving through:-

• Architectural Planning according to Sunlight and ventilation
• Hybrid Power System that includes two Wind Mill and 54 Solar PV Panels.
• One Green Lift.
• Energy Efficient Fixtures.
• Solar Water Heating System.

3.2 DATA ANALYSIS

3.2.1. Hybrid Power Systems

The system has two windmills located on top of the terrace, each of capacity 5KW peak & 36 solar PV Panels, each of capacity 120W and 54 solar PV Panels, each of capacity 144 Watt i.e. totaling to 12.0 KW peak, which will be able to produce, combined together, 22 KW peak i.e. maximum 60 units per day.

3.2.2. Solar Water Heating System

The maximum domestic electrical consumption is attributed to water heating.(approximate 55% of domestic electrical consumption) Therefore to minimize this consumption, Orange County has provided fully

programmable solar water heating system of 5000 LPD i.e. Thus the "Solar Water Heating" System will save at least 7.2 units/flat/day for average 300 days.
i.e. 7.2 × 27 × 300 + 8.7 × 09 × 300 = 81000 units yearly.

3.2.3. STP by Root Zone Cleaning System

The Orange County has this RZCS STP of capacity 35,000 liters. Daily they get treated water of approximately 20,000 liters without any electricity.
Total Energy Produced and Saved Yearly:

For Green Building:

• Solar wind hybrid production system – 60 × 300 = 18000 Units.

• Energy saving using Solar water heating system -- 81000 Units.
But it is consider that 20% people may use other sources of heating water or cold water for bathing. Therefore, only 80% should be considered.

Therefore, energy required for water heating = 81000 x 0.80 = 64800 units.

• Energy consumption using efficient fixtures such as

– T5 Tub Lights -212 Nos × 28W × 6 Hrs × 365 days = 12999Units.

– CFL-162 Nos × 9W × 2Hrs × 365 days = 1064 Units.

– Power saver fans -117 nos × 50W × 6Hrs × 365 days = 12811 Units.

– Green lift – 5KW × 60% × 5Hrs × 365 days = 5475 Units.

– Thus total energy saved =12999 + 1064 + 12811 + 5475 = 32349 units.

For Conventional Building:- Yash Construction

• Production of Electricity within the building- Zero Units.

• Energy consumption required for water heating- 81000 Units.

• Fixtures:-

–Fluorescent Tube Lights- 212Nos × 48W × 6Hrs × 365 days = 22285 Units.

– CFL Bulbs- 162 Nos × 40W × 2Hrs. × 365days = 4730 Units.

– Normal Fans- 117 Nos × 80W × 6Hrs. × 365 days = 20498 Units.

– Lift- 5KW × 5Hrs × 365 days = 9125 Units.

– Total energy consumed due to Fixtures - 56278 Units.

Savings :-

Saving by energy fixtures:- 56278 - 32349 = 23929 Units.

Energy saving in terms of money:
23929 x 6.05 = Rs. 144700.45

Electricity dependency = consumption using fixtures – electricity production =32349 – 18000 = 14349`~14350units.

VI. RESULTS

Total saving of energy at the site = 106729 units.

Amount of coal used to generate 1 unit of electricity = 0.00052 Tonne.

Total saving of coal = 106729 x 0.00052 = 55.50 Tonne.

Saving in CO_2 emission = 106729 x 0.085 = 90 Tonne/year

Table No. 1 Analysis Of Result

SR. NO	PARAMETERS	GREEN BUILDING	CONVENTIONAL BUILDING
01	Energy production using Wind & Solar energy	18000 Units	------
02	Saving due to Water Heating System	64800 Units.	------
03	Consumption using Fixtures.	32349 Units.	56278 Units
04	Saving by Energy Fixtures	23929 Units.	NA
05	Electricity dependency.	14350 Units.	139078 Units
06	Total energy saved at site	106729 Units.	NA
07	Total Saving of Coal.	55.50 Tonne	NA
08	Saving in CO2 Emission	90Tonne/year	NA

VII. CONCLUSION

Building an energy efficient home requires dozens of decisions by home designers, builders, and subcontractors. Many decisions affect the cost of construction and the profitability of the project. While

energy efficiency requires careful planning and attention to details throughout the construction process, it offers substantial benefits to building professionals.

Reduce the impacts of our built environment in areas such as energy efficiency, water conservation, waste reduction, and use of environmentally-friendly materials. Studies show that installing green building technologies can be cost-efficient in the long run .It can create jobs and expand the local tax base to create economically competitive communities. Improving indoor environmental quality creates a healthier environment for the occupants of a building, which may help increase their productivity.

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