INTEGRATED APPROACH TO GREEN BUILDING DESIGN

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ABSTRACT: A green building, which is otherwise called a supportable building, is intended to meet a few targets, for example, tenant welfare, utilizing strength, water, and different assets all the more creatively; and diminishing the general effect to the earth. It is a chance to utilize the assets effectively while making more advantageous structures that enhance human wellbeing, manufacture a superior domain, and give cost reserve funds. All the advancement ventures lead to over-utilization of common assets. This prompts genuine natural issues and human health. Green building idea manages the ideal utilization of regular assets for the improvement of base. The ease green building house is the present day development technique which utilizes locally accessible material and untalented work furthermore lessens the development time. Also, utilization of reused plastic, reused totals and civil waste for the development of asphalt has extensive impact on the earth. Another propelled technique is the development of low carbon building which utilizes reasonable materials like blended cement, compacted fly ash squares, low energy floor and material framework, and settled mud squares and so forth. This at last results in diminishment of greenhouse gasses which will decrease greenhouse impact. This paper introduces an overview of new green building technique by utilizing the natural resources and on preservation usage of assets like area, water, vitality, air, material and so on in this way diminishing the general expense of development and unfavorable effects of environmental change.

KEYWORDS: Green Building, Human Health, Natural Resources, Sustainable Building.

INTRODUCTION

A green building which is also called a supportable building, is intended to meet a few targets like tenant welfare, utilizing strength, water and diminishing the general effect to the earth. It is a chance to utilize the assets effectively while making more advantageous structures that enhance human wellbeing, manufacture a superior domain, and give cost reserve funds. All the advancement ventures lead to over-utilization of common assets. This prompts genuine natural issues and human health. Sustainable development is maintaining a delicate balance between the human need to improve lifestyles and feeling of well-being on one hand, and preserving natural resources and ecosystems, on which we & future generations depend. ***Michael Buzzelli (2009)*** explained with respect to Canada that the Canadian government launched a Green Energy Act after getting motivated by widespread adoption of green ideals. The purpose of this act was to set out a plan to work together to fight back the problems caused by it. The main area of focus for our research is this basic policy paradox of development of the Real estate industry along with minimal adverse implications on the environment. It also discusses ways that can be used to move forward, addressing the performance, energy use and greenhouse gas emissions connected with our built environment**. *Lee W L (2002)*** explained that materials and products used in building construction, such as steel and aluminum, are created by a production process consisting of raw material extraction, raw material process, melting, manufacture to final products, and transportation to building site. Each of the steps consumes energy, which is also expressed in terms of carbon emissions. Total carbon emissions of all building materials and products and the construction involved to put them together is known as building's embodied carbon. Embodied carbon accounts for about 20% of the carbon emissions from the building sector. Reducing embodied carbon is one of the simple and practical mitigation options for the building and construction sector by utilizing the carbon sink and low carbon materials and products in buildings**. *Kushagra Varma et.al (2014)*** explained that buildings are both, one of the biggest consumer of energy and producer of greenhouse gases and these days, it has become a global issue. It is a fact that buildings generate 35 percent of the hazardous gases found in the air. Since buildings are accountable for this

scenario, it has forced a direct requirement to not only think of, but implement sustainability in every new construction right away. This will render us a sustained environment and a healthy ecosystem. Green Buildings are buildings that subscribe to the principle of conscientious handling of natural resources, which means causing as little environmental interference as possible, using environment friendly materials, requires low operational energy, utilizes renewable sources of energy to fulfill its requirements, follows high-quality and longevity as a guideline for construction and last but not least, must be economically viable. ***Perez-Lombard, L.(2008)*** explained the various reasons for the occurrence of the different kinds of pollution that we, the people suffer due to the regular building construction and its lifecycle. It then focuses on the remedies as in how all these problems can be counted acted and the best can be made out of these. The research focused on ways to REDUCE and REUSE materials and waste prevention over the life of a home. They also examined the benefits of current recycling practices in Oregon as a means to understand the relative benefit of various REDUCE, REUSE, and RECYCLING practices. ***Piet Eichholtz (2010)*** explained that in today's scenario, sustainability has become an increasingly important attribute of economic activities for describing the methods of production. It also acts as a method of knowing the qualities of consumption and attributes of capital investment. The built environment and sustainability are closely intertwined, and popular concentration to “green” building has greatly increased over the past decade. This reflects the potential significance of real property in matters of environmental conservation. This is the reason that many of the majority of the world leaders in the field like RICS and USGBC are coming together to work shoulder to shoulder in this initiative. Here is an overview of new green building technique by utilizing the natural resources and on preservation usage of assets like area, water, vitality, air, material and so on in this way diminishing the general expense of development and unfavorable effects of environmental change.

IGBC (GREEN NEW BUILDING) RATING SYSTEM

IGBC (Green New Building) rating system gives the green characteristics under the following categories:

- Site Selection and Planning
- Water Conservation
- Energy Efficiency
- Building Materials and Resources

SITE SELECTION AND PLANNING

Site selection is the first step to a suitable and a sustainable habitat and thus, needs to be done appropriately, prior to commencement of design phase. Site selection and analysis should be carried out to create living spaces that are in harmony with the local environment. The development of a project should not cause damage to the natural surroundings of the site but, in fact, should try to improve it by restoring its balance. Thus, site selection should be carried out in light of a holistic perspective of land use, development intensity, social well-being, and preservation of the environment.

Figure.1. Location of the Construction site

The above figure no. 1 shows the location of the site where the green building is going to be constructed. The site is located 4.5km from a town called Perundurai which comes under the district Erode and state Tamil Nadu (figure 1).

Table.1. Location Details of the Site

Location Details	Location	Distance (km)
Name of the Place	Saravampathy	Nil
Latitude and Longitude	11.27°N 77.58°E	Nil
Altitude	252m	Nil
Nearest Town	Perundurai	4.5
Nearest City	Erode	20
Nearest Airport	Coimbatore	80
Nearest Railway Station	Ingur	2.5
Nearest Bus Stop	Saravampathy	0.7
Nearest Bus Stand	Perundurai	4.5
Nearest Hospital	Ingur	2.5
Nearest Bank	Ingur	2.5

Table.2. Soil Profile for the Site

Description	Observation
Soil Topography	No Undulation
Soil Type	Hard Soil
Vegetation	Thorn Bushes and Shrubs
Water Logging	No
Water Table	1.76m to 35.69m (depending upon the monsoon)

Public Transportation Access

Rail Station Proximity- Locate the project within 1/2-mile (800-meter) walking distance (measured from a main building entrance) of an existing or planned and funded commuter rail, light rail or subway station. (figure 2)
Bus Stop Proximity- Locate the project within 1/4-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for 2 or more public, campus, or private bus lines usable by building occupants.

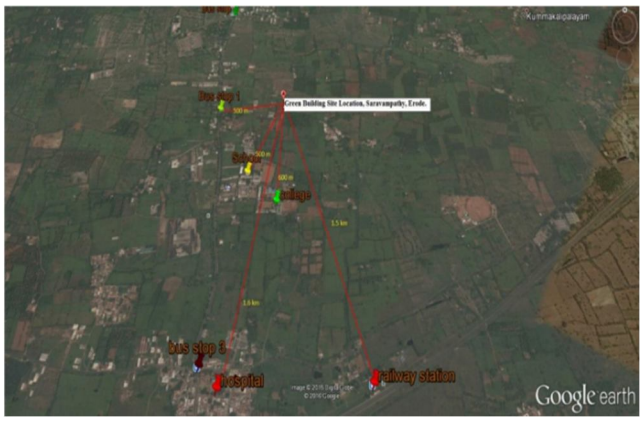

Figure.2. Location of basic amenities from the site

WATER EFFICIENCY

Since 1930 the water is being wasted in large amount, the usage of the water has been increased by 1% for each and every year. All the experts and organizations have decided that this is not sustainable. Therefore instant action should be taken to conserve the water.

Goals

- Reduce the quantity of the water needed for the building.
- Reduce municipal water supply and treatment burden.

Table.3. Water saved by using the low flow fixtures per individual

S. No	Activity	Water Saved (%)	Water saved with respect to increase in time (%)	Water saved with respect to increase in litres
1	Bathing (showers)	50	25	2.5
2	Bathing (tap)	61	30.5	6.1
3	Washing Clothes (tap)	58	29	8.7
4	Toilets (flush)	61	30.5	6.1
5	Cleaning Utensils (tap)	58	29	5.8
6	Cleaning house	61	30.5	3.05
7	Gardening (tap)	61	30.5	3.05
8	Drinking	0	0	0
9	Cooking	0	0	0
10	Wash basins(tap)	83	41.5	0.83
11	Wastage (others)	0	0	0

The table 3 describe about the water saved by using low flow fixtures instead of using normal fixtures. Nearly 22% of the total consumption of the water by an individual per day has been saved with the use of low flow fixtures. The water consumption of the green building is about 37% less when compared with the conventional building. In green building, recycling technique of the grey water is done and the water is reused for the toilet flush and for gardening purposes. The total water consumption of an individual in the green building comes out to be 98.87 litres per day whereas in conventional building per day water usage by an individual is 135 litres. Hence the water demand can be reduced to some extent by the construction of green building.

Rainwater harvesting system

The process of gathering or accumulating and storing the rain water is called rain water harvesting. Rainwater harvesting can save the extra runoff water for the future usage like drinking water, water for gardening or irrigation, water for domestic animals or to restock the aquifers in a process called groundwater recharge.

Advantages of Rainwater harvesting system;

- It is used to reduce the runoff loss.
- By using this we can avoid flooding in the roads and Soil erosion can be brought in control.
- The water can be used for irrigation purpose.
- It helps in reducing the water bills.
- It will boost the ground water level.
- It helps to meet the rising water demand.

Table.4. Calculation of the annual runoff volume obtained from the building

1	Annual Rainfall	=	660	mm	=	0.66	m
2	Catchment area	1			=	89.96	Sq. m
3	Runoff Co-efficient	=	70	%	=	0.7	
4	Filter Co-efficient	=	90	%	=	0.9	

Formula;

Runoff Volume = Annual Rainfall * Catchment Area * Runoff Coefficient * Filter Coefficient

Total Runoff Volume = 37.406 cubic meters
= 37406.69 litres per annum

1	Water required in normal building	197100	litres/year
2	Water required in green building	76502.51	litres/year
3	Water Saved finally in Green Building	120597.50	litres/year

The above table calculate the amount of water saved in the green building with help of the calculations mentioned above.
It also gives the water requirement of water for one whole year, water obtained from recycling, rainwater obtained per year.

ENERGY EFFICIENCY

Energy Efficient Appliances

1. Refrigerator
2. Television
3. Washing Machine
4. Light Emitting Diodes
5. Computers and Home Office Equipment

Table.5. Comparison of power consumption in normal and green building

S.No	Items	Approx. usage of in equipments Normal Building (hr/day)	Approx. usage of equipments in Green Building (hr/day)	Total Power consumption in GB (W/hr)	Total Power consumption in NB (W/hr)
1	Light 8W	6	4	384	1080
	4W	6	4	128	480
2	Night Lamp	10	7	84	300
3	Fan	15	8	576	2340
4	TV 32"	4	4	400	600
5	Exhaust fan	4	3	60	120
6	Refrigerator	24	24	5400	7200
7	Mixer	1	1	250	350
8	Water pump Motor	0.5	0.5	250	300
9	AC	8	6	0	8000
10	Washing Machine	1	1	250	350
11	Miscellaneous power consumption	2	1	125	300

The table 5 shows the comparative results of power consumption in normal and green building, which includes the approximate usage of the electrical equipment and total power consumption by each and every electrical appliance. Finally the power consumed in the normal building for a single family comes out to be around 21 KWh/day and 7712 KWh/year. Whereas, in the green building the power consumed by the appliances comes out to be around 8 KWh/day and 2846 KWh/year. Therefore around 60% of the energy is saved in case of green building. The major difference is because in the green building the usage of air-condition is not necessary due to the good indoor air quality and proper ventilation. Meanwhile trees will be planted around the building which prevents the heat entering the house and increases the air circulation.

Windows

Windows in the building are designed efficiently so that to attract a high fraction of solar energy and this consequently reduces the heat gain. The fraction of solar heat absorbed by the window is referred as SHGC (solar heat gain

coefficient), (Figure 3). The solar hear gain coefficient will be marked for the new windows. More windows are placed in the direction where the wind.

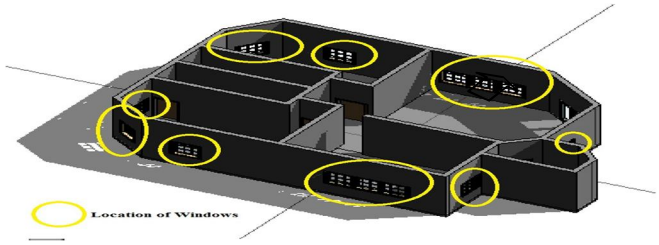

Figure.3. Location of windows in the building

Solar Panels

The sun gives a huge amount of solar energy to the earth. That energy can be trapped with the help of solar panels and can be converted in to electrical energy. This converted energy can be used for the running of appliances such as tube lights, fans, television, laptops, computers etc. The amount of solar radiations received by the earth for every half an hour will be sufficient to fulfill the energy needed by whole world for entire year.

Advantages of solar panels with respect to energy conservation:

- Electricity is produced from renewable energy source.
- Maintenance is low.
- Environmental friendly with no emission of harmful gasses.
- They are highly reliable.
- Government has also given tax credits to one who install solar panels.
- Gives shade to the roof and reduce the heat entering from the roof top.
- These are also used to heat water.

MATERIALS

1. Concrete with fly ash
2. Fly-Ash Bricks
3. Baled Straw and POLLI bricks
4. Plywood
5. Glass Fiber Reinforced Gypsum

Glass fiber reinforced gypsum (GFRG) panel known as Rapid wall is a building panel made of calcite gypsum plaster, reinforced with glass fibers. The panel was originally developed by GFRG Building System Australia and has been used for mass scale construction since 1990. Now, these panels are being produced in India and technology is being used in India. This is an integrated composite building system using factory made prefab load bearing cage panels & monolithic cast- in- situ RC in filled for walling & floor / roof slab suitable for low rise to medium rise buildings.

Low Emitting Materials

Materials such as adhesives, sealants, paints, coatings, composite wood and agri-fibre products can harm the indoor air quality. The following measures can avoid harming the indoor air quality:

- Utilize the adhesives or glues with low – VOC or no –VOC discharge, for example, acrylic or phenolic gums (made with phenol formaldehydes).
- Reduce the amount of indoor air contaminants that are rotten or possibly disturbs the owner's and tenants' wellbeing and relief**.**
- Use only zero or low VOC paints which are to be used in the interior of the building. Prefer water–based acrylics over solvent based oil paints.
- Must ensure that all the agri-fibre products and composite woods do not contain any added urea formaldehyde resins.
- The products should be of 100% composite woods.

CONCLUSION

Green buildings have always been part of the Indian ethos. The large-scale adoption today comes naturally for Indian designers and architects. The only change, perhaps, that we are seeing today is the need to blend our traditional wisdom with contemporary technologies and practices. This can largely be attributed to the changes in lifestyle and general increase in economic affordability of the people. At initial stages the incremental cost has been experienced between 12-18 percent and now we can observe that the incremental cost has been reduced to 5-8 per cent. Further, we are aiming at green buildings becoming less costly than conventional buildings thus making them affordable for the common man. A Green Building is one, which in the process of constructing a building, uses renewable materials and saves money on light bills, gas bills and water bills. This method can include using all natural materials but for the most part, it pertains to saving environment and costs. It is a reflection of the growing concern for environment and energy, and the awareness that huge consumption also leads to huge depletion of resources. More and more people are becoming aware of this fact and the concept of Green Building is here to stay and it should be encouraged and promoted for the betterment of the society.

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