International Journal of Multidisciplinary Approach and Studies

ISSN NO:: 2348 – 537X

Green Buildings: A Step towards Sustainable Development

Sadhana Tandon

Assistant Professor, Department of Zoology, Kanya Maha Vidyalaya, Jalandhar.

ABSTRACT

Our environment is being destroyed by pollution and consumerism and it has sparked the movement to promote energy efficiency and reduction in environmental pollution. Buildings have a major impact on the environment over their entire life cycle. Responsible for 40% of worldwide energy flow and material use, conventional buildings have been identified as the largest source of green-house gas emissions, even more than that of the transport and industry sector. They affect urban air quality and contribute to climate change. They are also hazardous to health at times. That's why we need green sustainable structures to reduce the negative effects of buildings on environment.

INTRODUCTION

Green buildings or sustainable design is the practise of increasing the efficiency with which buildings and their sites use energy , water , raw materials and reducing the negative impacts on human health and environment over the entire life cycle of a building. This new technology makes them more resource efficient, energy efficient and environmentally safe through out a building's life cycle.

FUNDAMENTAL PRINCIPLES OF GREEN STRUCTURES:

Life cycle assessment:

A life cycle assessment (LCA) helps in reducing environmental impacts of conventional buildings (*Rebitzer , G.et al*) by assessing all the impacts associated with all cradle-to-grave stages of a process: from extraction of raw materials through materials processing, manufacture, distribution, use, repair and maintenance, and disposal or recycling. Impacts taken into account include energy, global warming potential, resource use, air pollution, water pollution, and waste.

Structure and Design:

The objective of sustainable design is to minimise total environmental impact associated with all life cycle stages of a building project. It includes reduction in consumption and wastage of resources by using 3 R approach, reduction in total carbon footprints (*EPA, green building home, 2009*). Sustainable design standards and project design guides are also increasingly available and are vigorously being developed by a wide array of private organizations and individuals. The process of Biomimicry (redesigning industrial systems on biological lines enabling the constant reuse of materials in continuous closed cycle) is also being employed (*WBDG Sustainable Committee. 2009*). Robust eco-design: robust design principles are applied to the design of a pollution sources(*Hegazy.T,2002*) .The physics principle that

accounts for the urge to have sustainability, and for the evolutionary design in general, is the constructed law. (*Bejan, Adrian,2015*) and it serves as a basis for designing green buildings.

Energy efficiency:

Green buildings include practices for reducing energy consumption. As high-performance buildings use less operating energy, embodied energy has assumed much greater importance – and may make up as much as 30% of the overall life cycle energy consumption. The building materials such as wood gravel, and asphalt have lower embodied energy as compared to concrete, bricks and steel. ("U.S. Life Cycle Inventory Database." (2012). National Renewable Energy Laboratory, 2012).To reduce operating energy use, designers make efforts to reduce air leakage through the building envelope (the barrier between conditioned and unconditioned space). They also specify high-performance windows and extra 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 *(Simpson, J.R. Energy and Buildings, 2002*) to shade windows and roofs during the summer while maximizing solar gain in the winter. In addition, effective window placement can provide more natural light and lessen the need for electric lighting during the day. Solar water heating further reduces energy costs. Onsite generation of renewable energy through solar power, wind power, hydro power, or biomass can significantly reduce the environmental impact of the building.

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, 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 or by using water for washing of the cars. Wastage of water may be minimized by utilizing water conserving fixtures such as ultra-low flush toilets and low-flow shower heads. Bidets help eliminate the use of toilet paper, reducing sewer traffic and increasing possibilities of re-using water on-site. Effulent treatment systems improve water quality and promote reuse of waste water after treatment. The use of grey water for on-site use such as site-irrigation will minimize demands on the local aquifer. (*California Integrated Waste Management Board. 2008*) Large commercial buildings with water and energy efficiency can qualify for an LEED Certification.

Material efficiency:

Building materials typically considered to be 'green' include lumber from forests that have been certified to a third-party forest standard, rapidly renewable plant materials like bamboo and straw, dimension stone, recycled stone, recycled metal, and other products that are non-toxic, reusable, renewable, and/or recyclable. For concrete a high performance or Roman self-healing concrete is available. (*Henk M. Jonkers*)

The EPA (Environmental Protection Agency) also suggests using recycled industrial goods, such as coal combustion products, foundry sand, and demolition debris in construction projects (*components of green buildings, U.S E.P.A*) Energy efficient building materials and appliances are promoted in the United States through energy rebate programs. According to EPA, recycled industrial goods, foundry sand, demolition debris of buildings etc can be used as raw materials in construction.

Indoor air quality:

Indoor air quality (IEQ) category in LEED include indoor air quality, thermal quality and lightening quality. It focus on reduction in volatile organics and other air contaminants like air microbes and for this building materials and paints with zero or low voc emissions are used.

Another important aspect of IAQ is to control dampness that enhances microbial and fungal growth. Proper building envelope and proper ventilation systems helps to eliminate moisture from indoor sources like cooking, bathing, cleaning etc .Creating a high performance luminous environment through the careful integration of daylight and electrical light sources will improve on the lighting quality and energy performance of a structure (*WBDG sustainable committee,2009*).

Waste reduction:

One of the goal of sustainable buildings is to reduce the waste generated by construction and demolition of buildings and the waste generated by occupants as well. It is done by on site composting by using compost bins. Human waste and other organic waste can converted to useful biogas and manure by biogas plants.

At the end of the life cycle of buildings when they are demolished, wastes are hauled into landfills. But instead of throwing away this waste can be reclaimed into new building materials.

ADVANTAGES OF GREEN BUILDINGS:

Environmental benefits:

1. Enhance and protect biodiversity and ecosystems
2. Improve air and water quality
3. Reduce waste streams
4. Conserve and restore natural resources

Economic benefits:

1. Reduce operating costs
2. Improve occupant productivity.
3. Enhance asset value and profits.
4. Optimise life cycle economic performance.

Social benefits:

1. Improve quality of life
2. Enhance occupant health

3. Improve indoor air quality
4. Minimise strain of local utility infrastructure.

RATING SYSTEMS

LEED (leadership in energy and environmental design) is a set of rating systems for design, construction, operation and maintenance of green buildings developed by US green building council.

Other certificate systems that confirms the sustainability of buildings is british BREEAM(building research establishment environmental assessment method.)
IGBC green building rating systems:
In India, the Indian green building council(IGBC) provides LEED ratings to structures have made the country one of the leaders in green buildings.
According to recent IGBC data, 754 buildings have been certified by IGBC so far.

EXAMPLES OF GREEN BUILDINGS IN INDIA

The reserve bank of India's buildings in Delhi, Orissa and Kerala has been star rated.

In Tamil Nadu, 11 buildings were star rated.
In Maharashtra, near Mumbai in thane district, Govardhan eco village, a community in India, has built buildings with compressed stabilized earth blocks, rammed earth technique, cob houses with traditional thatched roofs. These buildings have received a five-star rating.

TRADITIONAL BUILDINGS

Traditional buildings in India like Hawa Mahal, Golkonda were energy efficient. In Hawa Mahal, articulated windows provides cool breeze in a desert area. In Golkonda, ventilation is designed to let in fresh cool breeze in summers too.

Cost involved in green structures:

The most criticized issue about constructing these sustainable structures is the cost involved. The technologies involved in it tend to cost more than conventional buildings. Most green buildings cost a premium of more than 2% but yield 10 times more benefits over entire life cycle of building(kats, greg, leon, 2008)

In wake of financial benefits of green buildings, over 20 years the economic benefits exceeds the cost of greening by 4-6 times by reduction in electricity and water bills and other benefits including reduction in GHG's, solid waste and indoor pollution have positive impacts on occupant's health and environment.
Numerous studies have shown that green buildings give positive, healthy and pollution free work environment to workers thus increasing the work efficiency and productivity.

CONCLUSION

Studies have shown that the global urban population is expected to grow from 47%of the total in 2000 to 70% in 2050. In line with expanding development and population, India's building sector is expected to grow five-fold till 2050. While India's total energy requirement is projected to grow at 6.5% per year by 2016-17 to support the country's projected growth rate. India is en route to become the world's second largest emitter of greenhouse gases. Thus

all developments need to switch to green development in order to address the future issues of energy efficiency, increased pollution, increasing footprint and emissions. Going green will ultimately lead to the sustainable development of society, the nation and world as whole.

REFERENCES

i. Yan Ji and Stellios Plainiotis (2006): Design for Sustainability. Beijing: China Architecture and Building Press.

ii. U.S. Environmental Protection Agency. (October 28, 2009). Green Building Basic Information.

iii. Hopkins, R. 2002. *A Natural Way of Building.* Transition Culture.

iv. Allen & Iano, 2008[Allen, E, & Iano, J. (2008). Fundamentals of building construction: materials and methods. Hoboken, New Jersey: John Wiley & Sons Inc.

v. WBDG Sustainable Committee. (August 18, 2009). Sustainable.

vi. Carson, Rachel. Silent Spring. N.p.: Houghton Mifflin, 1962.

vii. Kats, Gregory. (September 24, 2010). Costs and Benefits of Green Buildings

viii. Hegazy, T. (2002). Life-cycle stages of projects. Computer-Based Construction Project Management.

ix. U.S. Environmental Protection Agency. (October 28, 2010). Green Building Home.

x. Simpson, J.R. Energy and Buildings, Improved Estimates of tree-shade effects on residential energy use, 2002

xi. Langdon, Davis. The Cost of Green Revisited. Publication. 2007.