International Journal of Modern Engineering Research (IJMER)
www.ijmer.com Vol.2, Issue.1, Jan-Feb 2012 pp-349-352 ISSN: 2249-6645

GREEN BUILDINGS – ON THE MOVE

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ASTRACT:
Green building education requires successful teamwork of students from different disciplines in order to solve challenging problems in construction and design of buildings. "sustainable building" is the design and construction of buildings using methods and materials that are resource efficient and that will not compromise the health of the environment or the associated health and well being of the building's occupants, construction workers, the general public, or future generations. Sustainable building involves the consideration of many issues, including land use, site impacts, indoor environment, energy and water use, solid waste, and lifecycle impacts of building materials. Making existing and new buildings is one of the most effective levers to meet the challenges of CO2 reduction in cities. This paper discusses the concept of green buildings which are buildings based on sustainable principles, designed, built, renovated, operated and reused in an ecological and resource efficient manner and also presents a case study of building which is designed and constructed based on concept of green building.

Keywords: Green buildings, building materials, recycle & reuse, conservation

1. INTRODUCTION

India is witnessing tremendous growth in infrastructure and construction development. The construction industry in India is one of the largest economic activities and is growing at an average rate of 9.5% as compared to the global average of 5%. As the sector is growing rapidly It has in turn lead to many hazardous problems such as depletion of non renewable resources, generation of consumer waste on large scale, deforestation etc. which created a need to introduce a new concept called Green building.

Green building means a high performance building property that considers and reduces its impact on the environment and human health. Green buildings are designed and constructed to maximize whole life-cycle performance, conserve resources, and enhance the comfort of their occupants. This is achieved by the smart use of technology such as fuel cells and solar heated water tanks, and by attention to natural design elements such as maximizing natural light and building orientation. The result is a highly efficient building that saves money, is aesthetically pleasing, and contributes to the comfort and productivity of its occupants.

The goal of making Green building can be achieved by

- Efficiently using energy, water and other non renewable resources,
- Reducing waste, pollution and other environmental impacts
- Use of environmental friendly materials etc.

2. GREEN BUILDING CONCEPTS AND DESIGN

Green building construction practices that helps in lessen environmental impacts and improve the energy performance of new Constructions by a few fundamental principles that constitute the IGBC(Indian green building Council) designation, namely:

- Site selection and architectural planning
- Water management
- Energy efficiency and renewable energy
- Waste management
- Indoor environmental quality

SITE SELECTION AND ARCHITECTURAL PLANNING

Accessibility to basic amenities:

The site should be selected such that it is near public transit and/ or household services and amenities that are accessible by safe, convenient pedestrian pathways. The basic amenities include school, bank/ATM, crèche, medical clinic/ hospital, pharmacy, grocery store, electrician/plumbing services, dhobi/laundry, fitness centre, post office, place of worship, restaurant, supermarket, playground, electricity/ water utility bills payment counter and other neighborhood- serving retail.

Soil Erosion Prevention & Control:

Evolve strategies to stockpile top soil and reuse later for landscaping purpose. Stockpiled soil can be donated to other sites for landscaping purpose.

Natural Topography and Landscape:

Avoid site disturbance by retaining the natural topography of the site and / or landscape at least 20% of the site area or meet the local regulation to extent possible. In sites which have fully grown trees, destruction is to be avoided. Also avoid developing paved surfaces on the site as much as possible.

Reduction of Heat Island Effect on Roof and Parking Area:

Reduce heat islands that are reducing thermal gradient differences between developed and undeveloped areas to minimize impact on the microclimate. Use high Albedo roofing material or heat resistant paint or china mosaic or white cement tiles or any other highly reflective materials over the roof to cover atleast 50% of the exposed roof area. Provide vegetation to cover atleast 50% of the exposed roof area and Plant shade-giving trees to cover atleast 75% of the open parking areas (or) install permanent roof to cover 75% of the parking areas.

Design for Differently Abled:

Ensure that the factory building is user-friendly for differently abled people. Appropriately designed preferred car parking spaces in areas which have easy access to the main entrance or closer to the lift. Uniformity in flooring level / ramps in the factory areas. Rest rooms (toilets) designed for differently abled people.

WATER MANAGEMENT

Rainwater Harvesting:

The design should incorporate rainwater harvesting to increase the ground water table or to reduce the usage of water through effective and appropriate rainwater management. Capture rainwater at least 50% from the roof and non roof for reuse. The design should also include flushing arrangement to let out impurities in the first few showers. Such pollutants and impurities include paper waste, leaves, bird droppings, dust, etc.

Low Flow Water Fixtures:

To minimize indoor water usage by installing efficient water fixtures. While selecting water fixtures, look for the flow-rates. The product catalogue or the brochure may detail the flow rates at various pressures..

Turf design:

Turf design is to limit such landscapes which consume large quantities of water. Select turf, plants, shrubs and trees which consume less water and are resilient to local climatic conditions.

Drought Tolerant Species:

Ensure that atleast 30% of the landscaped area is planted with drought tolerant species. Select species that are well-adapted to the site.

Management of Irrigation System:

Reduce the demand for irrigation water through water-efficient management techniques. Provide highly efficient irrigation systems incorporating features mentioned below:

- Provide a central shutoff valve for the irrigation system.
- Provide a moisture sensor controller.
- Install time based controller for the valves such that the evaporation loss is minimum and plant health is ensured.
- Any other innovative methods for watering.

The designer and the installer must work together and ensure the design performance of the system.

Grey water treatment

Calculate the wastewater volumes generated in the building. Design appropriately the capacity of the on-site wastewater treatment system. While designing the treatment system,ensure that the treated wastewater meets the required quality standards based on its purpose of application.Grey water is neither clean nor heavily soiled waste water that comes from clothes washers, bathroom, bathtub, wash basins, showers, kitchen sinks and dish washers. More specifically, it is the untreated waste water which has not come into contact with toilet waste. An onsite grey water treatment plant to treat at least 50% of grey water generated in the building should be installed.

Treated grey water for landscaping and flushing

The demand for fresh water should be reduced by using treated grey water as much as possible. At least 50% of water requirement for landscaping should be met by using treated grey water generated within the site. The treated grey water should also be used for meeting at least 50%flushing requirements. Separate water plumbing lines should be installed to carry treated grey water for flushing requirements.

Water metering

All the major water consuming areas should be fitted with systems to monitor their consumption so that probable water saving can be predicted. Some of the areas that require water meters are treated grey water consumption, landscape water consumption, rain water reuse, air conditioning cooling tower makeup, hot water consumption, swimming pools, water fountain, common car wash facilities, etc.

ENERGY EFFICIENCY AND RENEWABLE ENERGY

CFC-Free Equipment:

Avoid the use of CFC based refrigerants and ozone layer depleting gases which negatively

Impact the environment. Install HVAC equipment which does not use CFC based refrigerant.

Minimum Energy Performance:

Optimise energy efficiency for non-process use in the building to reduce environmental impacts from excessive energy consumption. Identify the materials and equipment available in the market and their properties with regard to energy performance. While selecting these material and equipment, consider their associated environmental impacts. Determine the applications where automatic controls can help in

energy savings. Obtain details of the controls and ensure proper installation.

HCFC Free / Low Impact HCFC Equipment:

Avoid the use of HCFC based refrigerants and ozone layer depleting gases which negatively impact the environment. Install fire suppression systems which do not contain CFCs, HCFCs, HFCs or Halons.

Energy Metering:

To encourage continuous monitoring and enhance the performance of buildings. Identify all the major energy and water consuming equipment and install systems to monitor their consumption Have separate meters for process and non process loads. Provide meters for of the following items like Energy meter for air-conditioning, internal lighting, external lighting, water consumption, water pumping for landscaping, etc.

On-Site Renewable Energy:

Promote self sufficiency in energy through renewable technological sources of renewable energy that can be considered under this credit include solar energy, wind energy, biomass, biogas etc. for on-site power generation and use within the building.

Eco-Friendly Captive Power Generation:

It is nothing but to reduce emission levels and their impacts on environment through the use of low emitting fuels or better equipment. Such as Use of bio fuels or non edible oils or any other non-fossil based fuel for captive power generation .Use diesel generator sets which are certified by Central Pollution Control Board (CPCB) for emissions and noise compliance. Use ISI rated generator sets/

Efficient luminaries & lighting power density:

After careful assessment of economic viability, energy efficient light fittings should be fitted. These include efficient tubular fluorescent light fittings with electronic ballasts, T5 lamps, compact fluorescent light fittings, light emitting diodes, etc. The installed light fittings should be at least three star rated under BEE labeling programme. The lighting power density should be maintained within limits.

WASTE MANAGEMENT:

Handling of Non-process Waste:

Ensure effective non-process waste management, post occupancy for recycling and safe disposal. Have a facility to segregate at least five of the following non-process waste generated in the building. Organic waste,Plastic,Paper,Paperboard,Glass,Metals,'e'waste,Lamps,Batteries,etc.

Waste reduction during construction:

The waste generated during construction should be segregated based on its utility and should be sent for recycling. This will reduce waste going to landfills. Avoid at least 50% of the waste generated during construction being sent to landfills and incinerators. Typical construction debris include broken bricks, steel bars, broken tiles, glass, wood paste, paint cans, cement bags, packing material, etc.

Materials with Recycled Content:

Encourage the use of products which contain recycled materials to reduce environmental impacts associated with the use of virgin materials. Some of the materials with recycled content are fly ash blocks, tiles, steel, glass, cement, false ceiling, aluminum and composite wood.

Local Materials:

Low VOC Ensure that at least 50% of the total building materials by cost used in the building are manufactured within a radius of 500 km. Use of building materials available locally should be maximized thereby minimizing the associated environmental impacts.

Materials:

Use of materials with low emissions should be encouraged so as to reduce adverse health impacts for building occupants. All the possible interior materials which can have high VOC content is to be listed and replaced with materials with no or low VOC content based on durability, performance and environmental characteristics.

INDOOR ENVIRONMENTAL QUALITY:

Tobacco Smoke Control:

Minimize exposure of non-smokers to the adverse health impacts arising due to passive Smoking. Prohibit smoking in common areas like corridors, lobby, lifts etc., Building should be designed to eliminate or minimize tobacco smoke pollution in the common areas.

Minimum Fresh Air Requirements:

Naturally conditioned buildings may consider having window openings to bring in the fresh air. In case of forced ventilation systems, fresh air can be pumped into the spaces. In areas where the fresh air temperatures are either too high or too low, consider treating such air using systems like geo-thermal, wind towers, earth tunnel cooling, direct / indirect evaporative cooling etc.,

Day-lighting

During design stage, the orientation of the building should be adjusted such that maximum day-lighting to all the spaces is achieved for most part of the day.

Exhaust systems:

Exhaust systems in bathrooms and kitchens should be adequately designed to maintain indoor air quality.

3. INDIAN GREEN BUILDING CODE (IGBC) GREEN HOMES RATING SYSTEM:

The council encourages builders, developers and owners to build green to enhance the economic and environmental performance of buildings. IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The concept of a rating would encourage designers to address these by design. IGBC has set up the Green

Building Core Committee to develop the rating programme. This committee comprised of key stakeholders including corporate, architects, consultants, developers, manufacturers and institutions. As a general guideline, individual owners can use the checklist 'Projects with Interiors' and developers & builders can use the checklist titled 'Projects without Interiors'. The threshold criteria for certification levels are as given in Table 1:

Table 1 IGBC Green Homes Certification Criteria

Certification level	**Points for projects with interiors**	Points for projects without interiors
certified	**32-39**	**30-36**
Silver	**30-37**	**37-33**
Gold	**38-59**	**35-55**
platinum	**60-80**	**56-75**

4. GREEN RENOVATION:

The green building guidelines, design process, and team approach developed for new construction can also apply to building renovations. Green renovation practices include use of natural design elements, such as increased day lighting; installation of Resource conserving materials and systems; recycling and reuse of construction and demolition waste; and maintenance of good indoor environmental quality during construction. While renovation often provides an opportunity to improve indoor-air-quality problems and upgrade HVAC, electrical, solid waste, and water equipment and systems, the process can also have extensive environmental impacts on building occupants. Primary impacts include indoor-air-quality contamination, waste, noise, and hazardous conditions. These can be addressed by scheduling work when occupants are away from a building, placing barriers between the renovation and occupied areas, and providing adequate ventilation. Of special concern during the renovation process is the increased risk of occupant exposure to hazardous waste. The most common types of hazardous waste include asbestos,
lead paint, Plastic material ,mercury-containing fluorescent lamps. Proper handling, disposal, or recycling of these materials is critical to ensure compliance with federal environmental regulations. Hazardous materials that are moved off-site can bring long-term environmental liabilities to the building owner or operator when not disposed of properly.

5. CONCLUSION:

The principles and guidelines discussed imply that Green Buildings can have tremendous benefits, both tangible and intangible. The immediate and most tangible benefit is in the reduction in operating energy and water consumption right from day one, during the entire life cycle of the building. The energy savings could range from 25 – 30 % depending on the extent of green specifications. Other tangible savings would be reduction in first costs and enhanced asset value. Intangible benefits of Green Buildings include increasing productivity of occupants 'health, safety benefits and a green corporate image. The building studied showed that it scored a total of 57 points out of a possible 75 points and could possibly get Platinum rating (without interiors) under IGBC. If the future builders and developers continue to follow such green concepts and develop green housing sectors, the trend will lead to more energy efficient homes and protect the environment.

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