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IMPORTANCE OF GREEN BUILDING IN TODAY'S WORLD: BENEFITS AND IMPACTS

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Abstract

The construction industry in India, majorly consist of two sectors namely Real estate and Urban development sectors. Annual GDP growth rate of construction industry in India has decreased by 5.2% as compared with 2018. The slowdown of India GDP provides an opportunity for researchers, professional and others to rethink conventional method of designs, techniques and trends in construction industry. The main objective of the paper is to comprehend the benefits of employing green building standards, challenges, financial benefits, etc., of energy efficient building and their related issues. A green building generates less waste and provides a healthy living environment for the occupants. It is government duty to create more awareness regarding the energy efficient building and also encourage the stakeholders by means of providing subsidies. The green building / energy efficient building application in India have been exciting and challenging as well. It will ultimately serve to improve not only the energy performance of buildings but will also assist energy conservation and natural resources by increased recovery and recycling of building materials, techniques and technology.

Key Words: *Energy Efficient/Green Buildings, Benefits, Financial Status, Assessment Methods*

1. INTRODUCTION

Buildings account for more than 40% of all global carbon dioxide emission, one of the main culprits implicated in the phenomenon of global warming in which India comes on 144th position (1.4 metric ton) in carbon emission rating in the world. Green building is the practice of constructing or modifying structures to be environmentally responsible, sustainable and resource-efficient throughout their life cycle. This includes efficiently using energy, water and other natural resources, protecting occupant health, improving employee productivity and reducing waste, pollution and environmental degradation [1]. Green buildings accounts for improving environmental footprint by reducing energy use by 30-5-%, CO_2 emissions by 35%, waste output by 70% and water usage by 40%.

A sustainable building, or green building is an outcome of a design which focuses on increasing the efficiency of resource use i.e. energy, water, and materials while reducing building impacts on human health and the environment during the building's lifecycle, through better sitting, design, construction, operation, maintenance, and removal. Green buildings are designed to reduce the 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

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 commonly used terms include sustainable design and green architecture.

Reducing environmental impact

Green building practices aim to reduce the environmental impact of buildings. Buildings account for a large amount of land use, energy and water consumption, and air and atmosphere alteration. The environmental impact of buildings is often underestimated, while the perceived costs of green buildings are overestimated. A recent survey by the World Business Council for Sustainable Development finds that green costs are overestimated by 300 percent, as key players in real estate and construction estimate the additional cost at 17 percent above conventional construction, more than triple the true average cost difference of about 5 percent.

2. REPURCUSSION AT WORLD LEVEL

The pressure that man exerts upon nature for fulfillment of his needs is greater than ever and is escalating at an alarming rate. Whether one considers the availability of fresh water, resources, or ecological balance, the MEA (Millennium Ecosystem Assessment) study of 2005 has found that there has been a 62% decline over the last four decade, which in turn has brought about the undeniable realization that the system is under the risk of destructive and possibly irreversible changes. Another possible consequence of all this is the escalation of poverty on countries that rely on the resources produced by the collapsing eco systems. According to the reports published by MEA (millennium ecosystem assessment), the ability of the global ecosystem to nurture future generations can no longer be counted upon.

From the environmental viewpoint, buildings account for nearly half of all energy consumption and raw material use around the globe. The 2008 Building Energy Data book (USDE 2008) says that commercial and residential buildings are held responsible for 39.7 percent of the energy consumed (residential 21.5 percent and commercial 18.2 percent) globally and 76 percent of the electricity used and 15 percent of the total water consumed (Architecture 2030 2009). Building and Construction sector takes up the lion share of resources for land use and material extraction, 50 percent of the world's raw material wealth – many of which are non-renewable resources – and are responsible for 36 percent of all waste generated worldwide[2]. Some of the non-recyclable materials such as lead-based paints, asbestos, mould, wastes containing mercury, fluorescent bulbs, batteries pose serious environmental and health problems [3]. Hazardous waste must be disposed of in a separate landfill at a very high cost [4].

3. SUSTAINABLE DEVELOPMENT

Human activity growth has elevated the sustainability of development in modern times. Sustainability in real estate sector gives more importance towards the energy conservation and also includes the resource usage, environmental impacts etc., (Roy and Gupta, 2008). For promoting the healthier living for people, adverse effects of the construction and its operation on the environment should be maintained by introducing eco-friendly or green housing homes (Times of India, 2014). Green building practices were introduced in the early 19th century.

Global warming and climatic changes were caused by anthropogenic greenhouse gas emission, which should be avoided and take immediate action for future generation (Taleb and Sharples, 2011). Building may also generate harmful atmospheric emission (Alnaser et. al., 2008). Indian construction industries having fast growth rate of 10% per year over last 10 years (Indian Green Building Council, 2013). India's economic growing demand is being met by infrastructural development such as city transport, road networks, water board, sanitation etc., Due to urban infrastructure enlargement which requires green and sustainable techniques for building infrastructure (Ramesh and Khan, 2013). Indian Green Building Confederation of Indian Industry (CII), initiates green building concept in India by means of offering advisory services to the industry on environmental aspects and practices (Times of India, 2015).

4. MATERIALS

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 JERS/Vol. III/ Issue I/January-March, 2012/87-90 non-toxic, reusable, renewable, and/or recyclable (e.g. Trass, Linoleum, 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, roman 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 instead of CMTs by companies like American Insulock. Polyurethane blocks provide more speed, less cost, and they are environmentally friendly. Building materials should be extracted and manufactured locally to the building site to minimize the energy embedded in their transportation.

4.1 REDUCED ENERGY USE

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 (daylighting) can provide more natural light and lessen the need for electric lighting during the day. Solar water heating further reduces energy loads. Finally, onsite 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.

4.2 REDUCED WASTE

Green architecture also seeks to reduce waste of energy, water and materials used during construction. For example, in California nearly 60% of the state's waste comes from commercial buildings. 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 onsite 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", wastewater from sources such as dishwashing or washing machines, can be used for subsurface irrigation, or if treated, for non-potable purposes, e.g., to flush toilets and wash cars. Rainwater collectors are used for similar purposes.

Centralized wastewater treatment systems can be costly and use a lot of energy. An alternative to this process is converting waste and wastewater into fertilizer, which avoids these costs and shows other benefits. By collecting human waste at the source and running it to a semi-centralized biogas plant with other biological waste, liquid fertilizer can be produced.

5. BENEFITS OF ENERGY EFFICIENT BUILDINGS

Growing awareness of environmental aspects and demand on green building worldwide shows that, the status quo as it exists in the construction industry simply cannot go on. The industry must, and is, changing. In the United States, buildings are responsible for 72% of electricity consumption, 39% of energy use, 35% of carbon dioxide emissions, 40% of raw material usage, 30% waste output and 14% potable water consumption. (USGBC, 2009)

The benefits of adopting green building concept from the literature are discussed as follows:

1. Environmental Benefits
   - Enhance and protect eco-system and biodiversity
   - Energy Consumption reduction
   - Water Consumption reduction
   - Air Pollution reduction
   - Increased Material Efficiency
   - Handling Household Waste
   - Conserve natural resources
2. Economic Benefits
   - Short Term Benefits
   - Long Term Benefits
   - Added Project Value
3. Health Benefit

5.1 FINANCIAL STATUS/ BENEFITS

Kumar (2013) targeted moderate- and low-income group of population in Ernakulam city of central Kerala for this study. It focuses on the green homes under development stage of the buildings. It was observed that, people were unaware & unveiling to make heavy investments in constructing green buildings. The study suggests that housing finance institutions, policy makers and other lending agencies, should insist on compliance with green standards.

- Reduction of operating costs
- Reduction in life cycle energy costs
- Enhance asset value and profit
- Increased employee productivity and satisfaction
- Optimization of life cycle performance
- Less absenteeism / High productivity
- Less health-related costs such as insurance premiums

- Reduced litigation risks due to improved indoor air quality
- Staying ahead of regulations
- Reduced employee turnover
- Increased economic life of the facility
- Tax abatements at the federal, state and local level
- Federal grants used as enticements to promote green building (McKinsey and Company, 2009)

Additionally, green buildings function more efficiently by design and produce financial benefits of:

- Operating cost reduction of 8-9%
- Building value increase of 7.5%
- Return on investment improvement 6.6%
- Occupancy ratio increase of 3.5%
- Rent ratio increase of 3% (USGBC, 2009a)

5.2 MARKET BENEFITS

- Creation of compatible market value
- Occupancy high rates
- Lesser vacancy period
- Satisfy tenants growing demands
- Company recognition
- Least advertising costs

5.3 INDUSTRY BENEFITS

- Positive impact on the Construction Industry
- Allow technology to become part of the green building process improving the outcome of projects
- Allow professionals to become more qualified, educated, integrated
- Allow opening other countries and selling green building know-how
- Help other industries to benefit from new opportunities
- More job vacancies
- Increases funding Agencies / Grants

5.4 NEGATIVE IMPACTS

The numbers below are enough to demonstrate that there is indeed a huge negative impact on the environment due to existing buildings. In the United States, buildings are responsible for:

72% of Electricity Consumption
39% of Energy Use
35% of Carbon Dioxide Emissions
40% of Raw Material Usage
30% Waste Output
14% Potable Water Consumption (USGBC, 2009)

6. BUILDING ENVIRONMENTAL ASSESSMENT METHODS

Globally, large numbers of rating tools have evolved in a number of regions that are influencing property markets towards more sustainable practices. They are based on local climates and geographical conditions (Winter, 2008; Elias and Lin, 2015). The predominant ones are:

1. BREEAM
2. LEED
3. CASBEE
4. NABERS
5. GRIHA

Morri and Soffietti (2013) found that higher green premium in green building investment is due to factors viz. cost saving, high occupancy rate, cap rate reduction, and green labelling. Usman and Gidado (2015) pointed economic, social, technological and cultural factors as drivers for green building adoption. Some of the drivers to green building construction mentioned by various authors are presented here:

1. Consumer Demand
2. Energy Cost Increase
3. Superior Building Performance
4. Positive Publicity

5. Incentives
6. Codes and Regulations
7. Green Certification Programs
8. Lending Industry
9. Risk Management
10. Green Practice

7. CHALLENGES IN IMPLEMENTING GREEN BUILDINGS CONCEPT

The major barrier or challenges to implement green building concept were discussed by Choi (2009); Issa, Rankin and Christian (2010); Zhang, Platten and Shen (2011). The slow recovery of long-term cost saving hinders the progression of green building development as identified by Issa et.al. (2010).

1. Higher perceived First Cost
2. Lack of Knowledge
3. Lack of Widely used Standards
4. Scarcity of Products and Expertise
5. Lack of Implementation of Energy Conservation Building Code (ECBC)
6. Lack of Seriousness and Leadership
7. Awareness for Global Marketing Needs
8. Addressing with Economics Perspective
9. Risk and Uncertainty 10. Lack of Experienced Workforce
11. Lack of Effective Enforcement of Policies 12. Lack of Financial Incentives
13. Process of certification

8. RECOMMENDATIONS

The review of literature revealed that much efforts has been made to research area of "Benefits of Green Buildings", "Green Building rating Systems", "Barriers and Challenges in adopting Green Building concept" in India as well as outside India. The main objective of this review paper is to analyses the latest literature related to many aspects of housing and residential construction.

1. Educational institutions can carry out more researches to identify the issues and solutions in adopting Green building design and construction.
2. LEED and GRIHA should step forward and in collaboration with the educational institutions for creating awareness.
3. Government should make efforts in formulation strategies and policies which mandate builders to adopt features of green building in the construction projects and give incentives as a motivator for the builders and buyers for choosing
4. Case studies can be conducted to assess the performance of Green Building constructed in a city.
5. A study can be undertaken to find out the financial and environmental benefits of Green buildings.

9. CONCLUSION

The green building / energy efficient building application in India have been exciting and challenging as well. It will ultimately serve to improve not only the energy performance of buildings but will also assist energy conservation and natural resources by increased recovery and recycling of building materials, techniques and technology.

The green building experiences in India have been exciting and challenging as well. This will ultimately serve to improve not only the energy performance of buildings but will also assist the country conserve energy and natural resources by spurring increased recovery and recycling of building materials.

The easy availability of most of the green materials and equipment in the country has made it easier for the designers to adopt local materials to a very large extent. Now there is an imminent need for service providers, who would be required in large numbers, not in hundreds but thousands, as the movement is heading to reach greater heights.

The green building movement is here to stay for the benefit of individuals, society and the country at large. And energy savings are only the most obvious and most easily quantified of the cost benefits of green buildings. Extended building life cycles, greater worker productivity, and greater employee retention also are being realized by businesses that accept the challenges of building green. Furthermore, over time the real advantages offered by green buildings will be recognized increasingly as critical to companies' having a competitive edge.

We must think boldly and broadly about energy efficiency, conservation, and smart growth. Sustainability of growth – not mere growth – is the goal of both the smart company and the smart city. While, clearly, this is true for reasons related to the wellbeing of our environment, it is equally true for reasons related to the competitive arena of the business world. Beyond the obvious importance of safeguarding our environment and health, high performance green building will also benefit India's economy.

REFERENCES

[1] Alnaser, N.W., Flanagan, R., Alnaser, W.E., (2008), "Model for Calculating the Sustainable Building Index (SBI) in the Kingdom of Bahrain", Journal of Energy and Building, Vol. 40, Issue 11 pp: 2037- 2043
[2] Cassidy,(2003), A White Paper on Building for Platinum LEED Certification, Great River Energy, The Planning Designing and Construction of Great River Energy's headquarters building in Maple Grove, Minn. cited in http://www.usgbc.org/Docs/Resources/BDCWhitePaperR2.
[3] Indian Green Building Council (IGBC), (2012), "IGBC Green Homes"- Rating Systems, Abridged Reference Guide, Confederation of Indian Industry (CII), Hyderabad
[4] Indian Green Building Council, (2013) cited in http://www.igbc.in retrieved on 2013
[5] Indian Green Building Green New Buildings Rating System, (2014), Version 3.0, Abridge Reference Guide 2014
[6] Morri, G. and Soffietti, F., (2008), "Green Building Sustainability and Market Premiums in Italy", Journal of European Real Estate Research,Vol. 6, Issue 3, pp: 303-332
[7] Ramesh, S.P. and Khan, E.M., (2013), "Energy Efficiency in Green Buildings-Indian Concept", International Journal of Emerging Technology and Advanced Engineering, Vol. 3, No. 3, pp: 329-336
[8] Report on "Regional Green Buildings Case Study Project: A Post Occupancy Study of LEED Project in Illinois", 2009, U.S. Green Building Council
[9] Roy, T. And Gupta, A.K., (2008), "Cost Efficiency of Green Buildings in India", Greenomics, New Delhi: Jones Lang Lasalle Meghraj.
[10] Taleb, H.M. and Sharples, S., (2011), "Developing Sustainable Residential Buildings in Saudi Arabia: A Case Study", Journal of Applied Energy, Vol. 88, Issue 1, pp: 383-391
[11] Times of India, (2014), "Finding a Real 'Green' Home", JLL report "A Buyer's Guide to Green Homes in India", Vadodara, October 19
[12] Times of India, (2014), "India Embracing Green Tech in Big Way", Team Times Property, Vadodara, November 16
[13] Times of India, Vadodara, (2015), "Green Light for Sustainable Development in India" Sunday, January 25, Avani Jain
[14] Times of India, Vadodara, (2015), "On the Green Path", Saturday, August, 15, Anshuman Magazine and Chetan Dattani
[15] Udechukwu, C.E. and Johnson, O., (2008), "The Impact of Green Buildings on Valuation Approaches", The Lagos Journal of Environmental Studies, Vol. 6, Issue 1, pp: 3-13
[16] Winter, S., (2008) Paper 4b: Green Residential Building in North America: A perspective from the United States, Steven Winter Associates, Inc., Montréal, Québec: Commission for Environmental Cooperation, p.27
[17] Yi-Kai, J., Peng, G. and Jie, W., (2010), "A Hybrid Decision Support System for Sustainable Office Building Renovation and Energy Performance Improvement", Journal of Energy and Buildings, Vol. 42, Issue 3, pp: 290-297
[18] Yu, S.M., Tu, Y. and Luo, C., (2011), "Green Retrofitting Costs and Benefits: A New Research Agenda", Institute of Real Estate studies Working Paper Series.
[19] D.J. Sailor, A green roof model for building energy simulation programs, Department of Mechanical and Materials Engineering, Portland State University, USA February 2008
[20] Doreen E. Kalz, Sebastian Herkel, Andreas Wagner The impact of auxiliary energy on the efficiency of the heating and cooling system:Monitoring of low-energy buildings, Fraunhofer Institute for Solar Energy Systems ISE, Germany , University of Karlsruhe, Building Science Group, Englerstr. 7, D - 76131 Karlsruhe, Germany
[21] ENVJS Centre on Human Settlements, STATUS OF GREEN BUILDINGS IN CITIES OF INDIA, School of Planning and Architecture, New Delhi – 110002
[22] Fadi Chlela, Ahmad Husaunndee, Christian Inard, Peter Riederer A new methodology for the design of low energy buildings, University of La Rochelle, Av. Michel Cre´peau, 17042 La Rochelle, France