ISSN XXXX XXXX © 2017 IJESC

Research Article Volume 7 Issue No.7

Cost Benefits Analysis of 3 Star GRIHA Rating Hostel Building to Normal Conventional Hostel Building

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Abstract:
The need to study and finding the benefits of green hostel building over conventional building in respect to financial and additional cost perspective in the Govt. University for the preliminary estimate from the approval of govt. bodies. The study in a simple cost befit analysis of green building of 3-star GRIHA rating from site selection to design, construction, operation and maintenance etc. The adoption of green building in India is a new phenomenon. There are currently adopt the guideline in India is GRIHA by the Energy and resource Institute (TERI) The study was more comparative study between green and conventional building. The researcher compared the construction and operational cost of the building in terms of water, electricity and isurance cost and how to increase the work comfort of the occupants. The objective of this work to use the GRIHA rating guide line and used as input for measuring the green rating building and also use of solar energy, flyash and reuse material etc. and made for achieving desired green building rating. The study also shown that the green building plays a crucial role in improving the health of the occupants and improve the university image who build green and also help the government appropriate policy initiatives of adoption of such new technologies.

Keywords: LEED, GRIHA, CPWD, GHGs, IIPC, ROI, BREEAM, NABERS, VOC Paints, HVAC.

1. INTROUDCTION

"A Green Building is one which uses less water, optimizes energy efficiency, conserves natural resources, generates less waste and provide healthier space for occupants, compared to a conventional building," 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, encouraging environmentally preferable building material selection, and reducing waste, pollution and environmental degradation. For example, green buildings may incorporate sustainable materials in their construction (e.g., reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g., reduced product emissions); and/or feature landscaping that reduces water usage (e.g., by using native plants that survive without extra watering).

1.1 Aims of Study

The aim of this thesis is to develop a cost benefit trade off of GRIHA 3 star rated green hostel building and hence it aims to calculate the financial benefits of green constructions, finds out the benefits in term of operational and maintenance and extra expenditure incurred for making the same. The work also aims to promote and make people aware about the need of construction of Green Buildings.

1.2 Objectives of Studies

Keeping in mind the importance of the energy savings for our future generation and considering the issue to reduce the impact of buildings on environment degradation, the following objectives have been identified.

- To develop economic model for various green building proposals and calculating the extra expenditure incurred for making a building green.
- To identify and validate the advantages of green building in term of reduced operational and maintenance cost and payback period.
- To determine the influence of economic, environmental and social parameter on projects proposed to be sustainable.
- To study and define the tangible and intangible benefits arising out of projects integrating environmental, economic and social aspects.
- To highlight the importance of green buildings in energy conservation in order to spread awareness among general public that green building cost slightly more than similar conventional buildings and it is easy to get positive returns on this extra investment.
- To understand the importance of sustainable development through various green rating system used in India and to analyze the various green building technologies with the proper design and its result to produce a greater cumulative effect.

1.3 Cost Structure of Green Building.

The building projects have costs associated with land, designing and planning, execution and operation/ maintenance which extend over its lifetime. The cost of land is mostly invariant as options for sites are limited. For public projects, the time gap between the decisions to procure: land and actual execution of work is generally so large that it remains an activity outside the planning scope of the project. This is due to changes in the external environment like changes in prices of material and technology, availability of new technology, change in the needs of the owner and often a change in the set of decision making people. However, if options are available

over different locations, comparisons can be drawn for more energy efficient shape, orientation and other architectural features of the building. This aspect is beyond the scope of this work.

2 Green Building Concepts and Rating System

The definition of green building sometimes includes a description of a high performance building. A high performance building while similar to a green building specifically aims to be energy efficient. High performance building and there design are an all inclusive philosophy taking into consideration the interaction of the whole building structure and systems. Sustainability is to meet the needs of the present without compromising the requirements and needs for future generations. It is not to be consumed too much today so that there is nothing left for tomorrow. Sustainable building refers to a structure and using process i.e. environmentally responsible and resource assess non-air conditioned or partially air conditioned buildings. The emphasis is on indigenous solutions using local materials and construction practices, to the extent possible. GRIHA also integrates all relevant Indian codes, National Building Code 2005, Energy Conservation Building Code 2007, etc. and acts as a tool to facilitate implementation of the same. The various criteria and the concerns they address can be found in the GRIHA Manual.

- Efficiently using energy, water and other resources.
- Protecting occupant health and improving employee productivity.
- Reducing waste, pollution and environmental degradation.

2.1 Green Rating for Integrated Habitat Assessment (GRIHA RATING SYSTEM)

Internationally, voluntary building rating systems have been instrumental in popularising green building design. However, these rating systems have been tailored to suit the building industry specific to the country where they are developed. The priorities of the green design are set in the specific social context. For example, in the US, where energy consumption in heating is a major concern, energy efficiency has high priority in the LEED-NC system. The Hong Kong Building Environmental Assessment Method (HK-BEAM) is a performance based system, which apart from the percentage of overall credits, also requires minimum percentage points of Indoor Environmental Quality (IEQ). This is in keeping with the highly urbanised environment of Hong Kong, where IEQ is a major concern. The Energy Research Institute (TERI) in India has developed the Green Rating for Integrated Habitat Assessment (GRIHA) system which takes into consideration both established building practices and emerging technologies. The rating applies to new building stock - commercial, institutional and residential. Endorsed by the Ministry of New and Renewable Energy, Govt, of India as on November 1, 2007, it is a five star rating system. GRIHA was developed to address and assess non-air conditioned or partially air conditioned buildings. The emphasis is on indigenous solutions using local materials and construction practices, to the extent possible. GRIHA also integrates all relevant Indian codes, National Building Code 2005, Energy Conservation Building Code 2007, etc. and acts as a tool to facilitate implementation of the same. The various criteria and the concerns they address can be found in the GRIHA Manual Different levels of certification (one star to five star) are awarded based on percentage of points earned. The minimum percentage required for certification is 50. The points earned rating is tabulated below

Table.1. Rating of Building for Different Ranges of Points Scored

Points	Rating
50 to 60	One stars
61 to 70	Two stars
71 to 80	Three stars
81 to 90	Four stars
91 to 100	Five stars

It is also important to know criteria pertain to which aspect of environmental friendliness the following table thus throws some light on which aspects are given priority in the rating system

Table.2.Total Points allocated to Different Aspects of Sustainability

S.NO	Aspect of Green Building	Criteria Nos	Total points
1	Sustainable Sita Planning	C1,C2,C3,C4,C5,C7	17
2	Water Management	C10,C11,C12,C20,C21	13
3	Energy Optimization	C6,C13,C14,C18,C19	35
4	Sustainable building Materials	C15,C16,C17	14
5	Waste Management	C22,C23,C24,C25	5
6	Health and Well Being	C8,C9,C26,C27,C28, C29,C30,C31	14
7	Building Operation & Maintenance	C32,C33	2
8	Innovation	C34	4

3. METHODOLOGY

A project is an investment activity where we expend capital resources to create a producing asset from which we can expect to realize benefits over extended period of time. Or a project is an activity on which we will spend money in expectation of returns and which logically seems to lend itself to planning, financing and implementation as a unit.

A project should have the following characteristics.

- Should have a specific starting point and specific ending point.
- Major costs and returns are measurable.
- Should have a specific geographic location.
- Should have a specific clientele group.
- Should have a well-defined time sequence of investment and production activities.
- Analyses the compression of conventional building to green building based on CPWD DSR 2014.
- Analyses the saving in water consumption to conventional building to green building.
- Analyses the energy saving in green building.
- Additional cost required for construction of green building in percentage.
- Evaluate the 3 star GRIHA rating for hostel building.

4. CASE STUDY AND RESULT

Construction of Green Hostel building (3 star GRIHA rating) for J&K students at Jamia Milia Islamia.

- Developer: RITES
- Location: Jamia Millia Islamia, Delhi
- Project Usage: Residential (Hostel for J & K Students)
- Project Architect: G.C. SHARMA & SONS
- Project Execution: 2015-2017
- Rating type: 3-Star GRIHA Rating
- Built up Area: 12255.43 Sq.m
- No. of Floors : 7
- No. of Beds : For 350 students

4.1 Construction of 3 STAR GRIHA Rating Hostel Block at Jamia Millia Islamia

Location : Jamia Millia Islamia, New Delhi
Site Area : Built up Area: 12255sqm
Energy Consumption Reduction: 25.01% reduction in energy consumption compared to
Renewable Energy : Solar PV : 15 kWp and Solar Hot-water System: 8,000 Lt

GRIHA provisional rating : 3 Stars
Year of completion : 2017
The following strategies were adopted to reduce the building impact on the natural environment:

Sustainable Site Planning:
• The natural site contour is mostly maintained and a naturally existing water body on the site has been preserved.
• Excavation and construction started after the monsoon to prevent soil erosion and soil run-off from the site.
• Top soil was preserved and was later re-applied for landscaping on the project.

Reducing water consumption:
• Reduction of 45% has been demonstrated in the building water consumption compared to GRIHA base case scenario by installing low flow fixtures.
• Project has achieved a 40% reduction in the landscape water requirement over GRIHA base case.

Reducing energy consumption (compared to GRIHA benchmarks) while maintaining occupant comfort:
» Cut-outs have been provided in the buildings to maximize the penetration of daylight in the common areas.
» Efficient lighting ECBC requirements, has been implemented in the project.

Renewable energy technologies installed on site:
• 15 kWp solar panel has been installed to cater building energy requirement.
• Flat-plate collector based Solar Hot-water System of 8,000 Litre capacity has been installed.

Use of low energy materials:
• Fly-ash bricks and stone masonry have been used for construction.
• Gypsum and particle boards have been used for false ceiling.
• Low energy flooring materials like vitrified tiles, Kota stone, Granite and cement tiles have been used for flooring work. Acc block used in partition wall

Integrated Design Team:
Client : Jamia Millia Islamia
Coordinator : Mr Zafar Alam, Chief Engineer
Limited. Principal Architect
Consultant / Project
Management : M/S RITES

4.2 ANALYSIS OF BUILDING COMPONENTS COMPARISON OF GREEN BUILDING AND CONVENTIONAL BUILDING BASED ON CPWD DSR 2014

SITE DEVELOPMENT

Total Cost Without Sustainable Features	1611564
Total Cost With Sustainable Features	2232444

4.3 SUMMARY CIVIL AND ELECTRICAL WORK COMPRESSION

Discription	Green Building	Conventional Building
A) Civil work	127664007	126338122
Sanitary installation and water supply	6084200	5584200
Sewerage and drainage	1923738	1923738
Rainwater Harvesting	297972	-
Borewell	248615	-
Total Civil Work	136218532	133846060
B) Electrical work	11474400	7653000
C) Consultancy fees	2266871	1714814
Grand Total of A + B+C	**149959803**	**143213874**

Cost of green building Rs. 149959803/-
Cost of conventional building Rs. 143213874/-
Extra cost for construction of Green building **4.5%**

4.4 SAVINGS IN ANNUAL ENERGY CONSUMPTION

The building shows a significant saving in the lighting as well as the space cooling energy consumption as compared with the ASHRAE 90.1-2004 stipulated baseline model. These energy reductions can be primarily be attributed to improved Enveloped, Lighting power density as well as daylight sensors in perimeter spaces. Along with reduction in cooling loads due improved glazing specifications, better exterior design and better system. Total annual savings including lighting, Equipment, Ext lighting, Pumps Fans Heat Relaxation, cooling towards = 54529 KW = Rs. 558922

5. CONCLUSION

This report has analyzed the cost and financial benefits of 3-

star GRIHA rating green building and compression the construction cost of green building over conventional building, currently most building constructed careless like to care about health and environmental impact and hence my perceive lower financial benefits of green building. The first costs of the buildings are not indicative of the future costs and so the investors should invest inappropriate sustainable features which are efficient according to the requirements of the buildings. Savings in investment cost by installing such equipment and fixtures that are not efficient in the long run lead to eventual rise in maintenance and energy bills should be avoided. The investors should have a proper system/software's for estimating life cycle costs of buildings before the construction begins and should go for consulting services to have a valid source for selection of systems and materials for buildings. The data indicates that the average construction cost premise of green building is about 2-10% more than the construction of conventional building A careful weighing of the costs and benefits demonstrates that future will be richer if green our built world.

6. RECOMMENDATION

Green building incentive stratergies in government department to encourage construction of green building which may be:-

- Structural incentive
- Financial incentive
- FAR incentive

1. Insurance premium for green building.
2. Rebate in property text.
3. Use of renewable energy in government buildings.
4. Use of renewable building material.
5. Protection of human health in all development.

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