A Review of IGBC Rating System for New Green Buildings

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Abstract **-** The green building concept ensures the minimum wastage in every stage of construction and operation of the new green building resulting in initial higher cost of approximately 16% as compared to the saving in long term with recovery within 2 to 5 years of the life cycle of the building. The green building is so planned and design so as to reduce the overall impact of construction material on natural environment and human health by efficiently using energy, water and other resources and also by protecting occupant's health and increasing the overall productivity of the institution, it also helps in reducing the waste, pollution and environmental degradation. The adoption of green feature considered while planning create lowest effect to the existing landscape and the site layout, the building materials proposed to be used shall be either a recycled product or an environmentally sustainable material, avoiding use of toxic material and maximum utilization of recycled or recyclable materials, the use of water efficiently and recycling the same for reuse, maximum use of renewable energy, eco-friendly use of equipment, fresh air inside building, highest safety norm adoption for human use and providing maximum comfort to the users, with the use of building management system. The review involves the evaluation of realistic rating aimed for the proposed new building, as per overall requirements as required for fulfilling the IGBC rating program. This involves the identification for the reduction of greenhouse gases with financial implications and tangible benefits to a client over a life cycle period of the building in a specified time frame. To carry out the above study in accordance to ASHRAE 90.1-2004/ECBC, performance rating method a simulation would considered appropriate modelling assumptions, schedule for the project for various occupancies, air changes per hour, lighting density and U-factors for fenestration etc.

Keywords – *Green building, Sustainable building, IGBC rating.*

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I. INTRODUCTION

With the earth showing signs of non-sustainability, we need to stop here exploiting the natural resources available on the earth, which are being over exploited by the humans and are required for the survival. Since, natural resources are getting exhausted at an alarming level, thereby pushing for going green and adopting the green movement is the only way left. The green or sustainable building in generally is thought to not cause a negative impact on the environment or is thought to be surrounded & topped by horticulture & plants as compared to a non green building. An ideal green building can be defined as a building which will preserve the natural environment of the project site, use of passive architecture, natural lighting and ventilation with minimum use of water and also minimization of any kind of energy consumption not only at the time of construction but also while the building is being used for its lifetime. Green building concept is well beyond the layout of building and it involves site planning, social community planning and use of existing land planning as entity in totality.

Following is the concept of green building: (IGBC Green New Building, V-3.0, September 2016, Abridged Reference Guide).

- Sustainable layout planning.
- Optimization of building designs.
- Optimization of energy consumption.
- Utilization of renewable energy resources.
- Management of water and waste.
- Management of solid waste (dry and wet).
- Use of sustainable building material.
- Use of sustainable construction method.
- Quality of environment.
- Well-being and health of occupants.

The sustainable planning can be achieved by the professionals by mutually working together to create green building which may be new design, renovated, built, operated or used again in the most efficient manner.

For few companies green building tag is a marketing tool and at times its superficial practice and their approach is based on the modern adoption of building, facades, techniques and materials.

A. Why New Green Building

A new green building gives maximum benefits to the environment at the time of construction and utilization of building in its life cycle. The following are benefits of green buildings:

- High performance green building emerged that will prevent pollution, save energy, natural resources and money.
- The 60% cost reduction in energy expected.
- Human performed better with the skylight and windows that bring natural, non-glare light in indoor areas.
- They can reduce respiratory disease by 10 -20% and thus resulting in healthy occupants in Green building.
- Greater comfort to the users of building due to non-use of volatile organic compound emissions from the construction materials, thereby improving the quality of air indoors.
- They increase occupant performance by up to 25 %
- The occupants have 15% less absenteeism compared to those in non green building due to better health of occupants.
- Improves overall Productivity
- Green Building have higher market value.
- Tax benefits for Green Building.
- Improved Retail sales.
- The Lower Utility Demands in green buildings.
- Improved Quality of Life.

B. IGBC Certification

The certification of green building by IGBC rating system considers the following categories:

- *Sustainable architecture and design:* It is a form of architecture by adopting the natural forms and environment in the aesthetic feature of the building, the design also based on lower use of natural resources and energy in any form.
- *Site selection and planning:* The site selection has to be done as per the direction of sun with respect to the face of building, use of indirect sunlight and adoption of trees, planters and sun protection feature in building by use of architectural fins & other features. The use of wind towers to circulate fresh air in non-air conditioned areas like passages etc.
- *Water conservation:* The use of natural treated water shall be minimal by adopting water saving sanitary fitments and use of recycled water for horticulture, flushing and cleaning purpose.
- *Energy efficiency:* Energy efficiency can be achieved by use of energy saving equipment and light fitments. It can also be achieved by using thermal imaging sensors and light sensors.
- *Building materials and resources:* The building materials used for the construction shall be recycled or recyclable materials in addition to use of natural environment friendly sustainable material.
- *Indoor environmental quality:* The indoor environmental quality can be achieved by providing natural fresh air inside the building and use of non-volatile organic compound.
- *Innovation and development:* Innovation and development is an open invitation to the professionals to create or modify the existing model or technological use of building material, divergence in design and architecture.

The IGBC has detailed guidelines under every mandatory categories and the credit systems for the design and construction of buildings of any type and size.

The following are the levels of certification of green building which are awarded depending on the credits earned for the building in totality but also should meet the given mandatory requirements which are non-negotiable and non-compromised as given below:

TABLE I
CERTIFICATION RATINGS

Certification Level	**Recognition**
Certified	Best Practice
Silver	Outstanding Performance
Gold	National Excellence
Platinum	Global Leadership

C. IGBC rating system parameters

The IGBC rating system parameters are as given below:

1) *Sustainable architecture and design:* The credits for sustainable architecture and design involves, integrated design approach, site preservation and passive architecture design.
2) *Site selection and planning:* The site selection and planning involves two mandatory requirements to be complied, which are local building regulations and soil erosion control. Credits are also taken for compliance of basic amenities, proximity to public transport, use of low emitting vehicles within campus, natural topography or vegetation, preservation or transplantation of existing trees within campus, reduction of heat island effect in non-roof area, reduction of heat island effect in roof area. Outdoor light pollution reduction, use of universal design, provision of basic facilities of construction work force at the time of construction and other green building guidelines which may be applicable.
3) *Water conservation:* Water conservation involves two mandatory requirements to be complied, which are rainwater harvesting (roof and non-roof), and water efficient plumbing fittings. Credits are also taken for compliance of landscape design of campus, management of irrigation system using minimal energy consumption, rain water harvesting of roof and non-roof areas, use of water efficient plumbing fitting and fixtures, waste water treatment its reuse and efficient water metering.
4) *Energy efficiency:* Energy efficiency involves three mandatory requirements to be complied, which are ozone depleting substances, minimum energy efficiency and commissioning plan for building equipment and systems. Credits are also taken for compliance of use of eco-friendly refrigerants, enhanced energy efficiency, use of on-site renewable energy, use of off-site renewable energy, commissioning, post-installation of equipment and systems and use of energy metering and management.
5) *Building materials and resources:* Building materials and resources involves a mandatory requirement to be complied which is post-occupancy segregation of waste. Credits are also taken for compliance of use of sustainable building materials, post-occupancy organic waste management, handling of waste materials during construction period, proper use of certified green building materials, products and equipment.
6) *Indoor environmental quality:* The environmental quality involves two mandatory requirements to be complied, which are minimum fresh air ventilation and tobacco, smoke control in the building. Credits are also given for monitoring for CO_2 levels, use of indirect day lighting, outdoor views, minimize indoor and outdoor pollutants, use of low emitting materials, testing of indoor air quality just after completion and also before the occupancy of the building and indoor air quality management during the construction period.
7) *Innovation and development:* The credits are considered for innovation in design process, optimization in structural design, reduction of water use for construction and deployment of IGBC accredited professionals.

II. SIGNIFICANCE OF NEW GREEN BUILDING

The following are the significance of new green building:

1) *Tangible benefits:* Reduction of consumption of water during construction period and also during the lifetime occupancy of the building, reduction of consumption of

energy during the use of building. Lesser depletion of natural resources.

2) *Intangible benefits:* These includes enhanced quality of air, excellent indirect day lighting in the building, well-being and health of occupants of building, benefits due to compliance of safety norms and conservation of national resources.

III. Literature Review

Robichaud and Anantatmula (2011), has studied the modification of conventional building practices to efficiently reduce the cost of green building. Author also researched the cost and the trends of the green building for the greening management practices in the construction industry within acceptable cost constraint using matrix analysis and concluded with a guideline to be adopted while pursuing the green building, like setting up of specific sustainability goals, integration of project team with team work approach and use of bonuses, rewards, training and communication for achieving sustainable goal.

Thus, besides the new constructions, there is quite a huge potential of existing buildings to adversely affect the environment unless their operation and maintenance methods checked and evaluated. Mandatory restrictions will have to be imposed in the Govt. Policies regarding energy/water use and CO_2 emissions (Gaur et al. 2015) Aside from energy/water efficiency, many other significant sustainability improvements can be made in existing buildings in terms of resource use, waste reduction via recycling programs (Shishri and Singh 2014) as also, sustainable purchasing policies, procurement, and ongoing operations and maintenance procedures which will improve a building performance (Shishri and Singh 2015; Sunita et al. 2015). According to Kohler (1999), sustainable building has three dimensions: ecological, cultural and economic sustainability. Depending upon the type of country due to regional variations expectation of people also changes likewise culture also important aspect in achieving sustainability.

The U.S. federal government and other third-party organizations, like the U.S. Green Building Council USGBC, have commissioned surveys, reports, and analyses to prove the environmental benefits of green building (U.S. Green Building Council 2006a, b). Their studies show that the built environment has significant impacts on the consumption of natural resources, the generation of pollution and waste, and the productivity and health of people (UNEP 2007). Although this paper does not rely on the benefits of green construction as a basis for recommended project management life cycle adjustments, it is useful to understand the arguments supporting the expansion of green building. According to the Department of Energy, there were more than 76 million residential and 5 million new green buildings in 2002 in the U.S. (U.S. Green Building Council 2003). The built environment in the U.S. accounts for 30% of greenhouse gas emissions, 12% of potable water consumption, 70% of electricity consumption, and 39% of all energy use (U.S. Green Building Council 2006). The U.S. federal government and other third-party organizations, like the U.S. Green Building Council USGBC, have commissioned surveys, reports, and analyses to prove the environmental benefits of green building (U.S. Green Building Council 2006a, b). Their studies show that the built environment has significant impacts on the consumption of natural resources, the generation of pollution and waste, and the productivity and health of people (UNEP 2007). Although this paper does not rely on the benefits of green construction as a basis for recommended project management life cycle adjustments, it is useful to understand the arguments supporting the expansion of green building.

According to the Department of Energy, there were more than 76 million residential and 5 million new green buildings in 2002 in the U.S. (U.S. Green Building Council 2003). The built environment in the U.S. accounts for 30% of greenhouse gas emissions, 12% of potable water consumption, 70% of electricity consumption, and 39% of all energy use (U.S. Green Building Council 2006). The system was initially conceived and developed by TERI (The Energy and Resources Institute) as TERI-GRIHA which is modified to GRIHA as national rating system after incorporating various modifications suggested by a group of architects and experts. Green building construction is getting momentum in India. So far 203 buildings received certification under LEED-INDIA rating system (GRIHA) that comprises of around 1 Billion square footages of built up area. GRIHA has certified 8 buildings so far and another 67 buildings are under review for certification awareness about green building construction is increasing day by day, thanks to IGBC, TERI and CII (Confederation of Indian Industries) efforts, (Balakrishna 2011).

Buildings have a significant and continuously increasing impact on the environment since they are responsible for a large portion of carbon emissions and also use considerable number of resources, Montoya (2009). Buildings account for one-sixth of the world's fresh water withdrawals, one quarter of its wood harvest, and two-fifths of its material and energy flows, Roodman and Lenssen (1995). The Construction of Buildings and their operation contribute a large number of energy usages. In building construction activity, many types of material are used, modified and sometimes building materials produces another material. All material production requires raw material and then we can produce them according to standards. These raw materials require proper treatment to produce further product. Now main question remains regarding consideration of this production of each and every material with raw material.

IV. Discussion and Summary

- The initial investment in green building is typically higher than a non-green building by approximately 16% of the initial construction cost.
- The maintenance cost including cost of energy in green building is approximately 20% lower than the normal building.
- The overall total cost of ownership i.e. the initial cost plus maintenance and utility cost is recoverable within 5 years

of building life, thereby saving of 20% of maintenance and utility cost during the lifetime use of building.

- The energy saving is around 20-30%.
- Water saving is about 30-50%.
- Saving of scares natural resources for the growth forecast of 8-10% annually in real estate segment.
- Increase of 14-16% of human resource productivity

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