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Green housing – Review, rating systems and implementation

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Every engineer and builder would love to construct 'green buildings'. Acceptance of the concept is there but adoption is very limited. Such issues cannot be enforced by only enactment, because it is observed that public will find loopholes and short cuts and the expected benefit is not achieved. The government should try to provide enabling provisions. Better way is to educate, convince and motivate the decision maker to adapt. Further, such efforts need appreciation and encouragement and hence point systems and rating systems have been evolved for the purpose of quantification. This will be the logical base for extending any facilities, funding etc. Structures certified with higher ratings should be rewarded with incentives by way of easy financing, tax benefits, etc. and should be acknowledged prominently to create healthy competition and motivate others.

The paper discusses various aspects and stages of rating and also the provisions that can be made mandatory or optional selectively. The paper also suggests various incentives, which can be given, on achieving various levels of rating.

What is green building? Why the word 'green'?

Green building does not mean building is painted green but building which has incorporated nature friendly features. Green represents nature. In fact, evolution

of housing started by utilising nature and natural resources like trees and caves as shelter from the severity of natural elements like sun, rain, wind, etc. Based on such complex experiences, our *vedic* philosophy evolved certain methods to maximise the use of *Panch Mahabhuta* or the 5 basic elements of nature, i.e., *Jal* (water), *Agni* (fire), *Prithvi* (earth), *Vayu* (wind), *Avkash* (space). Our ancient builders tried to harmonies these five elements in building planning and construction so that maximum advantage of these elements can be taken and ill effects can be avoided. They called this science as *Vastushastra*.

The basic principals of *Vastushastra* is to get maximum advantage out of nature without harming nature. Leaving open spaces in a centre of a building was done to provide light and cross ventilation to adjoining rooms. Water storage and prayer rooms were positioned in the northeast direction to facilitate solar rays to disinfect water and rooms. The south west portion of the house was made heavy to protect it against heavy winds and heavy rains. The south east portion of the house receives comparatively less solar rays and hence the kitchen is placed here so that the general temperature of the kitchen is not raised. This was the kind of wisdom prevailing at that time. In simple terms, these were the bye-laws for the planning and construction of any building. Our ancient builders desired that everyone should follow these rules religiously. Hence, for better implementation

of these rules, they coupled it with fear psychology. They associated each building norm with aspects of personal life and specified that lack of adherence to these norms would result in loss of health, wealth or even reputation due to the disapproval of nature gods. This was done to instigate fear so that building rules are adopted properly. What a way to implement and enforce the laws, without any police, inspector or supervisors! Unfortunately, today many *Vastushastra* practitioners are using this science as *Shahastra* (tool, weapon) to make money by continuing the use of fear psychology.

In fact, well-designed *Vastu* (building) should give not only physical comfort but it should also give mental peace and space to mind, so that the occupant can evolve and analyse alternative solutions to his problems by lateral or abstract thinking. Thus, well designed *Vastu* is a frozen piece of music. Now, questions are being raised by technologists about the relevance of *Vastushastra* when air-conditioners and artificial lights are available in place of sun, wind, etc. There are various opinions on this point and answers to the questions are beyond the scope of this paper. It is believed that many engineers and builders are willing to construct eco-friendly houses. Acceptance of the concept is very wide, but adoption is very very less. Many fora have voiced these feelings resulting in an echo effect where voice returns back with louder intensity but there is no music because there is no systematic action plan available.

Why 'green buildings'?

'Better living for all and future generations' is an universal dream.

With increasing urbanisation, natural resources are being utilised rapidly and erratically without any planning and equivalent replenishment. This is not sustainable development. If such a situation continues for long, the disparity in living conditions will create social upheaval and revolt. Also, future generations will not have any natural resources. Thus, the dreams of our future will shatter if proper steps are not taken in time. Hence, nature's basic rule is to be adopted, 'Reduce, reuse and recycle', i.e., reduce the requirement, reuse the waste and recycle to use.

Eco-friendly practices include:

- Adequate land use and better site planning so as to not disturb the natural resources like trees, lakes, rivers etc.
- Conservation of electricity and efficient practices.

- Renewable and non-conventional energy generation, alternative fuels, etc.
- Water management including drainage, waste water disposal, rain water harvesting, recycling grey water, etc.
- Maintaining good air quality.
- Human safety and comfort.

For achieving the above, existing building materials, technologies, tools, equipment, machinery, etc. would have to be modified or newly developed. All this is to be done with minimum damage to natural resources so that the next generation can have an opportunity to enjoy the same and the natural chain can continue. This is nothing sustainable development.

Green Building Council (GBC), USA

All those who produce, develop, plan, design, build, alter or maintain the built environment including building material manufacturers and suppliers decided to work out a system to balance environmental, social and economic issues with development. Thus, the concept of Green Building Council took shape. It is also decided to share knowledge, expertise, experience with each other to advance the development of green buildings. USA, being a country known for evolving best motivation systems and methods, adopted the new system in a big way. They not only defined the parameters, but also gave marks (points) for each parameter. The quantification was done so that adoption becomes comparable and also to stimulate competition. An authentication agency was created to monitor, advise and certify green buildings. The agency is better known as the Green Building Council (USGBC) and it is based in USA.

Rating system

USGBC developed the green building rating system known as 'LEED' (Leadership in Energy & Environmental Design) to establish benchmarks for sustainable building performance and enable transformation not only in the USA but all over the world. The LEED green building rating system establishes a 'Common standard of measurement' for green buildings and attempts to define the term 'sustainability' which is often considered indefinable with respect to the property industry.

LEED has been created to:

- define 'green building' by establishing a common standard of measurement
- promote integrated, whole-building design practices

- recognise environmental leadership in the building industry
- stimulate green competition
- raise consumer awareness of green building benefits
- transform the building market

Weightage by points

LEED certification is based on a point system. Below is a list of the categories and examples of required (minimum) and possible (maximum) points for LEED certification. USGBC also provides an optional sixth category for innovation and design process.

- **Sustainable sites** (14 possible points): Erosion and sedimentation control (required point), Site selection (1 point), Urban redevelopment (1 point), etc.
- **Water efficiency** (5 possible points): Innovative wastewater technologies (1 point), Water efficient landscaping – 50% reduction (1 point), Water use reduction – 20% reduction (1 point), etc.
- **Energy and atmosphere** (17 possible points): Fundamental building system commissioning (required point), Minimum energy performance (required point), CFC reduction in HVAC&R equipment (required point), Renewable energy – 20% (1 point), etc.
- **Materials and resources** (13 possible points): Storage and collection of recyclables (required point), Building reuse – Maintain 75% of existing shell (1 point), Construction waste management, – Divert 50% (1 point), etc.
- **Indoor environmental quality** (15 possible points): Minimum IAQ (Indoor air quality) performance (required point), Environmental tobacco smoke (ETS) Control (required point), Ventilation effectiveness (1 point), Low-emitting materials – Adhesives and sealants (1 point); etc.
- **Innovation and design process** (5 possible points): Innovations in design, Provide specifics (1 to 4 points) and LEED Accredited professional (1 point).

The total points achieved will determine the level of LEED certification of the project. 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.

In India

There are a few USGBC LEED certified buildings in India:

CII-Godrej centre at Hyderabad

This building has the honour of being the first building outside USA to receive a platinum certification.

ITC Group's Commercial Complex at Gurgaon

This building has also been awarded a platinum rating.

There are many projects which are in the process of receiving USGBC certificates.

LEED provides a complete framework for assessing building performance and meeting sustainability goals. Based on well-founded scientific standards, LEED emphasises state of the art strategies for sustainable site development, water savings, energy efficiency, material selection and indoor environmental quality. LEED recognises achievements and promotes expertise in green building through a comprehensive system offering project certification, professional accreditation, training and practical resources.

Environmental assessment method of the building research establishment Ltd, UK (BREEAM)

Buildings have a significant impact on the environment. In Great Britain, they account for around half the emissions of carbon dioxide, the main 'greenhouse' gas. BREEAM is a tool that allows building owners, users and designers to review and improve environmental performance throughout the life of a building. It is a widely accepted and respected scheme that sets a benchmark for environmental performance and provides a wide range of benefits. BREEAM is independent and authoritative, being based on many years of construction and environmental research carried out at the Building Research Establishment Ltd., UK (BRE). The inputs of the construction industry apart from government building regulators have also been incorporated in the system.

The Building Research Establishment's environmental assessment method or BREEAM assesses the performance of buildings in the following areas:

- **Management:** Overall policy and site management, commissioning and procedural issues
- **Energy:** Operational energy and carbon dioxide (CO₂) issues

- Health and well-being: Indoor and external issues affecting health and well-being
- Pollution: Air and water pollution issues
- Transport: Transport-related CO₂ and Location-related factors
- Land use: Greenfield and Brownfield sites
- Ecology: Ecological value conservation and enhancement of the site
- Materials: Environmental implication of building materials including life-cycle impacts
- Water: Consumption and water efficiency

BREEAM encourages developers and designers to consider the above issues at the earliest opportunity to maximise their chances of achieving higher BREEAM rating. Credits are awarded in each area according to performance, a set of environmental weightings then enables the credits to be added together to produce a single overall score. The building that meets the above criteria are then rated on a scale of Pass, Good, Very Good or Excellent, and subsequently a certificate is awarded. BREEAM covers a wide range of building types such as offices, homes, industrial units, retail units, schools, leisure centres, laboratories, and even prisons.

Builders and developers can use BREEAM to specify the sustainability performance of their buildings in a way that is quick, comprehensive and recognised in the marketplace.

- Property agents are using it to promote the environmental credentials and benefits of a building to potential buyers and tenants.
- Design teams are using it as a tool to improve the performance of their buildings and their own expertise in the environmental aspects of sustainability.
- Managers are using it to measure the performance of buildings and develop action plans to improve performance.

BREEAM offers a variety of benefits ranging from environmental to financial gains. It is regarded by UK's construction and property sectors as a measure of best practice in environmental design and management. For over a decade it has been used to assess the environmental performance of both new and existing buildings. BREEAM's success stems from its unique ability to cover a wide range of environmental issues

within one assessment. It presents the results in a way that is widely understood by those involved in property procurement and management.

Typical components of BREEAM's assessment

- Carbon dioxide emissions with quantified benchmarks
- Healthy building features
- Air quality and ventilation
- Minimising ozone depletion and acid rain
- Recycling and reuse of materials
- Ecology of the site
- Water consumption and conservation
- Noise
- Risk of Legionnaire's disease
- Hazardous materials assessment
- Lighting
- Environmental impact of construction materials
- Transport implications of buildings

BREEAM leads to significant benefits such as:

- Financial benefits – Reduces energy and other running costs, improve staff productivity, makes office buildings more aesthetic and thus are able to attract higher rental incomes
- Publicity benefits – Makes offices more attractive to potential customers or tenants by demonstrating environmental commitment
- Benefits to management – Provides a thorough checklist for benchmarking building performance, setting realistic targets for improvement, apart from complementing wider corporate management strategies
- Benefits to staff and building users – Creates a better place for people to work more productively, by providing a healthier, and comfortable indoor environment

No information is available about BREEAM certified buildings in India.

Incentives for green buildings in india

The Indian Green Business Council is very much active and is trying hard to spread the concept of green buildings. However, the success ratio is very limited. It is believed that there are many other government, private and non-government organisations working in the field of green buildings. One such distinguished agency in India is the International Institute for Energy Conservation (IIEC), a NGO involved in developing the green building assessment criteria and rating systems. IIEC is very active in Pune and Mumbai. They follow a rating system having 1000 possible points.

Recently, the Pimpri-Chinchwad Municipal Corporation (PCMC) has allotted a plot of 11,000 m² at Kasarwadi, near Pune to establish the Sustainable Building Technology Centre (SBTC) and IIEC has been appointed as the principal implementing agency. This project is in partnership with PCMC and United States Agency for International Development (USAID). The assessment criteria being developed by IIEC primarily focus on resource conservation measures like site planning, total water management, energy conservation, environment-friendly and energy efficient building materials, renewable energy and solid waste management. This concept of assessment and rating system has been developed to offer benefits to the consumers as well as the local municipal corporation in terms of reduced load on municipal infrastructure. It is also believed by IIEC that such innovative approach towards conservation can help free valuable natural resources and facilitate utilisation of government funds more effectively.

The need of the hour in India is sustainable and systematic construction and development, be it for residential, commercial or infrastructure projects spread all over the country. It is estimated that by year 2010, there will be sizeable projects of green housing as per USGBC-LEED due to increased awareness. However, most of the construction will be in the commercial sector as such certified projects will have better marketability potential and offer higher returns. Moreover, there are various governmental and non-government organisations apart from leading U.S. funded organisations that are in the process of developing assessment criteria through a logical and scientific approach. However, such efforts are region specific and common guidelines, with a common platform is yet to be initiated by the government or any other organisation.

The Bureau of Indian Standards (BIS) can take lead in the formation of an acceptable and authentic council for green buildings. Everyone wants to have a tag of 'green'.

However, the concept of 'green' varies with individual, educational and socio-economic backgrounds. Ultimately, it is the policies that are implemented by the Government which would define 'green'. In the meantime, the established systems discussed in the paper can be a valuable reference guide.

It is also worthwhile to mention here that the government of India has made it compulsory to obtain an environmental clearance certificate for certain types and size of construction projects before an approval is granted for the commencement of the project. Such measures have created a negative feeling because of associated delays in starting such projects. By making it compulsory, the developer is compelled to seek loopholes and shortcuts in the system thus creating a negative effect for all and losing the prime focus from the main issue. Environmental issues can be implemented better by creating awareness and providing education and not by mere enactment. Also, the most important aspect of implementing green policies is that it has to be voluntary and not mandatory at least for now. Once the awareness is widespread and the financial aspects become known with some degree of certainty, then over a period of time the green policies can be converted as mandatory compliance feature for high value projects of over rupees 1 billion.

However, such criteria for India can only be created, adapted and implemented with the intervention of a common body like the Indian GBC. If many organisations try to formulate such criteria, then the prime purpose of the green policies would be lost due to disputes and vested interests.

An authentic agency or council that is acceptable to all can adopt the following procedures for processing the applications for certification from interested parties:

1. The willing owners would first submit an expression of interest proposal to the council. This proposal should be drafted by an approved expert.
2. The council would then scrutinise and appoint a group of specialists to advice about the minimum and maximum ratings that the project can be get. Subsequently, an approval document would be released to start implementation.
3. The council will provide periodic monitoring and inspection reports which will be recorded for future use. This whole process would be interactive and it will take care of unexpected issues that may arise during implementation.

- The compliance and completion certificate would be issued by the council only after a final inspection by the technical committee or a panel of experts from the council.

Some green structures

The move to reduce the environmental impact of buildings is also being driven by the corporate social responsibility of companies. The US\$ 1 billion Bank of America tower with 54 storeys is under construction in New York. It is a joint venture between the bank and the Durst organisation and is expected to be one of the most environmentally friendly high-rise structures in the world. The design aims to reduce energy and water consumption by 50%. Some of its features are grey water recycling, use of recycled and recyclable materials, a 4.6 MW cogeneration plant, etc. Another building, the Helena, funded by the Durst organisation is being built in Manhattan, New York, using 45% slag in the cement concrete used in the structural frame. This building will be entitled for tax benefits after certification by the New York State Green Building Tax Credit Department. In Bahrain, the World Trade Centre claims to be the world's first large scale integration of wind turbines buildings. The twin 50 storeyed sail shaped towers will support three 29 m diameter wind turbines that will provide 15% of the building's annual energy needs. A number of buildings in California state have external decorative glass fascia with UV cells that convert sunlight into energy for the lighting and cooling of the building.

Limitations

In USA and UK offices and commercial buildings are given on rent and bungalows are built for residential needs. Hence, most buildings have single ownership.

It is argued that in India only the single ownership agencies would be predisposed towards green building projects because it gives direct and indirect advantages. For example, in single ownership buildings, repairs and maintenance can be done without any problem. But, in cooperative housing societies, which has multiple ownership, this may not be possible due to difference of opinion. In India 75% of building projects are for cooperative housing societies. Builders can be motivated to implement green measures by highlighting the fact that it will improve the image of the project thus giving a marketing advantage. If the builder is ready to achieve specified higher standards, bank loans can be made available at lower rate of interest and/or housing finance to apartment purchasers can be charged at concessional rates.

Local authorities should consider provisions that reduce load on their infrastructure especially for those regarding water supply, drainage, solid waste, etc. Such reduction of load and the resultant cost savings should be shared with the cooperative housing society by the authorities to encourage more such buildings. Renewal of benefits should be done on a yearly basis based on annual audits. In the US and UK, mostly timber is used for building construction unlike India where concrete is used extensively. By using fly ash and slag in concrete, a builder can easily score many valuable points

Conclusion

It is high time that an Indian green building council is formed based on Indian Conditions. India being a vast country, provisions also need to be made for utilisation of regional methods and materials. Concrete using fly ash or slag is known internationally as green concrete. Such green concrete is being used in many projects in India and due credit should be given to such projects. Local municipal corporations and housing finance institutions should also be involved in rewarding the green achievements of the builder by giving some sort of incentives by way of reduced property taxes, loans at concessional rates, etc. Manufacturers and suppliers of energy efficient building materials and alternative products, solid waste management and waste water recirculation system suppliers, etc. can also be offered easy and low interest finance as well as tax concessions or exemptions. In short, the concept of green buildings and its implementation should be made optional so that the concept can develop on its own. Government should encourage it by framing proactive provisions. If such guidelines are implemented in the right manner, then the concept of green buildings would spread across the nation just like the IT revolution.



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