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Role of Green Buildings in Sustainable Construction- Need, Challenges and Scope in the Indian Scenario

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Abstract: *Change in climate, caused by the release of greenhouse effect causing gases (primarily carbon dioxide) into the atmosphere, has been recognized as one of the greatest threats of the 21st century. Share of the global energy consumption in India and China has also been on the rise due to heavy industrialization, urbanization, population explosion, and intensive growth of IT. Buildings are the prime energy consumers in modern cities accounting upto 40 to 45% energy consumption. Their consumption can be largely confined through improving efficiency, which is an effective means to lessen greenhouse gas emissions and slow down depletion of fossil fuels. There is a heavy (over 50%) saving potential in the building sector and thus it is considered as a potential sector to meet the challenges of global energy demand and climate change. Along with the advent of energy efficient measures, more effective means are needed to induce or compel greater efforts, especially to the signatories of the Kyoto Protocol. This technical paper highlights the importance of sustainable construction, discusses role of energy efficiency in green buildings in Indian context to reduce the energy consumption and environmental degradation through Green House Gas emission (GHG). Also it points out to the benefits of green construction as well as the incentives from govt. and municipal bodies for GRIHA certified green building.*

Keywords: *ECBC, GRIHA, Green Building, Green Building Rating, LEED, Zero Net Energy Buildings*

I. Introduction

In recent times the need for sustainability has gained remarkable momentum. International treaties such as the Kyoto Protocol Treaty, Basel Convention, The Rio Declaration have compelled leading industrial countries to form environmental rules and regulations.

Climate change, caused by the release of greenhouse gases into the atmosphere, has been the greatest threats of the 21st century .Being the largest primary energy consumers, buildings make the world's largest contribution to this growing menace.

World studies have acknowledged, buildings were attributable for 7.85Gt, or 33% of all energy-related CO2 emissions worldwide and these emissions are expected to grow to 11Gt (B2 scenario) or15.6Gt (A1B scenario) by 2030.

India continues to grow; by 2030 it is likely to have GDP of 4 trillion US$ and a population of 1.5 billion. Energy consumption in India and China is also on the ascent due to sharp urbanization, population explosion, and intensive growth of IT and related business. Buildings account for more than 41% energy consumption in developed countries.

Green building is on the rise around the world, through a mix of voluntary certification and mandatory requirements. The overall LEED rating system of the USA has expanded its international presence. Around 40 percent of the LEED registered projects are located outside of the United States (USGBC, 2011). For developed nations, the focus on LEED registration and certification stems from the opportunity to reduce building operational costs. For developing nations experiencing rapid economic progress, there could be a tendency to focus only on new building construction.

The two economic giants, China and India, could soon be major players in the booming green building market .Currently in these two nations, green construction can be seen mainly in private sector whereas in the U.S., all government buildings need to meet a minimum LEED silver standard.

Green and sustainable construction is a significant issue because buildings impact the global environment. According to the World Business Council for Sustainable Development (WBCSD) (2009), buildings account for 40% of global energy use. In the United States, the building sector consumes 49% of all energy produced in the United States, whereas building in the European Union accounts for only 25% of total annual energy consumption. To investigate how to minimize the amount of energy consumed in the building sector, many studies have been conducted on sustainable buildings. Studies on the zero-net-energy (ZNE) buildings (buildings that produce energy from renewable energy sources equal to or greater than the energy consumed) are an example of such investigations.

Today green building is the only way for the construction industry to move towards achieving a sustainable development, taking into account environmental, socioeconomic and cultural issues. The status of construction in South Asia is still in its infancy. Lack of awareness, trained personnel, education and ineffective procurement systems are among the major barriers for sustainable construction in the region. In countries like India govt. policies and regulatory frameworks do not encourage sustainable development in the public sector construction industry. Also a lack of adequate amount of incentives from govt. can be felt.

II. The Growing Crisis

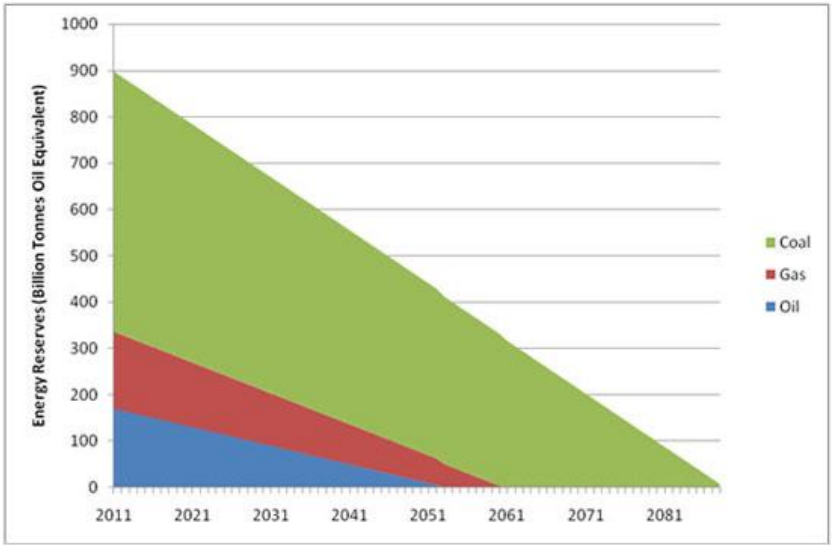
Increasing concentration of green house gases and consequent global warming are the alarming problems the world is facing today. Global warming is the increase in the average measured temperature of the Earth's near-surface air and oceans since the mid-20th century. Global warming can cause a 20% decline in the world's GDP as this phenomenon increases the possibility of occurrence of natural disasters altering the world's GDP. It threatens the melting of glacial ice caps, increasing the sea level and causing a submergence of the coastal world. The world is not taking adequate steps to address the issues leading to global warming. The first step in this regard was the United Nations Framework Convention on Climate Change (UNFCCC) treaty in 1992.Then the consequent Kyoto Protocol on 11 December 1997 was signed by over 150 countries, with the objective of reducing GHG emissions to prevent the man-made global warming process. The Kyoto Protocol aims to be a holistic guideline restricting and reducing emissions in developed countries and at the same time facilitating emission reduction in the developing world through technological support from developed nations.

The End Of Fossil Fuels....It's only a matter of time

Clearly fossil fuel being finite - it's only a matter of time when we run out. Statistically every year we consume the equivalent of over 11 billion tonnes of oil in fossil fuels. Crude oil reserves are vanishing at the rate of 4 billion tonnes a year, and if we continue at this rate without any increase for our growing population or aspirations, our known reserves will be gone by 2052.

We'll still have gas left, and coal too. But if we increase gas production to fill the energy gap left by oil, then those reserves will only give us an extra eight years, taking us to 2060. But the rate at which the world consumes fossil fuels is not standing still, it is increasing as the world's population increases and as living standards rise in parts of the world that until recently had consumed very little energy. Fossil Fuels will therefore run out earlier than expected.

It's often claimed that we have enough coal to last hundreds of years. But if we step up production to fill the gap left through depleting our oil and gas reserves, the coal deposits we know about will only give us enough energy to take us as far as 2088, but the carbon dioxide emissions from burning all that coal would again be detrimental.

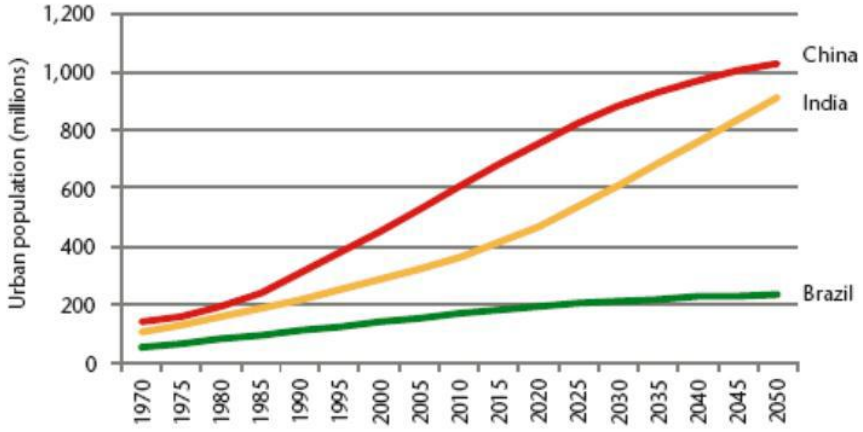


Graph 1: Showing The Decline of Fossil Fuel

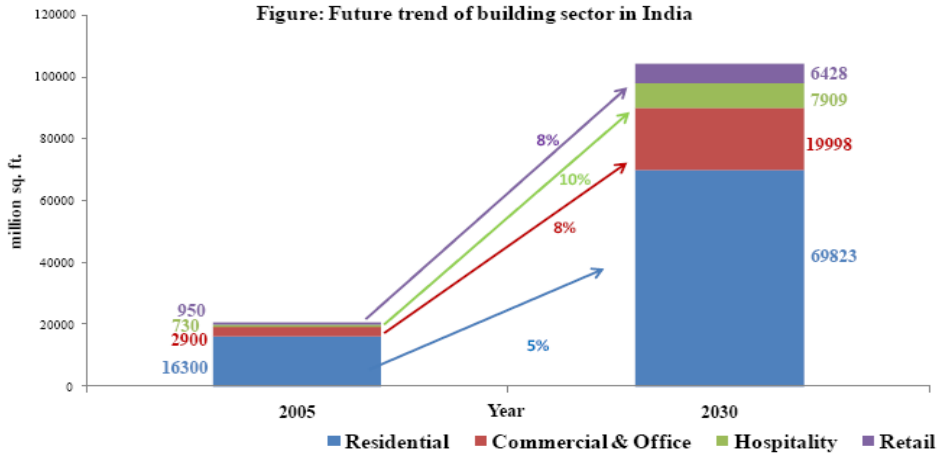
Some new reserves may be found which will extend this deadline. Renewables offer us another way to avoid this (fossil fuelled) energy time bomb, but we must we start now. As the Saudi Oil Minister said in the 1970s, "The Stone Age didn't end for lack of stone, and the oil age will end long before the world runs out of oil."

III. Indian Urban population and Energy consumption pattern in buildings

Population of China, India and Brazil is growing at an unprecedented level and with this their need for food, housing and energy has increased manifold. In line with this growing urbanization and population, India's building sector is expected to grow five-fold from 2005 to 2050 as two-thirds (about 70%) of the commercial and high-rise residential structures that will exist in 2030 are yet to be built. While India's total energy requirement is projected to grow at 6.5 percent per year between 2010-11 and 2016-17 to support the country's projected growth rate, India is en route to becoming the world's second largest emitter of greenhouse gases (after China).



Graph 2: Growing Population Trend of China, India and Brazil

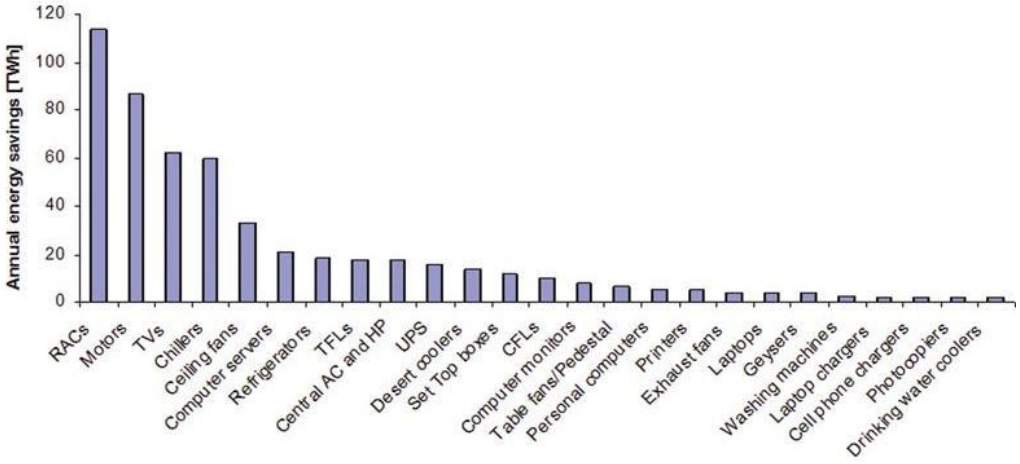


Graph 3: Rise Of Building Sector of India

IV. Background of Energy Efficiency in India

There is an urgent need to improve the energy efficiency of the Indian construction sector. About 70% of the infrastructure in 2030, such as buildings, will be added in next two decades—between 2012 and 2032. The projections for energy demand in 2032 imply a fourfold increase in requirements. Such a dramatic increase of energy supply will be difficult to manage because of resource constraints (renewables and nuclear energy seem the only solutions). In 2001, the Government of India (GoI) passed the Energy Conservation Act (EC Act, 2001) and the following year established the Bureau of Energy Efficiency (BEE) under its provisions. One of the first initiatives of BEE was to prepare an Energy Conservation Action Plan, which was released in August 2002. In June 2008, India released the first National Action Plan on Climate Change (NAPCC) outlining existing and future policies and programs addressing climate change mitigation and adaptation. The plan identified eight core 'national missions' including a National Mission for Enhanced Energy Efficiency (NMEEE).

Energy efficiency in building is an accumulation of energy efficiencies of appliances used like ACs, lighting, chillers, heaters, Fans and various other systems. BEE as a national agency has been introducing and monitoring efficiencies of buildings and appliances in India. Following figure shows the annual energy-saving potential for about 25 products estimated in a recent study. From this, one can say that a good strategy would be to concentrate on those 7-10 appliances consuming maximum energy.



Graph 4: Saving Potential Of Various Appliances

V. Energy Efficient Built- Green Building concept

Green Building (GB) is synonymous with 'high performance buildings', 'green construction', 'sustainable design and construction' as well as other terms that refer to a holistic approach to design and construction. Green Building design endeavours to balance environmental responsibility, resource efficiency, occupant comfort, well being and community sensitivity. The Green Building design consists of all players in an integrated development process, from the design team (building owners, architects, engineers and consultants), the construction team (material manufacturers, contractors, suppliers and waste haulers), maintenance staff and building occupants. The green building process ends in a high quality product that maximizes the owner's returns on investment by sustained savings of energy (40-50%), water savings (20-30%) and a smaller payback period on initial investment.

A Green Building is one, which incorporates several green features and facilities. The appearance of a green building is similar to any other building. However, the difference is in the intention which revolves round a concern for extending the life span of natural resources, provide human comfort, safety and productivity. This approach results in a reduction of operating costs like energy and water, besides several other intangible benefits.

The Green building movement has gained tremendous momentum during the past 5-6 years, since the CII-Godrej GBC embarked on achieving the prestigious LEED platinum rating for its own centre at Hyderabad. The rating awarded for this building sparked off considerable enthusiasm in the country. Today a variety of green building projects are coming up in India in the form of residential complexes, exhibition centres, hospitals, educational institutions, laboratories, IT parks, airports, government buildings and corporate offices. But recent statistics lists about 315 green buildings operational not only in the four metros of India but also in fast growing cities like Bangalore and Hyderabad.

VI. Green Building Adoption Pattern In India

Till 2006 developers in India were reluctant towards the concepts of green buildings. They saw it as an added expense. They hardly were aware of the benefits and the enhanced marketability that the green construction was able to offer.

Green buildings and their acceptance has been a relatively recent trend in the developing countries as compared to the developed world. Though, there have been several initiatives by the governments and other bodies in the developing countries to address sustainability in the construction sector, these initiatives have either faced economic and social problems or did not have a proper implementation strategy to ensure their successful adoption in the society. But, the recent trend in India suggests a rapid adoption of green buildings in construction. Out of 85 internationally registered projects under LEED NC-USA, 32 (37 percent) are registered in India (USGBC, 2007). More than 50 projects have been registered or certified under the green building guidelines developed in India (IGBC, 2007). These figures have then considerably grown in subsequent years.

Indian Green Building Council (IGBC) and LEED India has framed guidelines according to the Indian context for green construction and certification and therefore will be compatible to the Indian construction practices.

VII. Green Techniques

Emphasis of four 'R's:-

The four R's which forms the basis for sustainable construction includes:

Reduce: Lower quantity of building material, resources, and embodied energy.
Reuse: Construction materials that are practical and structurally sound are reused.
Recycle: Recycled materials are used, and home is designed for recyclables.
Renewable: Energy from natural and renewable sources are emphasized upon.
These four R's are the essence of green construction. The Green techniques can be classified as follows:

1. Structural or civil techniques:
a. Insulated wall
b. Green cement
c. Fly ash bricks
d. Transparent roof
e. Green roof

2. Electrical techniques
2.1 Conservation techniques
a. Optimum use of natural light.
b. Replacing incandescent lamps by compact fluorescent lamps (CFL).
c. Replacement of conventional fluorescent lamp by energy efficient fluorescent lamp/LED
2.2 Generation Techniques
a. Solar lighting
b. Solar wind hybrid

3. Special systems/ techniques
a. Grey water mgmt by evapotranspiration
b. RWH
c. Porous pavement blocks
d. Passive solar design

VIII. Green Buildings in India

The green building movement in India started with the establishment of the IGBC in 2001, which was an initiative of the Confederation of Indian Industries (CII) along with the World Green Building Council and the USGBC. The first green building in India, CII-Sohrabji Godrej Green Business Centre in Hyderabad, was inaugurated on 14 July 2004. This was a bench mark in the years to come. Since then, the number and volume of green buildings in India has been phenomenal. The movement started with 20,000 sq ft in 2004 and has grown exponentially, with an expected green building footprint of 15 million sq ft by end-2008. There are 18 LEED certified buildings with a total area of about 8.5 million sq ft and 195 projects registered for LEED certification with a total area of about 110 million sq ft as of year-end 2007.By the end of 2013 India had more than 1.28 billion sq.ft. of green building area (IGBC data). The real estate industry is one of the biggest emitter of GHGs in India. According to a report by the Ministry of Power in June 2004, 20–25% of the electricity consumed in government buildings is wasted due to inefficient design. The scenario is almost the same in the private sector.

It is heartening to know that the green building concept is widely being adopted in the Indian real estate industry. However, efforts are not enough and a greater push is required to make real estate development, sustainable. In the next 3-4 years about 200 million sq ft of commercial space and 45 million of retail space is expected to be constructed across the major cities of India which indicates that there is a great opportunity for developers and occupiers to promote green buildings.

The performance of green building and its trend in India indicates that with the incoming of new building techniques and materials the percentage increase in the initial cost as well as the payback period has reduced.

Name of the Project	Location	Built-up Area (sq ft)	Rating Achieved	Increase in Cost (%)	Payback Period (years)
CII-Sorabji Godrej GBC	Hyderabad	20,000	Platinum	18	7
ITC Green Centre	Gurgaon	170,000	Platinum	15	6
Wipro	Gurgaon	175,000	Platinum	8	5
Technopolis	Kolkata	72,000	Gold	6	3
Spectral Services Consultants Office	Noida	15,000	Platinum	8	4
HITAM	Hyderabad	78,000	Silver	2	3
Grundfos Pump	Chennai	40,000	Gold	6	3

Table 1: Green Building Performance in India

Building	Sq.ft	Normal Building (kWh)	Actual Building (kWh)	% Reduction	Annual Energy Savings (Rs in Lakhs)
Wipro , Gurgaon	1,75,000	48,00,000	31,00,000	40%	102
ITC , Gurgaon	1,70,000	35,00,000	20,00,000	45%	90
CII Godrej Hyderabad	20,000	3,50,000	1,30,000	63%	9

Table 2: Energy Savings From Green Building

Environmental Benefit Category	Annual Benefits Per Million Sq.ft*
CO_2 reduction	12,000 Tons
Energy savings	15,000 MWh

Table 3: Benefit From Green Buildings in India

IX. Scope of Green Buildings in India

With the advent of the era of green buildings architects and builders have begun using green principles like energy conservation, water harvesting and waste management in their designs. They now tend to understand the concept of sustainability in construction and its importance. They emphasize the use of eco friendly building materials like fly-ash & silica fume cement and blocks, steel and tiles, recycled aluminium, bamboo based products, green roofing products and so on. On the technology front too, there are a lot of options available to build green homes, energy saving air conditioners (HVACs), high performance glass windows, water saving solutions, composting toilets, and efficient building management systems are just some of them. Tapping solar energy is another method used by green home builders in India. The use of a photovoltaic array on the rooftop is a good source of alternate energy as are solar thermal arrays.

This way energy can be obtained from the environment, stored and used as required. A combination of innovative green ideas and high technology may be able to address India's energy and water needs.

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the growth of economy, partnering corporate India and government through advisory and consultative processes. CII is a non-government, not-for-profit, industry led and industry managed organization, playing a proactive role in India's development process. CII Sohrabji Godrej Green Business Centre (CII Godrej GBC), a division of Confederation of Indian Industry (CII) is India's premier developmental institution, offering advisory services to the industry on environmental aspects and works in the areas of Green Buildings, Energy Efficiency, Water Management, Renewable Energy, Green Business Incubation and Climate Change activities. The Centre sensitizes key stakeholders to embrace green practices and facilitates market transformation, paving way for India to become one of the global leaders in green business by 2015.

X. Green Building Rating Systems

Motivated by a desire to be environmentally conscious, many commercial and other facilities have adopted "Green technologies" in order to earn "Green and Sustainable" certifications. The Green Buildings Ratings and Certification process has gained tremendous momentum over the last few years. Particularly, growth in the number of projects certified by rating systems such as Energy Star and LEED has nearly doubled in size during this period.

In India, the Indian Green Building Council (IGBC) provides LEED ratings to structures and aims to make the country one of the leaders in green buildings by the year 2015. The Green rating for Integrated Habitat Assessment (GRIHA) is the National Rating System of India. It has been conceived by The Energy and Resources Institute (TERI) and developed jointly with the Ministry of New and Renewable Energy, India. It is a design evaluation system for green building and is intended for all kinds of buildings across every climatic zone in India. Because of the gradual spread of awareness about eco-friendly buildings, there has been a considerable rise in the number of registered green buildings all over India.

Green Building Certification Processes in India:-

GRIHA : Green Star Rating System

Formed by The energy And Resources Institute (TERI), INDIA, it identifies projects that have demonstrated a commitment to sustainability by designing, constructing or owning a building to a determined standard. TERI (GRIHA) certification system consists of 34 criteria of the rating under 4 categories namely site selection and planning**,** building planning and construction**,** building operation and maintenance, innovation.

Within each category, the credits awarded have an effective weightage by virtue of the numbers of credits awarded versus the total credits available.

Different levels of certification (one star to five star) are awarded based on the number of points earned. The minimum points required for certification is 50. Building scoring 50 to 60 points, 61 to 70 points, 71 to 80 points, and 81 to 90 points will get one star, two stars, three stars and four stars respectively. A building scoring 91 to 100 points will get the maximum rating i.e. five stars.

Leadership in Energy and Environmental Design Rating System (LEED), INDIA

LEED, a product of the U.S. Green Building Council (USGBC), provides a complete framework for assessing building performance and meeting sustainability goals within 6 category rating system.

The categories are: sustainable sites, water efficiency, energy & atmosphere, materials & resources, indoor environmental quality and innovation & design. LEED Certification is based on point system. The amount of points achieved will determine which level of LEED certification the project is awarded.

There are 69 possible points and four certification levels. Basic LEED Certification requires 26 to 32 points; LEED certified silver level requires 33 to 38 points; LEED certified Gold level requires 39 to 51 points; and LEED certified platinum level requires 52 to 69 points.

The maximum possible points are based on:

- Sustainable sites (14 possible points total)
- Water efficiency (5 possible points total)
- Energy and atmosphere (17 possible points total)
- Material and resources (13 possible points total)
- Indoor environmental quality (15 possible points total)
- Innovation and design process (5 possible points total)

BEE: Star Rating

The scheme is based on actual performance of the buildings in terms of energy performance index (EPI, kWh/m2/yr), in which air-conditioned and non- air-conditioned buildings (offices, hotels, hospitals, retails malls and IT parks) are rated on 1 to 5 scale targeting three climate zones (hot and dry, warm and humid, composite).

The Star Rating Program for buildings will create a demand in the market for energy efficient buildings based on actual performance of the building in terms of specific energy usage. This programme will rate buildings having a connected load of 100 kW and above on a 1-5 Star scale with 5 Star labelled buildings being the most efficient. Five categories of buildings - office buildings, hotels, hospitals, retail malls, and IT Parks in five climate zones in the country have been identified for this programme. The energy Performance Index (EPI) in kWh/m2/year will be considered for rating the building.

The Indian Bureau of Energy Efficiency (BEE) had launched the Energy Conservation Building Code (ECBC) on February 2007. The code is set for energy efficiency standards for design and construction with any building of minimum conditioned area of 1000 Sq. mts and a connected demand of power of 500 KW or 600 KVA. The energy performance index of the code is set from 90 kW·h/sq./year to 200 kW·h/sqm/year where any buildings that fall under the index can be termed as "ECBC Compliant Building".

XI. Green Building Benefits

Pre-project planning effort required in green construction is tremendous, but if an integrated approach towards planning and execution is undertaken by all the teams involved then benefits will far exceed a conventional structure.

Potential benefits of green building include:

Environmental benefits (intangible)

Enhance and protect biodiversity and ecosystems

Improve air and water quality

Reduce waste streams

Conserve and restore natural resources

Economic benefits(tangible)

Reduced energy bills
Reduced water consumption and subsequent load on treatment plants
Enhanced Marketability
Optimize life-cycle economic performance
Social benefits (intangible)
Enhance occupant comfort , health and consequent productivity
Heighten aesthetic qualities
Reduced Absenteeism at work place
Improve overall quality of life

XII. Incentives to GRIHA rated projects

GRIHA rated projects are entitled with various incentives which are given by the government bodies, municipalities etc. Various government bodies/organizations grant following incentives to stakeholders:

1) Incentives from Ministry of Environment and Forest:

GRIHA pre certified projects are entitled to receive fast track EIA (Environmental Impact Assessment) from MoEF. Fast track process enables to save at least 3 months.

2) Incentives from Ministry of New and Renewable Energy.

- Incentives to developers: (up to 2012)

90% of registration cum rating fee will be reimbursed for projects having built up area less than 5,000 sq.m with minimum 3 star rating and built up area more than 5,000 sq.m with minimum 4 star rating.

- Incentives to Municipal corporations/ Urban local bodies:

Incentives of Rs. 50 lakhs and Rs. 25 lakhs are given to municipal Corporations and Urban local bodies respectively that announce rebate in property tax for green building and make it mandatory to get the new buildings for government and public sector rated under GRIHA. Additional award of Rs. 50 lakhs will be announced to Municipal Corporation and Rs. 25 lakhs to other urban body who performs best.

- Subsidy:

A capital subsidy is given on solar photovoltaic panels.

- Promotional activities:

For organizing workshops/ trainings/ seminars/ awareness campaigns etc. funds up to Rs. 2 lakhs will be given to specialized Institutes.

- Annual award is given to 5 star GRIHA rated buildings.

3) Extra ground coverage and FAR for GRIHA projects:

Ministry of Urban Development, Government of India has announced free of cost 1 to 5 % extra ground coverage and FAR for GRIHA rated projects of plot size more than 3,000 sq.m. Noida, Greater Noida and Punjab have incorporated this policy.

4) Incentives from Pimpri Chinchwad Municipal Corporation (PCMC) :

PCMC is the first municipal Corporation in the country to a take a prominent step towards promoting sustainable development by incentivizing GRIHA rated project in their Jurisdiction. PCMC gives financial assistance to developer and occupants.

GRIHA rating	Discount in premium (for developers)	Discount in property tax (for occupants)
5 Star	50 %	10 %
4 Star	40 %	8 %
3 Star	30 %	5 %
2 Star	20 %	--
1 Star	10 %	--

Table 4: Incentives to Developers and Occupants for adopting GRIHA

5) Incentives from banks:

- Small Industries Development Bank of India (SIDBI) has announced a scheme of providing financial assistance at a concessional rate of interest to GRIHA rated projects.
- For GRIHA compliant projects, processing fee is waiver from SBI for home loans.
- SBI gives a 0.25% rebate on interest on housing loans.

XIII. Constraints and Challenges

a. The first and foremost constraint for the spread of green building concepts is the lack of information and incorrect perception. It is generally believed that green buildings cost more and have long payback period. Although experts have highlighted the advantages of green buildings, this information does not seem to reach developers and customers.

b. The required support from government in terms of the incentives granted to the developers for constructing green has to increase. This could be in the form of additional FSI , rebate on property taxes , development charges etc. A uniformity in the policy for incentives should be present.
c. Turbulence in the real estate industry directly affects developer's propensity to invest in additional cost centres such as a premium on green buildings.
d. Stand-alone green constructions do not fulfil the larger goal of sustainability. Green building criteria must be as per the local requirement. In the Indian context, green real estate must also include town planning, sanitation and relevant social infrastructure. Hence, we have to take this green building concept further to green towns and green cities.
e. Making the required materials available for green buildings can be difficult and complex. IGBC's requirement of sourcing materials locally has noble intentions. However, the lack of available materials might also discourage developers to pursue green building developments.
f. Lack of professional knowledge for facilitation of LEED certification and consultancy services is still present. However with time awareness on sustainability in India, competency among consultants , and skills in the construction and real estate industry is increasing. This will in turn facilitate developers with their required professional support.

XIV. Conclusion

With India facing rapid urbanization, globalization and expanding economy, it is experiencing a rapid spurt in building construction across a range of city activities and socio-economic spectrum, increasing consumption of building materials such as glass, cement, metals and ceramics. Uncurbed consumption of these high embodied energy materials is a reason for environmental degradation.

In today's era where energy crisis is a major problem, green buildings gives a brilliant and promising solution. These are designed to use minimum energy. All the systems for cooling, heating, ventilating are designed such that they require very less energy.

The IGBC has adopted the LEED rating system for evaluating green building performance in India. The payback period for existing green buildings range from two to seven years, depending upon their certification level.

The key challenges for the development of green buildings in India are mostly in the lines of awareness on the benefits of green buildings, green materials and technology. The CII-IGBC and other professionals are working towards addressing these challenges to enable developers to operate with ease.

Green building is a boon to the society where energy and water consumption can be reduced while still maintaining an increase in productivity for occupants, their health, safety and well being.

In today's era green buildings are essential as environmental balance is important for survival and further development of human beings, but first people have to be made aware not to see green buildings as an extra monetary burden. Green buildings are only way to a sustainable tomorrow.

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