

Green Technology- A review

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Abstract: The term ‘Green Building’ is quite new and unfamiliar to people and the construction industry. In the present paper, the concepts of green building, its advantages to the environment and humans are studied and a building is designed using its concepts. A green building is shown in this article that is environmentally friendly and resource efficient using renewable energies such as wind, solar, and hydro energy. The term environmentally friendly means constructing a building safe for the surrounding such as it emits less harmful gases. Green building will not affect the environment i.e. it reduces air pollution, water pollution and global warming. The study has shown the plantation of various brushes for reducing carbon dioxide in building environment. Also the models of conventional equipments, used for utilizing the renewable energies, like biogas digester, pellet stove, weather vane, and solar cooker are created.

Keywords: Green building, environment, renewable energy, global warming

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I. INTRODUCTION

“Building Green is Building the Future!” It means that it is needed to make every proposed building by Green Technology and convert existing building with Green technology so that they become eco-friendly. A green building is the one in which the use of water is less due to the materials used in construction that require less water and uses water efficient fixtures such as rain water harvesting, and dual flush toilets. Green optimizes energy efficiency with the use of various green appliances like solar water heater and solar cooker. It conserves non-renewable natural resources by using renewable energies like solar, wind and hydro, and it provides healthier spaces for occupants as carbon emission is less in it, as compared to a conventional building.

A green building is a structure that is environmentally friendly and resource efficient using renewable energies such as wind, solar, and hydro energy. The term environmentally friendly means constructing a building safe for the surrounding such as it emits less harmful gases. Green building will not affect the environment i.e. it reduces air pollution, water pollution and global warming. The difference between a green building and a conventional building is as follows:

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Green Building	Conventional Building
It is a structure which consists of appliances which use renewable forms of energy such as solar energy, wind energy, and hydro energy and optimizes the efficiency.	It is a structure which uses the technologies that are not energy efficient i.e. it extract energy from non renewable resources such as coal, natural gas, gasoline.
It is healthier, more durable, more comfortable and has less impact on environment such as it reduces air pollution, waste, global warming.	It is not much healthier, durable, and comfortable and has greater impact on environment than green building.
Renewable materials are used in the building such as waste which is used in the process of biomass to produce energy	To produce the energy, conventional building use non renewable resources.

1.1 Advantages of Green Building

- Reduced energy consumption by using various types of equipments such as solar panels, solar cooker, and biogas.
- Reduced air pollution by using biogas in kitchen, less emission of carbon from building and reduced water pollution by using rain water harvesting technique etc.
- Limited waste generation due to recycling and reuse.
- Reduced energy consumption provides financial benefits for the building owners.
- Maximizes the use of renewable sources of energy such as solar energy, wind energy and uses efficient water management practices i.e. rain water harvesting.
- Though initial cost is higher, a green building becomes economical over its lifetime due to reduced energy bills and less maintenance than conventional buildings.

1.2 Purpose of Green Building

- The common objective of green building is to reduce the overall impact i.e. air pollution, water pollution, global warming of the environment by efficiently using energy i.e. solar energy, wind energy, water, and protecting occupant health by providing proper ventilation.
- The another objective of a green building design is to minimize the demand on non-renewable resources such as coal, natural gas, by using efficient equipment to meet its lighting, air-conditioning by proper ventilation & by constructing insulating wall, ceiling and floor.
- Increase use of recycled and renewable materials in new construction and renovation projects; reduce construction waste.

II. GREEN BUILDING

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

- Efficiently using energy and water.
- Protecting occupant health.
- Reducing wastes, pollution and environmental degradation.

The various materials generally used in green buildings, plants and bushes planted for fresher and oxygenated air, the efficiency of a green building in comparison to conventional buildings as well as the rating system adopted by the Indian Green Building Council (IGBC) are included.

2.1 Materials

The various types of materials are generally used in practice to make a building green. Some of the following materials can be used:

2.1.1 Fly Ash Concrete

The use of fly ash in concrete has a wide acceptance. Fly ash is a fine, glass like powder obtained as a residue after burning of coal. Fly ash consists mostly of silica, alumina and iron. It is a pozzolan i.e. a substance containing aluminous and siliceous material that forms cement in the presence of water. The properties are Density of fly ash= 2.31 gm/cm^3 , Specific surface area = $3960 \text{ cm}^2/\text{gm}$ & Compressive strength of fly ash bricks is about 100kg/cm^2 .

2.1.2 AAC (Autoclaved Aerated Concrete) Blocks

Autoclaved Aerated Concrete block is a precast structural product made with natural raw materials. In 1914, the Swedes discovered a mixture of cement, lime, water and sand that expands by adding aluminum powder. The material was further developed to what we know today as autoclaved aerated concrete. It is also known as Autoclaved Cellular Concrete. The properties are Density of AAC block = 400 to 650 kg/m^3 , Characteristic compressive strength = 2.5 to 7.5 N/mm^2 & Weight of AAC blocks = 7.8 to 21 kg (As per client's requirement)

2.1.3 Composite Wood

Wood is the harvested material most commonly used in buildings and building products. Wood has low thermal conductivity and good insulating properties. Wood is durable, and wood-framed buildings can be easily adapted to meet new needs and extend their life. After decades or even centuries of use, wood can be reused in new buildings and this requires little or no energy. Wood products such as plywood, particle board, and paper are used extensively throughout the construction industry. Dimensional lumber i.e. timber that is cut to standardized width and depth, is used in framing the majority of residential buildings and many commercial structures.

2.1.4 Natural Clay Plaster

In temperate and tropical climates, natural clay and lime plasters can be a green exterior finish material. Natural clay plaster is a practical, environmentally friendly material that can be used instead of paint to decorate interior walls and ceilings. This nontoxic covering doesn't emit harmful volatile organic compounds.

2.1.5 Glazing

Windows and skylights allow daylight to reach the interiors of buildings, reducing the need for artificial lighting. Improved glazing techniques offer low-emissivity glass and inert gas-filled air spaces between panes. Low-E glass acts as a radiation mirror, reflecting infrared (heat) rays back to the source. This prevents solar heat gain in the summer and retains heat within the building during the winter. Double glazed windows give an insulation keeping the noise out, i.e. they are sound proof. Double Glazing significantly reduces the costs of heating and cooling and contributes to a reduction in greenhouse gases

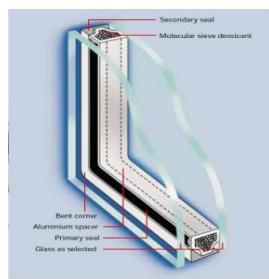


Fig. 1: Glazing

2.1.6 Paper Insulation

Made from recycled newspapers and cardboard, paper-based insulation is a superior alternative to chemical foams. It includes borax, boric acid, and calcium carbonate (all completely natural materials that have no associations with health problems). It is insect resistant and fire-retardant. Paper insulation can be blown into cavity walls, filling every crack and creating an almost draft-free space.

2.1.7 Ceramic tile flooring

Ceramic tile is a beautiful, inert material used for durable finishes. Ceramic tiles are available in a wide variety of colors, sizes and textures and require minimum maintenance. Recycled-content ceramic tiles are friendlier to the environment through use of up to 100% recycled glass. Ceramic tiles are often more durable moisture-resistant, and stain-resistant.

III. TECHNOLOGIES

There are number of new technologies that are being used in the construction of green buildings now-a-days.

3.1 Passive Solar Design

Passive solar design incorporate features in your home that harnesses the sun's low rays in winter and deflects the sun's high rays in summer to naturally warm and cool the interior. It incorporates the use of windows, walls, and floors to collect, store, and distribute solar energy in the form of heat in the winter and block solar heat in the summer.

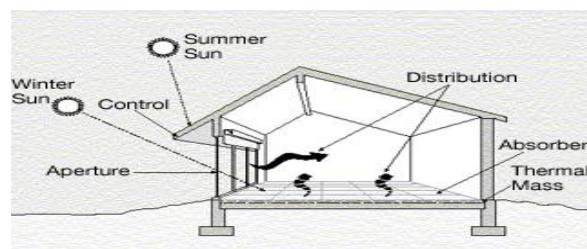


Fig 2: Elements of passive solar design, shown in a direct gain application

3.2 Rain Water Harvesting

- Rainwater harvesting is the accumulation and deposition of rainwater for reuse before it reaches the aquifer.
- Rainwater harvesting from roofs consists of collecting, storing and putting to use the rooftop rainwater from houses or any construction is rooftop rainwater harvesting.
- Rainwater harvesting can also be collecting, filtering and recharging ground water through percolation pits, open wells or bore wells.

3.3 Energy Efficient Lighting

Electric lighting consumes up to 25% of the average home energy. The electricity used over the lifetime of a single incandescent bulb costs 5 to 10 times the original purchase price of the bulb itself. Hence there is a need of energy efficient lighting. Light Emitting Diode (LED) and Compact Fluorescent Light (CFL) bulbs have revolutionized energy-efficient lighting.

3.4 Dual Flush Toilets

A dual-flush toilet is a variation of the flush toilet that uses two buttons or handles to flush different levels of water.

The main feature of the toilet is that it has two buttons for releasing water. It outputs water in both 0.8-gallon (3 litres) and 1.6-gallon (6 litres) capacities. The smaller level is designed for liquid waste, and the larger is designed for solid waste

IV. APPLIANCES

There are various appliances that can be used in green building practices for the efficient use of energy. Solar lanterns, solar home lighting systems, solar power inverter, solar water heaters, biogas, pellets stove are some of the green appliances generally used in green building.

4.1 Government Schemes for Appliances

4.1.1 National Biogas and Manure Management Programme

The Central Sector Scheme on National Biogas and Manure Management Programme, which mainly caters to setting up of family type biogas plants, has been under implementation since 1981-82. National Biogas and Manure Management Programme provides for central subsidy in fixed amounts.

Sr. No .	Items for Central Financial Assistance (CFA)	Family type Biogas Plants under CDM		Family type Biogas plants under NBMMP**	
		1 cum	2-4 cum	1 cum	2-4 cum
A. Central Financial Assistance to beneficiaries of Biogas Plant (in Rs. per plant)					
1.	NER States, Sikkim (except plain areas of Assam)	11,700	11,700	14,700	14,700
2.	Plain areas of Assam	9,000	9,000	9,000	10,000
3.	Jammu & Kashmir, Himachal Pradesh, Uttrakhand , Niligiri of Tamil Nadu, Sadar Kursoong & Kalimkpong Sub-Divisions of Darjeeling, Sunderban s (W.B.) and Andaman & Nicobar Islands	3,500	4,500	4,000	10,000
4.	All Others	2,100	2,700	4,000	8,000

Table 1: Financial Assistance under National Biogas and Manure Management Programme

The Ministry of New and Renewable Energy, govt. of India also has schemes for solar appliances, and biomass cook stoves.

V. PLANTS AND BUSHES

Plants and bushes reduce the pollutants from the air and increase the oxygen content of the environment. Some plants for example, Shatavari (*Asparagus racemosus*), Aloe Vera, Tulsi (*Ocimum tenuiflorum*), Money Plant (*Epipremnum aureum*), Gerbera Jamesonii (Gerbera Daisy) that can be planted in houses to improve the indoor air quality of the building.

VI. RATING SYSTEM

Leadership in Energy and Environmental Design (LEED) is a rating system for the design, construction, operation and maintenance of green buildings. Development of LEED began in 1994 under the U. S. Green Building Council.

Indian Green Building Council has licensed the LEED Green Building Standard from the U.S. Green Building Council and currently is responsible for certifying buildings in India. LEED-INDIA provides building owners, architects, consultants, developers, facility managers and project managers the tools they need to design, construct and operate green buildings.

6.1 LEED (Leadership in Energy and Environmental Design)

LEED is a measurement system designed for rating new and existing commercial and institutional buildings. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts.

There are various criteria given by LEED based on which it award points, and according to points the rating as silver, gold or platinum are given to a building.

6.2 Efficiency

Efficiency of green building over conventional building can be stated by the following tangible benefits of the green building. According to the study by the 'Confederation of Indian Industry' under the 'Indian Green Building Council', following are the benefits of a green building.

- Reduced operating costs
- Optimized life cycle economic performance
- Sustained savings
 1. Energy Savings: 40 – 50 %
 2. Water savings: 20 – 30 %

From the above statistical information, we can say that adopting a green building is not only beneficial for the environment but also efficient in energy savings and cost savings.

VII. CONCLUSION

Solar energy has been properly utilized for day lighting by providing proper orientation to the building and optimum window positions. Energy efficiency has been achieved by using green appliances that use renewable energy sources. Indoor environment has been made more oxygenated and pollutant free by planting small plants like Tulsi,

Aloe vera, shatavari, money plant and gerbera. The Construction has been made a LEED India certified or rated green building by the application of LEED India criteria. Finally it is concluded that Green Building construction is beneficial both to the occupants of the building as well as the environment.

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