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GREEN BUILDING TECHNOLOGY

AN ECO-FRIENDLY SUSTAINABLE DEVELOPMENT

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ABSTRACT

Green building is generally defined as a building, which utilizes less external energy and is capable of producing ample amount of energy for its intended use itself without causing harm to the environment.

Building energy design challenges make designers to think about climate, orientation, delighting and the qualities of environment as a part of initial design conception. Architects and engineers who incorporate energy design concepts and method into their design projects can play a significant role in reducing energy consumption and achieving sustainable energy structure for our society. The building design should being with understanding of the physiological needs of human comfort and take advantage of local climate elements so it is a need to optimize these requirement naturally and efficiently. The present paper brought out the need to adequately understand the demand side of the energy requirement for the modern building and plans an energy efficient building with a critical analysis of the various parameters with Existing approach to the "Sustainable Green Building System".As the green construction is the most upcoming field for the future to be safe to the environment. Leading organizations striving for the environment give credits and ratings for using green building technology .today when effects of global warming are striking. Only solution that would prove vital for us is use of green technology in construction and infrastructure activities from our part to stop the harmful effects which can lead to end of this world.

Keywords: - Design Analysis and Aspects, Non Conventional Energy Resources, Green Building

I. INTRODUCTION

Construction, real estate and infrastructure development are the sun-shine industries of India. As per some estimates construction sector contributes to 10% of India's GDP. This sector is growing at a rate of 9.2% against the world average of 5.5%. It is expected that these sectors may soon account for nearly 50 billion US $ business in India. However, construction and creation of office commercial and residential buildings cause serious impact on Environment during erection and subsequently during its operation. Buildings account for 33% of all energy consumption, 12% of all water use, 30% of all greenhouse gas emission, 65% of all waste out put and 70% of all electricity consumption. India is already facing a serious environmental crisis. Pollution of water air and soil has reached alarming proportions. Besides, we already have a major power crisis on hand and

threat of global warming and pressure on India to cut emissions is going to force us to rethink on our energy consumption patterns. In view of the above, Green Building concept and Green construction has recently emerged as important areas in India and have caught the imagination of builders, planners and environmentalists.

Importance of Building Energy Efficiency

Buildings are significant users of energy and building energy efficiency is a high priority in many countries. Efficient use of energy is important since a global energy resource is finite and power generation using fossil fuels (such as coal and oil) has adverse environmental effects.

II OBJECTIVES

a. This present study will meet following objectives
b. To examine existing system of the energy requirement.
c. To make a comparative study of the existing and proposed green building system.
d. To study a existing township project with the green building system

III NEED OF STUDY

a. To enhance a building's overall performance while improving comfort; indoor air; energy, water and materials efficiency; and the bottom line.
b. To optimize the energy requirement naturally and efficiently.
c. To adequately understand physiological needs of human comfort and take advantage of local climate elements

IV METHODOLOGY

A green building depletes the natural resources to the minimum during its construction and operation. The aim of a green building design is to minimize the demand of non-renewable resources, maximize the utilization efficiency of these resources, when in use, and maximize the reuse, recycling, and the utilization of renewable resources. In sum, the following aspects of the building design are looked into in an integrated way in a green building.

A) Small – scale wind turbines

This rooftop – mounted urban wind turbine charges a 12 volt battery and runs various 12 volt appliances within the building on which it is installed. Wind turbines have been used for household electricity generation in conjunction with battery storage over many decades in remote areas. Household generator units of more than 1 kW are now functioning in several countries.

B) Energy saving

The use of energy in a building can be reduced by adopting some new techniques and equipments instead of using old conventional equipments for household works such as

i) Solar water heater

A Solar Water Heater (SWH) is a device that uses solar energy to heat water. Solar Water Heater has several advantages over conventional water heating systems. They require little or no care and attention while providing hot water for about 300 days in a year in most parts of India. For society at large, they reduce the need for fossil fuels for electrical generation and for fuels such as firewood, coal, furnace oil, etc, that are used in domestic, commercial and industrial boilers. Thereby, they also reduce degradation of the environment.

ii) Solar lantern

A Solar lantern is a simple application of solar photovoltaic technology, which has found good acceptance in rural regions where the power supply is irregular and scarce. Even in the urban areas people prefer a solar lantern as an alternative during power cuts because of its simple mechanism. The operation is very simple. The solar energy is converted to electrical energy by the SPV panel and stored in a sealed in a sealed maintenance-free battery for later use during the night hours. A single charge can operate the lamp for about 4-5 hours.

C) Saving Water

i) Xeroscaping

Xeroscaping means the conservation of the water and energy through creative landscaping. This word is derive from the Greek word xeros meaning dry and these plants can live, once established, with little or no supplemental watering. Some are drought tolerant. It is recommended that:

1. The landscape should be a mix of native shrubs and xeroscape plants.
2. Reduce the lawn area, and plant more of trees that require no water alter Establishment.
3. Plant palm trees, which are xerophytes such as phoenix dactylifera, yucca starlight.
4. Use ground covers such as asparagus sprengeri, which is succulent, pandanus dwarf, which is Xerophytes and Bougainvillea, which is a climber.

Ii) Drip Irrigation:-

Drip irrigation system or sub-surface drip irrigation system results in saving of water as it avoids loss of water due to run-off, deep percolation, or evaporation.

Native Vegetation:-

Native vegetation is original to a particular place, including trees, shrubs and other plants.

Efficiency of irrigation system:-

Irrigation efficiency refers to the ability of an irrigation system to deliver water to plants without evaporation or other means of water loss.

Iii) Sprinkler Irrigation:-

Sprinkler irrigation is a method to natural in which water is distributed through a system of pipe. For maintaining uniform distribution of water, the pump supply system, sprinklers and operation conditions must be designed appropriately. Sprinklers are most suited to sandy soil with high infiltration rates. The average

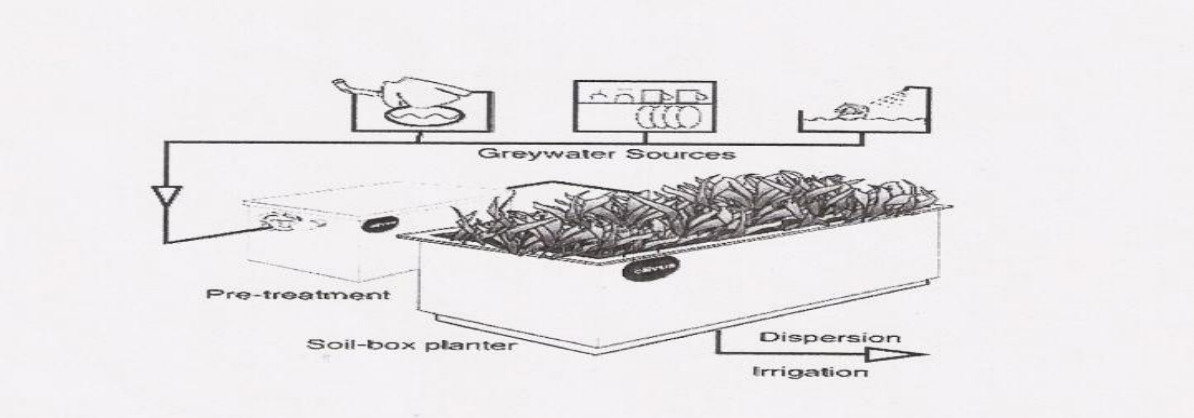
application rate should be less than the basic infiltration rate of the soil so as to avoid surface ponding and run-off. It is better to use sprinklers that produce fine sprays and not those that produce larger water droplets.

Iv) Rain Water Harvesting

Rainwater harvesting in urban areas can have modified reasons. To provide supplemental water for the city's requirement, to increase soil moisture levels for urban greenery, to increase the ground water table through artificial recharge, to mitigate urban flooding and to improve the quality of groundwater are some of the reason why rainwater harvesting can be adopted in cities. In urban areas of the development world, at a household level, harvested rainwater can be used for flushing toilets and washing laundry. Indeed in hard water areas it is superior to mains water for this. It can also be showing for showering or bathing. It may require treatment prior to use for drinking.

V) Grey Water Management

Grey water is defined as the wastewater produced from baths and showers, clothes washers, and lavatories. The wastewater generated by toilets, kitchen sinks, and dishwashers are called black water. The primary method of grey water irrigation that will be discussed is through sub-surface distribution.



Vi) Solid Waste Management:-

Solid waste management includes all activities that seek to minimize the health, environmental and aesthetic impacts of solid wastes.

Solid waste can be defined as material that no longer has any value to the person who is responsible for it, and is not intended to be discharged through a pipe. It does not normally include human excreta. It is generated by domestic, commercial, industrial, healthcare, agricultural and mineral extraction activities and accumulates in streets and public places. The words "garbage", "trash", "refuses" and "rubbish" is used to refer to some forms of solid waste.

Compost is created by the decomposition of organic matter such as yard waste. Compost systems confine compost so that it can receive air and create suitable temperatures for proper decomposition into fertilizer.

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D) Guidelines for domestic solid waste management

a) Commercial available prefabricated compost bins.

b) Require little or no site preparation.

c) They are placed at a convenient outdoor location with easy access and low visibility.

E) Various Design Features of Green Building Are

a) Environment friendly material.

b) Orientation.

c) Water conservation techniques.

d) Energy efficient lighting

e) Energy efficient air conditioning.

f) Solar energy.

g) New compact biogas plant.

F) Environment Friendly Material

a) Siporex material.

b) AAC blocks.

c) Low VOC paints.

d) Roof gardening

a) Siporex Material

The Siporex material provides us with floor, wall, roof slabs etc. They are completely inorganic, they totally incombustible and offer twice the fire protection of concrete. It is ideal for fire wall and for fire protection of structural steel.

Advantages : -

1. They provide us with more carpet area.
2. Saving in cement, steel, construction supervision costs, construction time, water requirement for construction, timber required for conventional system for centering and form work.
3. Uniform quality due to mass production in the factory.
4. Convenient for use in congested areas and water deficient areas.

b) AAC blocks

1. Thermal performance (k = 0.14 W/m deg. K) is 5 times better than clay bricks and 10 times better than RCC.
2. The AAC bricks can with stand fire for 240 minutes.
3. Average temperature on unexposed surface for 200 mm thick wall was found to be 52°C against 1200°C on exposed surface.

c) Low VOC paint

The paint used should be low VOC because the content of air pollutants in these paints is less as compared to normal paints. Thus using these paints in our houses protects us from the harmful effects of these elements.

d) Roof Gardening

The roof gardening provided should be at least 60% of the roof area. This avoids the heat gain from the slab thus requiring less energy for cooling. Installation of high reflecting roof coating or paint is most cost effective if done during new construction.

HVAC Systems and Orientation play crucial role in design and construction of green buildings. Thermal storage systems (such as ice thermal storage) are also being studied to achieve energy cost saving. Although in principle they will not increase energy efficiency, they are useful for demand-side management.

V. DESIGN AND COST ANALYSIS

For the better understanding of the green building concept, residential apartment building was considered to adequately understand the demand side of the energy requirement for the modern building and plan an energy efficient building with critical analysis of the various parameters with existing approach to the "Sustainable Green Building System"

Design of energy efficient systems for
"Suryaoday" Apartment

Total no. of flats = 5 nos
Population = 25 nos
Electricity connection = 6 nos
Water Connection = 3 nos

Following parameters considered for designing a green building for above mentioned existing residential building

A) Urja Economical Biogas Plant:- This plant is made using sintex tanks. There are two tanks used one for digester and other for gas holder. There is inlet and outlet provided to digester tank for feeding waste material and taking out digested slurry. Slurry is used for gardening. Gas is stored in the gas holder and is being used for cooking. There is moderate pressure sufficient for cooking but not comparable with LPG pressure its calorific Value is less than LPG. (Calorific value is less than LPG is 8000 Kcal and Biogas 5000 Kcal.)
Cost of Biogas plant (Capacity 20 kg Waste per day) = Rs. 50,000/-

Advantages of URJA Biogas Plant

a. Smokeless cooking gas
b. Manure as a byproduct
c. 7 lit. food waste gives 1 Cu. Meter of Biogas

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d. 1 Cu. Meter of Biogas=600 ml Kerosene = 3.5 kg fire wood = 1.5 kg charcoal = 400 gms of LPG = 4.7 units of electricity

e. Decentralization of energy generation

f. Environmental balance / pollution control

B) Roof Rain Water Harvesting

Considering the building with a flat terrace area of 125 sq.m the average annual rainfall is 750 mm i.e. 30". The rainwater to a height of 750 mm is collected in one year without any lost of water.

Volume of water can be calculated as follows

Area of terrace = 125 sq.m

Height of rainfall = 0.75 m

Volume = 125 X 0.75

= 93.75 cu.m

= 93750 litres

Formula:

1) Total quantity of water = Roof Top Area x Average Monsoon Rainfall (m) x 0.8 to be collected

2) Where, 0.8 is Runoff Coefficient Assume, 60% of total rainfall is harvested.

Volume = 93750 X 0.60

= 56250 litres

Family needs 295650 litres of water per year. i.e. 84000 litres/day

Requirement of water for 7 days = 84000 X 7

= 588000 litres

Quantity of water still required = 588000 – 215600

= 372400 liters

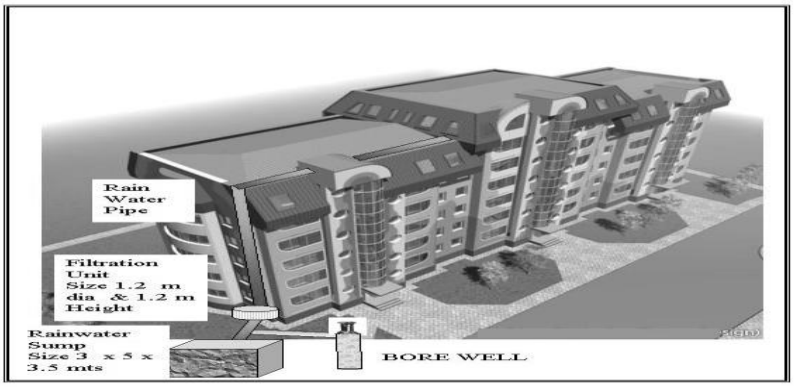

Figure :- Rainwater Harvesting System for a Residential Building

Hence, for existing building

Cost of lighting the whole appt = [Total cost of tube light

Total cost of incandescent bulbs] X 5

= (1600+120) X 5

= Rs. 8600/-

For Green building,

Cost of lighting the whole appt = [Total cost of CFL] X 5

= 2520 X 5

= Rs.12600/-

TABLE I

Specification	Tube lights (40w)	Incandescent Bulb (60 w)	CFL (22W)
Master Bedroom	1		1
Store room		1	1
Study room	2		2
Attach toilet		1	1
W.C.B		1	1
Bath		1	1
Bedroom	1		2
Living room	2		2
Kitchen	1		1
Lobby	1		1
Verandah		1	1
Staircase		1	1
Total	8 nos	6 nos	14 nos
Cost	Rs .200/- each	Rs 20/- each	Rs. 180/- each
Total cost	Rs .1600/-	Rs. 120/-	Rs. 2520/-

Table 1: - Tube lights/ Incandescent Bulbs Vs CFL Bulbs (For 1 flat)

Note:- Cost of tube lights, incandescent bulbs and CFL bulbs includes cost of fitting accessories and labour charges

Energy saving = [(40X8X5) + (60X6X5)]-[22X14X5]

(in Watts) = 1860 watts

C) Solar-Wind Hybrid System

Total cost of Solar-Wind Hybrid System= Rs. 4, 25,000/-

Including storage batteries.

VI. COMPARISON BETWEEN EXISTING AND GREEN BUILDING WITH COSTING ASPECT

For the Apartment Building with same & size and orientation if the green building concept is implemented than the cost of the project will be as follows.

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A) EXISTING BUILDING

I. Non-recurring Cost

1. Lighting Cost = Rs. 8600/-
2. LPG Cylinder Booking = Rs. 2000 X 5 =Rs. 10000/-
3. MSEB deposit = Rs. 2500 X 6 = Rs. 15000/-
4. Municipal Corporation water = Rs. 1800 X 3
   connection deposit = Rs. 5400/-
   Total Non-recurring Cost = Rs. 39,000/-

II. Recurring Cost

1. MSEB Electricity charges = Rs. 36000/-
2. Municipal Corporation water charge = Rs. 1800 X 3 = Rs. 5400/-
3. LPG gas charges = Rs. 300 X 5 X 12
   = Rs. 18000/-

Total Recurring Cost per year = Rs. 59,400/-

B) GREEN BUILDING

I. Non-recurring Cost

1. Solar-Wind Hybrid System = Rs. 4, 25,000/-
2. CFL Bulbs = Rs.12,600/-
3. Rainwater harvesting System = Rs. 20, 000/-
4. Urja Biogas Plant = Rs. 50,000/-
5. Other cost = Rs. 40,000/- [Sprinkler system, vermiculture, Xeroscaping, Roof gardening.etc]

Total Non-recurring Cost (Approx) = Rs. 5, 50,000/-

II. Recurring Cost

Recurring cost only includes maintenance cost that is very negligible compared to other cost. Hence, it is not considered.

III. Comparison between the expenditure required for existing building with green building.

a) Recurring Cost for Existing = Rs. 59,400/-
   Building per year
b) Interest on Non-recurring Cost = Rs. 3510/-
   (per year @ 9%)
c) Therefore, Total Cost required = Rs. 62,910/-
   for existing building per year
d) Non-recurring cost of green building = Rs. 5, 50,000/-

- Interest on Hybrid system of Rs. 4,25,000/- @ 2% = Rs. 8500/-
- Interest on other green building systems= Rs. 15,000/-

(Of Rs. 1, 50,000/- @ 10%)

Therefore, total expenditure on = Rs. 24, 500/-
Green Building per year
Therefore, Net Saving per year = Rs. 62,910 - Rs. 24, 500
if above used Green Building Systems are

VII. CONCLUSION

A) Study Findings

Green Building

1) Minimize the demand for non-renewable resources.
2) Utilize these resources in most efficient manner.
3) During operation aim for reuse, recycling and utilization of renewable resources like water, energy and other materials.
4) Utilize efficient building materials and construction practices.
5) Optimize the use of onsite sources and sinks by bioclimatic architectural practices.
6) Use minimum energy to power it.
7) Use efficient equipment to meet its lighting, air conditioning and other needs.
8) Use renewable energy (like solar, biomass, wind energy) to the maximum extent possible.
9) Are embedded with efficient water saving devices.
10) Recycle wastewater and treat it in environment friendly way using minimum energy.
11) Green building design has no set principles.

It is a practice of increasing the efficiency of buildings and their use of energy, water and materials and reducing building impacts on human health and the environment through better sitting, designing, construction, operating, maintaining it. It is a complete environmentally conscious building cycle.

Green building does not compromise on comfort of indoor environment but actually contribute to it. Green building construction and operation is a collective effort of developer, architect, plumber, electrician, and contractor all of them to conceive, develop and operate a green building. It is a process of critical valuation of each step to arrive at viable design solutions to minimize the negative impact and enhance the positive aspects on the environment.

B) Recommendations

Green buildings should be seen as a part of overall sustainable development sweeping the entire world. Green buildings reduce the impact of natural resource consumption; improve the bottom-line and minimize the strain on local infrastructure. Green buildings offer on image to builder and provide better opportunities of sound public relations. For commercial building; it provides better health for employees and their productivity. Hence it is recommended that

The concept of "GREEN BUILDING" should be adopted by all the construction company for the ecofriendly approach and thus, it will be possible to achieve environment friendly characteristics and also sustainability in the huge building construction industry.

C) Way Forward

To think and transact globally for the cause of social development we have started two years before a social group INDIAN DREAMERS. The aim of this group is to solve the problems of society through our engineering knowledge. We have surveyed the far flung rural areas in tribal regions in Ahmednagar district. This was our first project that we initiated with the help of NGO. Under this project, the energy requirements for the tribal ashrams are to be fulfilled through locally available renewable and non conventional energy resources

This "Green building" project have been initiated by a NGO called Kisan Kranti Krushi Vikas Pratishthan from Ahmednagar and with the help of them this project is to be sent for approval to the Central Govt. of India.

Already the first phase of the green building project i.e. Rainwater harvesting System has been designed for the tribal ashram schools and is on way of execution. Our next project is planning and designing an Eco-Mansion Community Center for unprivileged people incorporating green building technology with prime focus on cost optimization.

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