

Evaluation of Green Building with Resources and Cost Aspects

Nangare Priyanka Pandharinath.

Address:-Sunita vihar ,Alka gruhnirman society , Near Gite Hospital,Jadhav Mala .Ahmednagar. 414111 India
Phone number :-9175891932/
priyankanangare1990@gmail.com

Pund Gaurav Chandrakant.

Address:-Sunita vihar ,Alka gruhnirman society , Near Gite Hospital,Jadhav Mala . Ahmednagar.414111 India.
Phone number :976399968
g.c.pund@gmail.com

Prof.Warudkar A.A.

Imperial college of Engg.&Research ,
Wagholi ,Pune.

Abstract— Zero energy home, that produces as much energy as it consumes is an idea whose time has come in today's world of climate change and high energy prices. In India there is a small but growing movement towards the design and construction of "green" buildings. To ensure continued growth in the adoption of green building technologies it is important to ensure that customer needs are being addressed and that claims of performance are warranted; this means evaluating the performance and life-cycle costs of new green buildings as they come on line. In this paper the comparison of green building with conventional building with respect to economy is studied. It also includes study of existing green building, by carrying out survey with respect to energy saving, operating cost, saving in electricity water etc.

Keywords- Energy, Comparison, Savings, Green building.

I. INTRODUCTION

Due to tremendous climate change and environmental pressures are to be created the major international issues, to which governments ,businesses and consumers are having to respond through more environmental friendly and aware practices, products. It is necessity that to reduce greenhouse gas emissions, save energy, look to renewable energy sources and more renewable raw materials, and reduce waste. "A green building uses less energy, water and natural resources .It generates less waste and provides a healthy living environment for the occupants." The simplest definition of green building is to build in a way that minimizes environmental impact and creates a healthy indoor environment for occupants. This indicates that there is a real opportunity to develop green buildings in the country. Real estate development uses about 40% of the energy and the prime contributors to global warming due to the emission of Green House Gas caused by the energy used .Buildings in our country consumes about 20% of the country's total electricity and have a significant impact on the environment and resources. India depends on coal to supply 70 percent of its electricity and this contributes to the air pollution. India is expected to develop about 110 million sq ft of green space in the next few years. 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. WHY BUILD GREEN?

A) Environmental Impact of building:-

1. Development without environmental considerations causes serious long term damage to the quality of life of present and future generations.
2. Global warming has been accelerated due to human activity and construction industry.
3. Production of building materials leads to irreversible environmental Impacts.

B)Payback:-

Conventional home = Average building costs of 5625 /sq. ft. = 6750000

Annual energy costs = 135000

Green home = Average building costs at a 2% premium =6885000

Annual energy costs = 101250 (25% savings)

Average payback period = 3 years (without government rebates,4 to 5 years)

C) Environmental Benefits of Green Building

1. Materials and Resources.

- a) It reduces the Waste .
- b) Locally sourced materials and resources.
- c) Minimized material usage due to durability.

2. Water.

- a) Reduced water consumption.
- b) Water reuse and collection

3. Indoor Environmental Quality (IEQ).

- a) 9 to 50% reduction in sickness.
 - b) 20 to 25% reduction in non-specific health and discomfort.
 - c) 9 to 20% reduction in communicable respiratory diseases.
 - d) 18 to 25% reduction in allergies and asthma.
4. Energy and Atmosphere.

- a) *Reduced greenhouse gas emissions.*
- b) *Reduced energy consumption.*

2. FEATURES OF GREEN BUILDING.

Buildings achieves Energy Efficiency through

- Efficient lighting systems.
- Use of Green lift.
- Use of alternative renewable energy sources such as Solar or Wind Energy.
- Effective insulation of walls and roof.
- Use of double glazed Ultra Violet reflective glass to prevent heat gain.
- Use of lime as a plaster material.
- Good management, maintenance & monitoring to facilitate continuous performance improvement Buildings that have Effective Waste Management
- Re-use of construction waste.
- Garbage disposal & Compositing.
- Ensuring Improved Indoor Environment Quality
- Achieving optimum Indoor Air Quality.
- Ensuring maximum daylight and natural views.
- CO2 monitoring through sensors.
- Use of Low VOC adhesives, sealants, paints, etc.

III. PARAMETERS OF GREEN BUILDING

Sr No.	PARAMETERS	TYPICAL BUILDING	GREEN BUILDING
1	Walls	9"-12" Brick Wall.	ACC Blocks or Cellular Concrete Blocks or Cavity wall with rigid insulation with Fly ash Bricks.
2	Roofing	Flat slab-250mm thick.	Roof with at least 75mmwithrigid insulation.
3	Flooring	Floor tiles	Local stone or Bamboo floor tiles.
4	Interior lighting	Tube light and CFL lighting.	T5 with on-off control and day-light

			sensors.
5	HVAC	No Automated system	AHU with larger face area for increased air intake, intelligent BMS control.
6	Water Efficiency	Normal system without recycling water system.	Water treatment plant. Non-potable water is for Landscape use. Gray water reuses for flushing.
7	Building orientation	As per site and design with no Orientation according to Sunlight and ventilation.	consideration of sunlight and ventilation.

Table 1- Comparison of Parameters used in building.

IV. ANALYSIS OF CASE STUDY

For study of economical aspects of Green Building analysis of case study is as follows:

Name of The Project- ORANGE COUNTY-PHASE-2

Location- Baner-Pashan Link Road.

Area- 21780 sq.ft.

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.

Data Analysis:-

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. totalling to 12.0 KW peak, which will be able to produce, combined together, 22 KW peak i.e. maximum 60 units per day.

2. Solar Water Heating System:

The maximum domestic electrical consumption is attributed to water heating.(approximate55%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. $7.2 \times 27 \times 300 + 8.7 \times 09 \times 300 = 81000$ units yearly.

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- $60 \times 300 = 18000$ 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 is , $81000 \times 0.80 = 64800$ units.

- Energy consumption using efficient fixtures such as
 - T5 Tub Lights -212Nos $\times 28W \times 6Hrs \times 365$ days= 12999 Units.
 - CFL-162Nos $\times 9W \times 2Hrs \times 365$ days= 1064 Units.
 - Power saver fans -117nos $\times 50W \times 6Hrs \times 365$ days = 12811 Units.
 - Green lift – $5KW \times 60\% \times 5Hrs \times 365$ days = 5475 Units.
 - Thus total energy saved = $12999 + 1064 + 12811 + 5475 = 32349$ units.

For Conventional Building:

- Production of Electricity within the building- Zero Units.
- Energy consumption required for water heating- 81000 Units.
- Fixtures:-
 - FluorescentTubeLights-212 Nos $\times 48W \times 6Hrs \times 365$ days= 22285 Units.
 - CFL Bulbs- 162Nos $\times 40W \times 2Hrs. \times 365$ days= 4730 Units.
 - Normal Fans- 117nos $\times 80W \times 6Hrs. \times 365$ days= 20498 Units.
 - Lift- $5KW \times 5Hrs \times 365$ 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 : $23929 \times 6.05 = Rs144700.45$

Electricity dependency = consumption using fixtures – electricity production = $32349 - 18000 = 14349 \sim 14350$ units.

V. RESULT

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= $106729 \times 0.00052 = 55.50$ Tonne.

Saving in CO2 emission= $106729 \times 0.085 = 90$ Tonne/year

Analysis of Result:-

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

Table 2 Analysis of Result

VI. CONCLUSION

The economical parameters of the greenbuilding have a wide scope. The construction of greenbuilding should be widely adopted. The green building proves to be economical in the long run .It serves various benefits. While design costs, options, and styles vary, most energy-efficient homes have some basic elements in common: a well constructed and tightly sealed thermal envelope; controlled ventilation; properly to provide a structurally sound, long-lasting house. With proper construction and attention to details, the conventional wood-framed home can be very energy efficient.

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