Go Green with Green Building Concept for a Sustainable Development

[Extracted from website www.igbc.in, www: wikipeia and www. bharatestates.com]

Green Building (Fig. 1), also known as green construction or sustainable building, is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from sitting to design, construction, operation, maintenance, renovation, and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability and comfort.

Fig 1: A 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 overall impact of the built environment on human health and the natural environment by:

- Efficiently using energy, water, and other resources
- Protecting occupant health and improving employee productivity
- Reducing waste, pollution and environmental degradation
- Natural deterioration

A similar concept is natural building, which is usually on a smaller scale and tends to focus on the use of natural materials that are available locally. Other related topics include sustainable design, green architecture, and energy efficient buildings.

The green building movement originated due to need and desire for more energy efficient and environmentally friendly construction practices. There are a number of motives to building green, including environmental, economic, and social benefits. However, modern sustainability initiatives call for an integrated and synergistic design to both new construction and in the retrofitting of an existing structure.

Also known as sustainable design, this approach integrates the building life-cycle with each green practice employed with a design-purpose to create a synergy amongst the practices used.

Green building brings together a vast array of practices and techniques to reduce and ultimately eliminate the impacts of buildings on the environment and human health. It often emphasizes taking advantage of renewable resources, e.g., using sunlight through passive solar, active solar, and photovoltaic techniques and using plants and trees through green roofs, rain gardens, and for reduction of rainwater run-off. Many other techniques, such as using packed gravel or permeable concrete instead of conventional concrete or asphalt to enhance replenishment of ground water, are used as well.

While the practices, or technologies, employed in green building are constantly evolving and may differ from region to region, there are fundamental principles that persist from which the method is derived: Sitting and Structure Design Efficiency, Energy Efficiency, Water Efficiency, Materials Efficiency, Indoor Environmental Quality Enhancement, Operations and Maintenance Optimization, and Waste and Toxics Reduction. The essence of green building is an optimization of one or more of these principles. Also, with the proper synergistic design, individual green building technologies may work together to produce a greater cumulative effect.

On the aesthetic side of green architecture or sustainable design is the philosophy of designing a building that is in harmony with the natural features and resources surrounding the site. There are several key steps in designing sustainable buildings: specify 'green' building materials from local sources, reduce loads, optimize systems, and generate on-site renewable energy.

Siting and Structure Design Efficiency

The foundation of any construction project is rooted in the concept and design stages. The concept stage, in fact, is one of the major steps in a project life cycle, as it has the largest impact on cost and performance. In designing environmentally optimal buildings, the objective function aims at minimizing the total environmental impact associated with all life-cycle stages of the building project. However, building as a process is not as streamlined as an industrial process, and varies from one building to the other, never repeating itself identically. In addition, buildings are much more complex products, composed of a multitude of materials and components each constituting various design variables to be decided at the design stage. A variation of every design variable may affect the environment during all the building's relevant life-cycle stages.

Creating sustainable buildings starts with proper site selection. The location of a building affects a wide range of environmental factors such as security, accessibility,

and energy consumption, as well as the energy consumed by transportation needs of occupants for commuting, the impact on local ecosystems, and the use/reuse of existing structures and infrastructures. If possible, locating buildings in areas of existing development where infrastructure already exists and conserving resources by renovating existing buildings will help minimize project's environmental footprint.

Maximizing the green impact of site design and building infrastructure may be accomplished by considering energy implications during site selection and the design of building orientation. Improved grading and natural landscaping practices can help control erosion as well as reduce heat islands. Incorporating transportation solutions along with site plans that acknowledge the need for bicycle parking, car pool staging, and proximity to mass transit can help encourage alternatives to traditional commuting and reduce both energy consumption and waste emissions.

Energy Efficiency

Green buildings often include measures to reduce energy use. To increase the efficiency of the building envelope, (the barrier between conditioned and unconditioned space), they may use high-efficiency windows and insulation in walls, ceilings, and floors. Another strategy, passive solar building design, is often implemented in low-energy homes. Designers orient windows and walls and place awnings, porches, and trees to shade windows and roofs during the summer while maximizing solar gain in the winter. In addition, effective window placement (day lighting) can provide more natural light and lessen the need for electric lighting during the day. Solar water heating further reduces energy loads.

On site generation of renewable energy through solar power, wind power, hydro power, or biomass can significantly reduce the environmental impact of the building. Power generation is generally the most expensive feature to add to a building.

Fig. 2: Measurement of temperature difference between Energy Efficient Heatshield coated and uncoated surfaces

Some of the other facets of green buildings are: heat reduction insulated roofs (Fig. 2) and walls that substantially reduce heat ingress (up to 60%) thereby resulting in lower AC loads, cross ventilation with fresh breeze, goodbye to high energy costs (up to 40%), solar lighting is safe for people as well as the planet, 100% natural light all across, thereby cutting down usage of artificial light by 50%.

Water Efficiency

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas of the country, the demands on the supplying aquifer exceed its ability to replenish itself. To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site. The protection and conservation of water throughout the life of a building may be accomplished by designing for dual plumbing that recycles water in toilet flushing. Waste-water may be minimized by utilizing water conserving fixtures such as water less urinal (Fig. 3), ultra-low flush toilets and low-flow shower heads (Fig. 4). Point of use water treatment and heating improves both water quality and energy efficiency while reducing the amount of water in circulation.

Fig. 3: Waterless urinals

Fig. 4: Low-flow shower head

Materials Efficiency

Building materials typically considered to be 'green' include rapidly renewable plant materials like bamboo (because bamboo grows quickly) and straw, lumber from forests certified to be sustainably managed, ecology blocks, dimension stone, recycled stone, recycled metal, and other products that are non-toxic, reusable, renewable, and/or recyclable (e.g. Trass, sheep wool, panels made from paper flakes, compressed earth block, adobe, baked earth, rammed earth, clay, vermiculite, flax linen, sisal, seagrass, cork, expanded clay grains, coconut, wood fibre plates, calcium sand stone, concrete (high and ultra high performance, self-healing concrete, etc.) The EPA (Environmental Protection Agency) also suggests using recycled industrial goods, such as coal combustion products, foundry sand, and demolition debris in construction projects.

Polyurethane heavily reduces carbon emissions as well. Polyurethane blocks are being used for walls which provide more speed, less cost, and they are environmentally friendly. Light weight energy saving sandwich panel is also used for wall for heat reducing (Fig. 5). Building materials should be extracted and manufactured locally

to the building site to minimize the energy embedded in their transportation. Where possible, building elements should be manufactured off-site and delivered to site, to maximise benefits of off-site manufacture including minimising waste, maximising recycling (because manufacture is in one location), high quality elements, less noise and dust.

Fig. 5: Energy saving sandwich panel

Indoor Environmental Quality Enhancement

The Indoor Environmental Quality (IEQ) category in LEED (Leadership in Energy and Environmental Design) standards, one of the five environmental categories, was created to provide comfort, well-being, and productivity of occupants. The LEED IEQ category addresses design and construction guidelines especially indoor air quality (IAQ), thermal quality, and lighting quality. Indoor Air Quality seeks to reduce volatile organic compounds, or VOC's, such as microbial contaminants. Buildings rely on a properly designed HVAC (High Volume Air Conditioning) system to provide adequate ventilation and air filtration as well as isolate operations (kitchens, dry cleaners, etc.) from other occupancies. During the design and construction process choosing construction materials and interior finish products such as antimicrobial coating (Fig. 6) with zero or low emissions will improve IAQ. Many building materials and cleaning/maintenance products emit toxic gases, such as VOC's and formaldehyde. These gases can have a detrimental impact on occupants' health and productivity as well. Avoiding these products will increase a building's IEQ. The temperature and airflow control over the HVAC system coupled with a properly designed building envelope will also aid in increasing a building's thermal quality. Creating a high performance luminous environment through the careful integration of natural and artificial light sources will improve on the lighting quality of a structure.

Fig. 6: Hygiene coating

Healthy indoors: One can enjoy healthy living with innovative solid waste management, waste segregation system and nature-friendly infrastructural facilities.

Recycling to conserve nature: Owners can take pride in being a responsible citizen and make the most of '0% discharge building.

Operations and Maintenance Optimization

No matter how sustainable a building may have been in its design and construction, it can only remain so if it is operated responsibly and maintained properly. Ensuring operations and maintenance (O&M) personnel are part of the project's planning and development process will help retain the green criteria designed at the onset of the project. Every aspect of green building is integrated into the O&M phase of a building's life. The addition of new green technologies also falls on the O&M staff. Although the goal of waste reduction may be applied during the design, construction and demolition phases of a building's life-cycle, it is in the O&M phase that green practices such as recycling and air quality enhancement take place.

Waste Reduction

Green architecture also seeks to reduce waste of energy, water and materials used during construction. During the construction phase, one goal should be to reduce the amount of material going to landfills. Well-designed buildings also help reduce the amount of waste generated by the occupants as well, by providing on-site solutions such as compost bins to reduce matter going to landfills.

To reduce the impact on wells or water treatment plants, several options exist. 'Greywater', waste water from sources such as dish washing or washing machines, can be used for subsurface irrigation, or if treated, for non-potable purposes, e.g. to flush toilets and wash cars (Fig. 7). Rainwater collectors are used for similar purposes.

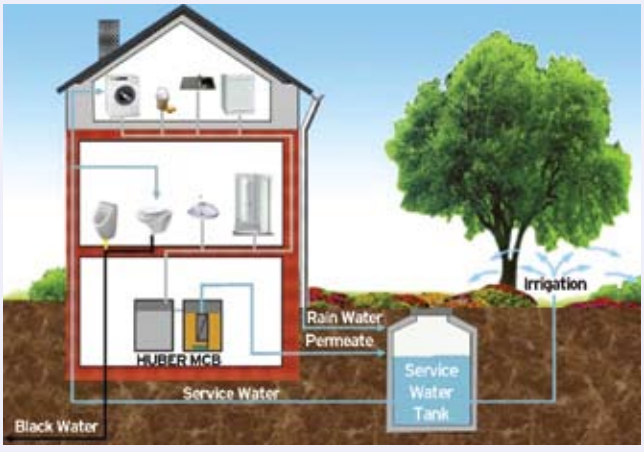

Fig. 7: Grey water recycling system

Centralized waste water treatment systems can be costly and use a lot of energy. An alternative to this process is converting waste and waste water into fertilizer, which avoids these costs and shows other benefits. By collecting human waste at the source and running it to a semi-centralized bio gas plant with other biological waste, liquid fertilizer can be produced. Practices like these provide soil with organic nutrients and create carbon sinks that remove carbon dioxide from the atmosphere,

offsetting greenhouse gas emission. Producing artificial fertilizer is also more costly in energy than this process.

Indian Green Building Council

Indian Green Building Council (IGBC) is a part of CII(Confederation of Indian Industry) and Federation of Indian Chambers of Commerce and Industry (FICCI)which is actively involved in promoting the Green Building movement in India. The council is represented by all stakeholders of construction industry comprising of corporate, government & nodal agencies, architects, product manufacturers, institutions, etc. The council is industry-led, consensus-based and member-driven. The vision of the council is to serve as single point solution provider and be a key engine to facilitate all Green Building activities in India.

The Indian Green Business Centre in Hyderabad is the first platinum rated building to be built outside of the USA and an example of an institution created by an industry association. CII jointly with the Andhra Pradesh government and with technical support from USAID (United States Aids for International Development) set it up as a public-private partnership.

IGBC Green Homes Rating System

Indian Green Building Council (IGBC) Green Homes is the first rating programme developed in India, exclusively for the residential sector. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts. The system is designed to be comprehensive in scope, yet simple in operation.

To bridge the demand for a rating system for non-air conditioned buildings and one that took into account the possibility of a partially air conditioned building as well, TERI (The Energy and Resources Institute) developed its own system known as GRIHA (Green Rating for Integrated Habitat Assessment). This system responded specifically to India's prioritized national concerns such as extreme resource crunches in the Power and water sectors and a fast eroding biodiversity. It attempted to stress on solar passive techniques for optimizing indoor visual and thermal comfort and relying on refrigeration based air-conditioning systems only in cases of extreme discomfort. However, this system has only been developed for the largest upcoming energy consuming segment, i.e. commercial, institutional and residential buildings (new construction), and is in the course of developing a similar standard to address the needs of other building typologies such as existing buildings, industrial buildings, etc.

Now, in consultation with the experts from various related fields in India, the MN&RE (Ministry of Natural Resources & Renewable Energy) is planning developing a national rating system for green buildings. This shall be a voluntary system to be adopted by builders and individuals alike. The MN&RE is trying to develop an incentive mechanism for the same as well.

Benefits of Green Homes

A Green Home can have tremendous benefits, both tangible and intangible. The immediate and most tangible benefit is in the reduction in water and operating energy costs right from day one, during the entire life cycle of the building.

Tangible benefits include energy savings between 20 – 30% and water savings between 30 – 50% where as intangible benefits include enhanced air quality, excellent day lighting, health & wellbeing of the occupants, conservation of scarce national resources, and enhance marketability for the project.

Eligibility

IGBC Green Homes Rating System is a measurement system designed for rating new residential buildings which include construction categories such as individual homes, high rise residential apartments, gated communities, row houses, and existing residential buildings which retrofit and redesigned in accordance with the IGBC Green Homes criteria.

The project team can evaluate all the possible points to apply under the rating system using a suitable checklist. The project can apply for IGBC Green Homes certification if it can meet all mandatory requirements and achieve the minimum required points.

IGBC Green Factory Building rating system

With the advancement of green building movement in India, many companies have evinced keen interest in having a holistic green design and construction framework for upcoming factory buildings. IGBC, in its endeavor to extend green building concepts to all building types has developed the IGBC Green Factory Building rating system. IGBC Green Factory Building rating system is the first of its kind addressing sustainability in industrial buildings. The programme is fundamentally designed to address national priorities and quality of life for factory workmen.

IGBC Green Factory Building Rating System is a voluntary and consensus based programme. The rating system has been developed based on the contemporary materials and technologies. This rating system would facilitate the development of green factories. The rating system evaluates certain credit points using a prescriptive approach and other credits on a performance based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly.

LEED India

In the year 2001, The US-GBC's internationally accepted

and renowned rating system – LEED was introduced in the Indian building sector. Thereafter LEED-INDIA Green Building Rating System has become a nationally and internationally accepted benchmark for the design, construction and operation of high performance green buildings.

LEED-INDIA provides building owners, architects, consultants, developers, facility managers and project managers the tools they need to design, construct and operate green buildings. It promotes a whole-building approach to sustainability by recognizing performance in the following five key areas such as Sustainable site development, Water savings, Energy efficiency, Materials selection and, Indoor environmental quality.Its' rating system provides a roadmap for measuring and documenting success for every building type and phase of a building lifecycle. Specific LEED-INDIA programs include for New Construction (LEED India NC) and for Core and Shell (LEED India CS).

Green Building Materials

The concept of sustainable building incorporates and integrates a variety of strategies during the design, construction and operation of building projects. The use of green building materials and products represents one important strategy in the design of a building.

Building and construction activities worldwide consume 3 billion tons of raw materials each year or 40% of total global use. Using green building materials and products promotes conservation of dwindling nonrenewable resources internationally. In addition, integrating green building materials into building projects can help reduce the environmental impacts associated with the extraction, transport, processing, fabrication, installation, reuse, recycling, and disposal of these building industry source materials.

Typical Products and equipment are Roof paints, Variable frequency drives, High efficiency chillers, BMS, Efficient lighting etc. According to IGBC, after the introduction of the LEED rating system in India, several new energy efficient equipments have been introduced in the country and are being produced locally. It would be accurate to say the introduction of the system has stimulated some innovation within the building materials supply industry. To name a few – High albedo roofing materials, High performance glass, waterless urinals, Fly ash bricks for walls, Roof insulation Materials, High COP (Coefficient of Performance) chillers. Besides this, a market has been created to offer energy simulation services.

Three basic steps of product selection

Product selection can begin after the establishment of project-specific environmental goals. The environmental assessment process for building products involves three basic steps such as research, evaluation and selection.

Research: This step involves gathering all technical information to be evaluated, including manufacturers' information such as Material Safety Data Sheets (MSDS), Indoor Air Quality (IAQ) test data, product warranties, source material characteristics, recycled content data, environmental statements, and durability information. In addition, this step may involve researching other environmental issues, building codes, government regulations, building industry articles, model green building product specifications, and other sources of product data. Research helps identify the full range of the project's building material options.

Evaluation: This step involves confirmation of the technical information, as well as filling in information gaps. For example, the evaluator may request product certifications from manufacturers to help sort out possible exaggerated environmental product claims. Evaluation and assessment is relatively simple when comparing similar types of building materials using the environmental criteria, e.g., a recycled content assessment between various manufacturers of medium density fiberboard is a relatively straightforward "apples to apples" comparison. However, the evaluation process is more complex when comparing different products with the same function. Then it may become necessary to process both descriptive and quantitative forms of data.

A life cycle assessment (LCA) is an evaluation of the relative "greenness" of building materials and products. LCA addresses the impacts of a product through all of its life stages. Although rather simple in principle, this approach has been difficult and expensive in actual practice (although that appears to be changing).

Selection: This step often involves the use of an evaluation matrix for scoring the project-specific environmental criteria. The total score of each product evaluation will indicate the product with the highest environmental attributes. Individual criteria included in the rating system can be weighted to accommodate project-specific goals and objectives.

Conclusion

'Green Building' technology is a futuristic idea for the planet and is pro life. It is inspired from various elements of nature and innovatively designed to generate significant economic and health advantages to us. It takes us closer to nature by bringing nature closer to home. In fact, it makes the whole growth story of mankind sustainable.