



## Economical Aspects of Green Building

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### ABSTRACT

Nowadays in our country, the Green Building and Sustainable development is increasing swiftly. It is now well proven fact that the built environment and construction sector is as much a contributor to the Global Warming. The concept and Economics of Green Building is the main focus of our study. This paper explains the concept of Green Building, Benefits and study of Green building in our country. This paper includes the comparison of green building with conventional building with respect to economy and resource saving. It also includes study of existing green building, by carrying out survey with respect to energy saving, operating cost, saving in electricity, water etc. we are showing this comparison. Finally, this paper aims at raising awareness not only within the building sector but in all social bodies to creating green environment.

**Keywords :** Material, Energy, Consumption, Water, Savings Green Buildings.

### 1. INTRODUCTION:-

Climate change and environmental pressures are now well established as major international issues, to which governments, businesses and consumers are having to respond through more environmental friendly and aware practices, products. It is the need of today to reduce greenhouse gas emissions, save energy, look to renewable energy sources and more renewable raw materials, and reduce waste.

Real estate development uses about 40% of the energy and it is one of 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. Adoption of Green concept is the need of India. In the next 3-4 years about 200 million sq ft of commercial space and 45 million of retail space is expected to be constructed across the major cities of India which indicates that there is a great opportunity for developers and occupiers to promote green buildings. 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.

"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.

### 2. WHY BUILD GREEN?

#### 1) 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.

#### 2) 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)

#### 3) Other Financial Benefits:-

**Property value** – Green Buildings show higher property values and average sale price increases of more than 900 ₹ per sq. ft.

**Decreased demand on infrastructure** – High Performing Buildings demand less energy and water, which decreases the strain on common resources and allows infrastructure capacity to extend farther.

**Improved sales** – 40% increase in sales.

**Investment decision** – LEED buildings have an ROI of 15 to 20% just based on energy efficiency measures.

**4) Environmental Benefits of Building Green**

**A. Indoor Environmental Quality (IEQ).**

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

**B. Energy and Atmosphere.**

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

**C. Materials and Resources.**

- a) Waste reduction.
- b) Locally sourced materials and resources.
- c) Minimized material usage due to durability.
- d) Renewable resources.

**D. Water.**

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

**3 . TYPICAL GREEN BUILDING FEATURES:-**

- I. Buildings achieves Energy Efficiency through
  - Appropriate orientation of the building.
  - Efficient HVAC systems.
  - 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.
  - Good management, maintenance & monitoring to facilitate continuous performance improvement
  - Use of reflective material on roofs like Albedo roof finish.
  - Use of lime as a plaster material.
- II. Buildings that ensure Water Efficiency through
  - Recycling of waste water.
  - Rain Water Harvesting Systems.
  - Water saving fixtures.
  - Sewerage Treatment Plant.
  - Water efficient landscaping.
- III. Buildings that use local/recycled material for construction
  - Use of rapidly renewable materials such as fly ash blocks.
  - Recycling of material from the construction site.
  - Use of construction materials available locally.
- IV. Buildings that have Effective Waste Management
  - Re-use of construction waste.
  - Garbage disposal & Compositing.
  - Recycling of waste water.
- V. 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.
- VI. Buildings using efficient and integrated Building Management Systems.
- VII. Buildings that use innovative design features to achieve sustainable development.

**1. PARAMETERS OF 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 75mm with rigid insulation.
3	Roofing Protection	Normal roof protection with normal water proofing.	Membrane water-proofing topped up with light coloured roof china mosaic or other high albedo roof finish.
4	Flooring	Floor tiles	Local stone or Bamboo floor tiles.
5	Interior lighting	Tube light and CFL lighting.	T5 with on-off control and day-light sensors.
6	HVAC	No Automated system	AHU with larger face area for increased air intake, intelligent BMS control.
7	Water Efficiency	Normal system without recycling water system.	Water treatment plant. Non-potable water is for landscape use. Gray water reuses for flushing.
8	Building orientation	As per site and design with no consideration of sunlight and ventilation.	Orientation according to sunlight and ventilation.

**Table 1- Comparison of Parameters used in building.**

**5. 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.

**6. 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.

7.1 Features-

**1. 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.

**2. Water Savings through:**

STP by Root Zone Cleaning System.

**7.2 Data Analysis:**

**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. 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.(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.  $7.2 \times 27 \times 300 + 8.7 \times 09 \times 300 = 81000$  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.

**7.3 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.
- Energy consumption using efficient fixtures such as
  - T5 Tub Lights - $212 \text{Nos} \times 20\text{W} \times 6\text{Hrs} \times 365 \text{ days} = 9285$  Units.
  - CFL- $162 \text{Nos} \times 30\text{W} \times 2\text{Hrs} \times 365 \text{ days} = 3547$  Units.
  - Power saver fans - $117 \text{nos} \times 30\text{W} \times 6\text{Hrs} \times 365 \text{ days} = 7686$  Units.
  - Green lift -  $5\text{KW} \times 60\% \times 5\text{Hrs} \times 365 \text{ days} = 5475$  Units.
  - Thus total energy saved =  $25993$  Units, say  $26000$  Units.
  - Thus total electricity consumption =  $26000 - 18000 = 8000$  Units.
- i.e. 8000 units is the only dependency on country's electricity generation. Hence the Total CO2 emission saved -185 Tones / year.

**For Conventional Building:**

- Production of Electricity within the building- Zero Units.
- Energy consumption required for water heating- 81000 Units.
- Fixtures:-
  - Fluorescent Tube Lights-  $212 \text{Nos} \times 40\text{W} \times 6\text{Hrs} \times 365 \text{ days} = 18571$  Units.
  - Incandescent Bulbs-  $162 \text{Nos} \times 60\text{W} \times 2\text{Hrs} \times 365 \text{ days} = 7095$  Units.
  - Normal Fans-  $117 \text{nos} \times 75\text{W} \times 6\text{Hrs} \times 365 \text{ days} = 19217$  Units.
  - Lift-  $5\text{KW} \times 5\text{Hrs} \times 365 \text{ days} = 9125$  Units.
  - Total energy consumed due to Fixtures- $54000$  Units.
  - Total energy consumption in Conventional Building-  $81000 + 54000 = 135000$  Units.
  - i.e. total energy requirement is dependent on country's electricity generation.

**8. RESULT:**

- Electricity generated in building itself =  $99000$  Units
- Total saving in terms of Money =  $99000 \times 7.5 \text{ ₹} = 742500 \text{ ₹}$
- Amount of coal used to generate 1 Unit of Electricity =  $0.00052$  Tonne.

SR. NO.	PARAMETERS	GREEN BUILDING	CONVENTIONAL BUILDING
1.	Energy production using Wind and Solar energy.	18000 Units	—
2.	Saving due to Water Heating System.	81000 Units	—
3.	Consumption using Fixtures.	26000 Units	54000 Units
4.	Saving by Energy Fixtures.	26000 Units	—
5.	Electricity consumption.	8000 Units	135000 Units
6.	Total Saving in terms of Money.	742500 ₹	—
7.	Total Saving of Coal.	51.5 Tonne	—
8.	Saving in CO2 Emission.	83.65 Tonne/year	—

**Table 2- Analysis of Result.**

**9. CONCLUSION:**

This paper concludes that the adoption of Green Building leads to the saving in economy of the customers. The Green Building not only saves money of the customers but also leads to the saving in the energy and water consumption. This will ultimately save the natural resources that are getting depleted nowadays. So the Green Building concept should be widely utilized to protect our environment and it will be a boon to the future generation.

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