BENEFITS AND HINDRANCES IN IMPLEMENTATION OF GREEN BUILDING TECHNIQUES IN REAL ESTATE PROJECT

S. Binil Sundar*

ABSTRACT

With the rise in economic growth, there has been a considerable growth in the Construction sector resulting in a wide and extensive usage of the natural resources, which is limited. Also with the growth in the infrastructure facilities for the development of cities there has been continuous harm being created to the environment. Hence, the need to implement Green Building techniques come into picture which would result in the development without harming the environment while also giving certain benefits for the Developers and End users.

The major challenge in Implementation of Green Building Techniques for the Real Estate Sector is the increase in Construction Costs resulting the Developers to not taking a step in adopting it because of the Cost Constraint, difficulty in sourcing green building materials, technology implementation and facilitators in India. The Benefits one could get is tangible and intangible benefits. The tangible benefits accrue from the operational cost savings and reduced carbon emission credits and high rentals or capital value. The intangible benefits are generated from the better working conditions within the building. The prime sources of revenue generation for green buildings are from the non-sustainability discount which gives the green buildings a higher rental value than conventional buildings in the vicinity and the carbon credits earned due to the reduced GHG emissions. Thus, the Benefits are for both the Developer as well as the End user.

* Asst Professor, Civil Engineering Department, B.S Abdur Rahman University, Chennai, India

The green concept is becoming very popular among developers as they have realised its benefits including fast return on investments. We expect nearly **2 billion sqft** of green building space under development by **2015**. 1,745 eco-friendly building projects with over 1.21 billion sqft of green footprint are registered with the IGBC. This indicates that there is a great opportunity for developers and occupiers to promote green buildings. Also, it is necessary to promote the Benefits of Green Buildings to everyone as this would increase the awareness and increase the demand for Green Spaces in the market.

LEED is derived from USGBC and similarly IGBC also has its own modified LEED rating system. This Paper follows the IGBC green homes rating system and has to do **Analysis** based on the different modules under it. Some of the credits of this rating system are very easy to implement and can be taken into consideration since the inception phase of the construction of green buildings.

Keywords :- Benefits , hindrances , present value ,cost.

1. Introduction

The tremendous growth in economic activity across the globe is placing pressure on natural and environmental resources. There is increasing evidence that human activities are causing an irreversible damage to the global environment, which will have an adverse impact on the quality of life of future generations. The rising concern for the environment in response to global warming is driving thinkers to seek sustainable solutions. The real estate industry is a significant contributor to the global warming due to extensive emissions of greenhouse gases (GHGs) from the energy use in buildings. In some countries, the built environment accounts for about 40% of the energy used. Therefore, there is an imperative for the industry to develop sustainable building technologies and green buildings.

Real estate sector in India is one of the rapidly growing sectors and contributes significantly to the Nation's economy. The sector contributes to 10% of India's GDP. Indian construction sector is growing at a rate of 9.2% as against the world average of 5.5%. The sector is likely to record higher growth in the coming years. It is observed that buildings in India consume about 20% of the total electricity in the country. Hence, real estate activity in India has a significant impact on

the environment and resources. This indicates that there is a real opportunity to develop green buildings in the country which would result in a lot of possible benefits such as energy savings and others for the developer and the occupant. This could open up a plethora (over abundance) of opportunities for several stakeholders of construction sector, architects, material, equipment manufacturers etc in India and abroad.

Sustainable buildings generally incur a "green premium" above the costs of standard construction. This premium is assumed to be very high over the cost conventional building. They also provide an array of financial and environment benefits that conventional buildings do not provide. These benefits, such as energy savings, should be looked at through over a longer period of time, not just evaluated in terms of upfront costs. From a long term perspective, saving resulting from investment in sustainable design and construction dramatically exceed any additional upfront costs.

2. Objective of the Study:

To understand the Benefits and Hindrances of Implementation of Green Building Technologies by understanding the Costs involved in implementing Green Technologies and Evaluating Cost & Benefit of Green Homes as per IGBC Standards for Customers as well as developers.

3. Problem Statement:

The Developers face a major challenge in the development of green buildings as in some cases this increases construction costs. Developers find it difficult to opt for green buildings due to price constraints difficulty in sourcing green building materials, technologies and service providers or facilitators in India.

It is generally believed that green buildings cost more and have long gestation periods. Although experts highlight the advantage of green buildings, this information does not reach developers and customers. Hence attempt is required to analyze the cost and benefit associated with green building. This type of study can provide the way in which both customer and developer gets benefited by green building.

4. Scope of the Study:

1. Cost benefit analysis is from customer point of view.

2. Analysis is limited to IGBC LEED green homes rating system April 2009 version.

3. Residential project is without interiors type of multi dwelling unit.

4. Limited availability of data related to such analysis associated with green buildings in India.

5. Need of the Project:

1. Maximize return on investment (ROI)
2. To Reduce Operating Costs.
3. To Save Energy.
4. for Environmental Responsibility.
5. To Improve Occupant Health and Comfort.
6. Increase Occupant Productivity.
7. Optimize Resource Efficiency

6. Methodology:

The basic aim of the study is to analyze the Benefits & Hindrances of Implementing Green Building Techniques in a Real Estate Project.

The Study involves understanding the Actual Costs in Green Building Project and also to understand the basic perceptions and reality of the Green Building Costs with respect to the Developers and also to understand the problems the Developer faces for implementing the Green building techniques in the Projects.

The Study is done to analyze the Tangible Benefits one is entitled to get after implementation of Green Building Techniques in a Real Estate Project. The work involved is to quantify the cost incurred and benefits accrued by doing the Cost Benefit Analysis for the Case Study done based

on the of assessment of the modules of IGBC Green Homes Rating System.

The Case taken is a Multi Dwelling Unit named Green Grace located at Hyderabad which is proposed for a LEED Platinum Rated Project comprising of 3 Towers of 14 storeys each and 416 apartments totally. The analysis assumes a life span of 20 years for the green buildings.

7. IGBC Green Homes Rating System :

IGBC has set up the Green Homes Core Committee to focus on residential sector.

The committee includes architects, realtors, experts on building science and industry representatives. The varied experience and professions of the committee members brings in a holistic perspective in the process of developing the rating programme.

The guidelines issued by IGBC for green home rating system he been converted in a tabular format for better understanding (version april2009).

7.1 Scope of IGBC Green Homes

IGBC Green Homes Rating System is a measurement system designed for rating new residential buildings which broadly include two construction types:

1. Dwellings where interiors are part of the project.
2. Dwellings where interiors are not part of the project

Interiors include but not limited to refrigerators, internal lighting, furniture, carpets, etc. Based on the scope of work, projects can choose any of the above options.

The following categories of dwelling can apply for rating:

- Individual homes
- Gated communities
- High rise residential apartments
- Existing residential buildings
- Residential buildings with major renovation
- Hostels, Service apartments, Resorts, Motels and Guest houses

In general all dwelling spaces which can meet the mandatory requirements and minimum points can apply. Various levels of green building certification are awarded based on the total points earned.

7.2 The Future of IGBC Green Homes

Many new green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of new green technologies and products, it is important that the rating programme also keeps pace with current standards and technologies. Therefore, **the rating programme will also undergo**

Periodic revisions to incorporate the latest advances and changes. It is important to notethat project teams applying for IGBC Green Homes should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system. IGBC will highlight new developments on its website on a continuous basis at www.igbc.in

7.3 IGBC Green Homes Certification Levels

The rating system caters to projects like individual houses, apartments, motels, resorts, hostels, etc., amongst the different types; projects are broadly classified into two categories:

- Projects where interiors are part of scope of work
- Projects where interiors are not part of the scope of work

Interiors include but not limited to materials like interior finishes & furniture and appliances like refrigerators, fans, lights etc., As a general guideline, individual owners can use the checklist 'Projects with Interiors' and developers & builders can use the checklist titled 'Projects without Interiors'. However, if the context varies, projects can adopt the one which is the closest fit. The threshold criteria for certification levels are as under:

Table 1 : Criteria for Certification

Certification Level	Points for projects with interiors	Points for projects without interiors
Certified	32 - 39	30 - 36
Silver	40 - 47	37 - 44
Gold	48 - 59	45 - 55
Platinum	60 - 80	56 - 75

7.4 Documentation

The project team is expected to provide supporting documents at each stage of submission for all the mandatory requirements and the credits attempted. Supporting documents are those which provide specific proof of meeting the required performance level, such as,

specifications, drawings (in native format only), cutsheets, manufacturer's literature, purchase invoices and other documents. These details are mentioned in this guide, under each credit / mandatory requirement.

Documentation is submitted in two phases –Design submittals and constructionsubmittals:

- The design submission involves those credits which can be evaluated at the design stage. The reference guide provides the list of design and construction phase credits. After the design submission, review is done by third party assessors and review comments would be provided within 40 working days.

- The next phase involves submission of clarifications to design queries and construction document submittal. The construction document is submitted on completion of the project. This review will also be provided within 40 working days,

after which the rating is awarded.

It is important to note that the credits earned at the design review are only considered as anticipated and are not awarded until the final construction documents are submitted along with additional documents showing implementation of design features. If there are changes for any design credit anticipated, these changes need to be documented and resubmitted for the construction review phase.

IGBC will recognise homes that achieve one of the rating levels with a formal letter of certification and a mountable plaque.

7.5 Precertification

Projects by developers can register for Precertification. This is an option provided for projects aspiring to get precertified at the design stage. The documentation submitted for precertification must detail the project design features which will be implemented. The rating awarded under precertification is based on the project's intention to conform to the requirements of Green Homes Rating system. It is important to note that the precertification rating awarded

need not necessarily correspond to the final certification.

Precertified projects are required to provide the status of the project to IGBC, in relation to the rating, once in every six months until the award of the final rating. Precertification gives the owner/developer a unique advantage to market the project to potential buyers.

Those projects which seek precertification need to submit the following documentation:

- For each credit, a narrative on how the project would meet the goal
- Design calculations, wherever appropriate
- Drawings (in native format only) as appropriate
- Filled in templates wherever applicable

IGBC would take 40 working days to review the first set of precertification documents. On receiving the clarifications posed in the first review, IGBC would take another 40 working days to award the precertification. A certificate and a letter are provided to projects on precertification.

7.6 Credit Interpretation Ruling

In some instances the design team can face certain challenges in applying or interpreting a mandatory requirement or a credit. It can also happen in cases where the project can opt to achieve the same goal through a different compliance route. To resolve this IGBC uses the process of 'Credit Interpretation Ruling' (CIR) to ensure that rulings are consistent and applicable to other projects as well.

The following are the steps to be followed in case the project team faces a problem:

- Consult the Reference Guide for description of the credit goal, compliance options and calculations.

- Review the goal of the credit or mandatory requirement and self-evaluate whether the project satisfies the goal.

- Review the Credit Interpretation web page for previous CIR on the relevant credit or mandatory requirement. All projects registered under IGBC Green Homes will have access to this page.

- If a similar CIR has not been addressed or does not answer the question sufficiently, submit a credit interpretation request. Only registered projects are eligible to post CIRs. Two CIRs are answered without levying any fee and for any CIR beyond the first two CIRs, a fee is levied.

Table 2 : Reduced Energy Use in Green Buildings as Compared with Conventional building

	CERTIFIED	SILVER	GOLD	AVERAGE
Energy Efficiency (Above Standard Code)	18%	30%	37%	28%
On Site Renewable Energy	0%	0%	4%	2%
Green Power	10%	0%	7%	6%
TOTAL	28%	30%	48%	36%

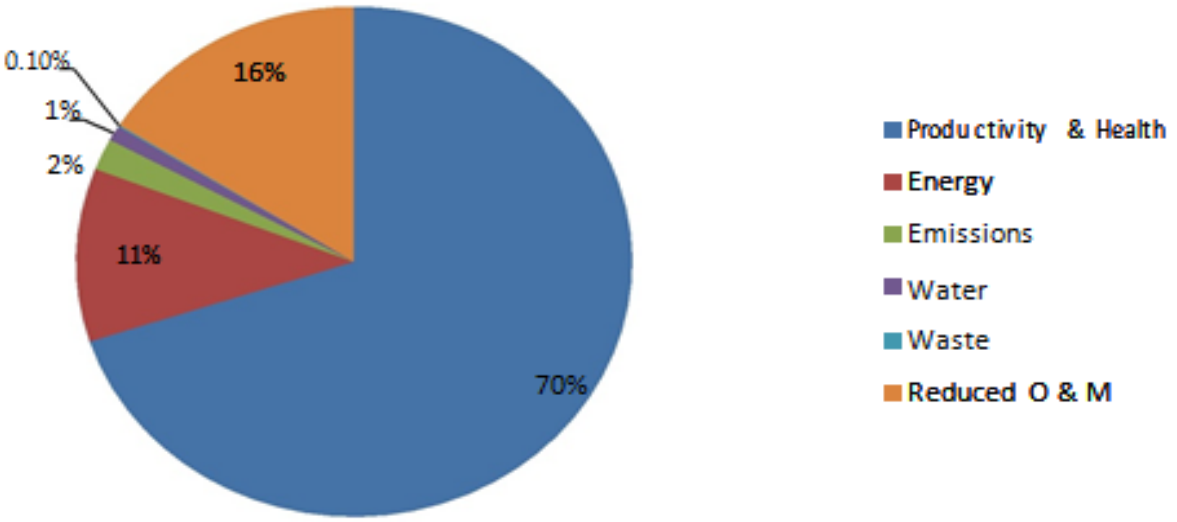


FIG 10.2 : Percentage Breakdown of Green Building Financial Benefits.

8. Understanding Benefits & Hindrances OfGreen Building Techniques

8.1 BENEFITS OF GREEN BUILING TECHNIQUES

These Benefits can be broadly classified into 3 categories.

1. **Saving Opportunities for Owner.**
2. **Benefits for Occupants.**

8.1.1 SAVING OPPORTUNITIES FOR OWNER:

Owners, designers and Developers have been conscious of the value of energy cost savings for some time. However, most building industry professionals do not fully understand yet how green buildings can improve building financial performance by reducing other costs that may seem unrelated to design, construction and operation. Among these savings opportunities, some are well documented, while others are not. These include.

- **Lower utility rates and total utility costs** because of lower consumption, lowerpeak demand and lower infrastructure costs.

- **Lower facilities management costs** because move costs are reduced in high-churn offices.

- **Property tax incentives** for reducing city government's infrastructure costs.

- **Improved Employee recruiting results**, increased morale and loyalty and reduced employee turnover.

- **Increased Worker Productivity** is a particularly strong incentive for ownerswho will occupy and operate their office buildings.

- **Lower insurance costs** because health–related liabilities are lower–particularlyfor self – insured businesses.

- **Lower repair, maintenance and operating costs** because of commissioning forboth new and existing buildings – particularly during early years of operation.

- **Lower administrative costs** by reducing vacancy and turnover in leasedbuildings.

- **Business income tax deductions** for qualifying green features.

These opportunities help the Owner to ***Benefit Financially*** in much aspect which is dealt further.

a) Energy Savings: Energy is a substantial and widely recognized cost of buildingoperations that can be reduced through energy efficiency and related measures that are part of green building design. Therefore, the value of lower energy bills in green buildings can be significant. On average, green buildings use 30% less energy than conventional. A detailed review of 60 LEED rated buildings, including 5 LEED rated buildings in California, clearly demonstrates that green

buildings, when compared to conventional buildings, are:

- On average 25-30% more energy efficient;
- Characterized by even lower electricity peak consumption;
- More likely to generate renewable energy on-site; and
- More likely to purchase grid power generated from renewable energy sources (green power and/or tradable renewable certificates.

Table 3: Reduced Energy Use in Green Buildings as Compared with Conventional building

	CERTIFIED	SILVER	GOLD	AVERAGE
Energy Efficiency (Above Standard Code)	18%	30%	37%	28%
On Site Renewable Energy	0%	0%	4%	2%
Green Power	10%	0%	7%	6%
TOTAL	28%	30%	48%	36%

b) Water Savings : Urban water users have experienced mandatory rationing, small ruralcommunities have seen wells go dry, agricultural lands have been fallowed, and environmental water supplies have been reduced. Without additional facilities, all of these conditions will only deteriorate with projected population increase. Thus, water conservation not only saves money for the end user through reduced utility expenditures, but also saves water districts the costs of facilities construction and expansion and prevents potential environmental

damage.

Green building water conservation strategies typically fall into four categories:

- Efficiency of potable water use through better design/technology.
- Capture of gray water – non-faecal waste water from bathroom sinks, bathtubs, showers, washing machines, etc. – and use for irrigation.
- On-site storm water capture for use or groundwater recharge.
- Recycled/reclaimed water use.

Taken together, these strategies can reduce water use below code/common practice by over 30% indoors and over 50% for landscaping. Of 21 reviewed green buildings submitted to the USGBC for LEED certification all but one used water efficient landscaping, cutting outdoor water use by at least 50%. Seventeen buildings, or 81%, used no potable water for landscaping. Over half cut water use inside buildings by at least 30%.

c) Waste Reduction : Waste reduction strategies such as reuse and recycling, as promotedin green buildings, help to divert some waste from being disposed of in landfills. Diversion strategies result in savings associated with avoided disposal costs as well as in reduced societal costs of landfill creation and maintenance. In addition to diverting waste from landfills, recycling and reuse can catalyze further economic growth in industries that reprocess diverted waste and use recycled raw materials.

Green building waste reduction strategies can occur at time of construction and throughout the life of the building.

Construction waste reduction options include:

- Reuse and minimization of construction and demolition (C&D) debris and diversion of C&D waste from landfills to recycling facilities.
- Source reduction, e.g., (1) use of building materials that are more durable and easier to repair and maintain, (2) design to generate less scrap material through dimensional planning, (3) increased recycled content, (4) use of reclaimed building materials, and

(5) use of structural materials in a dual role as finish material (e.g. stained concrete flooring, unfinished ceilings, etc.).

- Reuse of existing building structure and shell in renovation projects.

Building lifetime waste reduction includes:

- Development of indoor recycling program and space.
- Design for deconstruction.
- Design for flexibility through the use of moveable walls, raised floors, modular furniture, moveable task lighting and other reusable building components.

Together, these strategies can have a dramatic impact on reducing landfill disposal. These strategies can lead to reuse of about 50% - 75% waste generated during construction and also this reuse could be upto 100% for Renovated Projects.

d) Insurance Benefits of Green Buildings: Risk, and associated losses, is costly, with orwithout formal insurance. With conventional insurance, customer costs include deductibles, premiums and possible excess costs if the insured loss level is capped. If commercial insurance is not used, then the building owner is either formally or informally self-insured. Formal self-insurance implies that a distinct "premium" is paid from internal budgets and accumulated in the form of an earmarked loss reserve. If self-insurance is informal, then the risks are said to be

"retained" and losses are paid from general operating budgets, without the creation of an anticipatory loss reserve. Where formal or informal self-insurance is used, risk management is particularly important, since there is no hedge (upper limit) against loss costs.

e) **Lower Operation & Maintenance Costs:** The efficient use of water, heating, andelectricity will assist in stabilizing long-term economic growth, while simultaneously lowering lifetime utility costs for individual owners and tenants. Intelligent buildings help the owners to significantly reduce operating costs as a result of more efficient operations and control. Intelligent features of a building, such as monitoring and control of energy-intensive systems including HVAC and lighting, can be measured for optimum performance and predictive maintenance needs, reducing both energy usage and operating expense.

In an endeavour to provide a comfortable and reliable environment, intelligent buildings essentially help achieve a reduction in energy consumption, use resources more efficiently, and explore renewable alternatives that enable them to be financially, as well as environmentally sustainable assets over time. Reducing operating costs enhances a building's asset value.

f) **Increase Occupancy And Higher Rent :**The efficient use of all the green buildingtechniques lead to considerable benefits in operating and maintenance cost for the owner as well as tenant. Thus due to these factors and after high initial investment, the owner is in a position to demand Higher Rent for the space as it would indeed result in Savings for the tenant. Also, the demand for occupancy of such premises are high. Thus, implementation of such techniques is very much beneficial for the owner.

7.1.2 BENEFITS FOR OCCUPANTS

The Benefits of Green Building for Occupants are in many ways few of which are stated

below as :

a) Increased Worker Productivity : The Productivity increase is a very important benefitdue to Green Building Techniques implementation. Infact, they may represent upto 70 percent of all financial benefits. The principal reason for this is the spread of costs for the company operating a building; the large majority of the cost goes to salaries of occupants. The importance of productivity in the overall benefit is therefore 20 to sometime 100 times the energy cost.

The various areas of Worker Productivity are as follows :

- Decreased Absenteeism.
- Improved Quality Of Work Performed.
- Reduce Illness And Asthama.

b) Recruit & Retain Top Employees.

c) Higher Sales For Retailers In Natural Light.

b) Golden Marketing Opportunities.

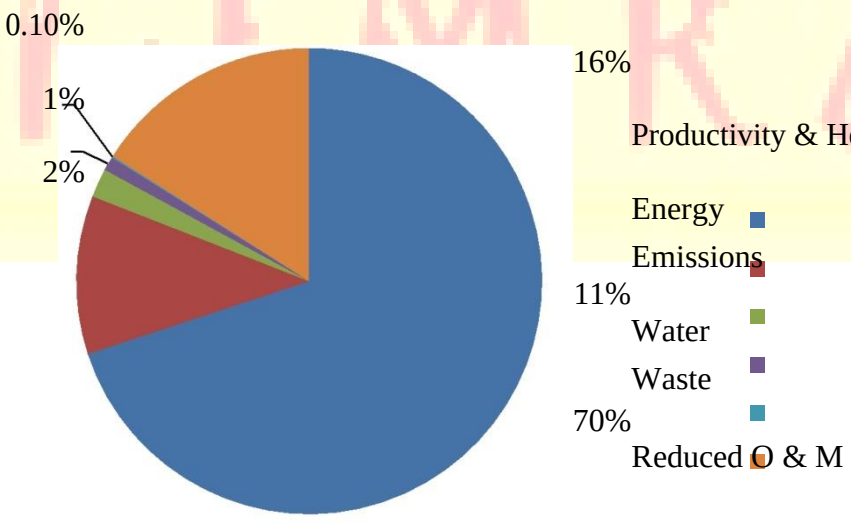


FIG 7.2 : Percentage Breakdown of Green Building Financial Benefits.

8.2 Hindrances In Implementing Green BuildingTechniques

While the green construction industry has increased over the last decade, specific technology challenges continue to arise, which stall exploration into more efficient building technologies needed to make a cultural shift. Research must be conducted to specify the financial advantages of green building, as well as how to make it competitive in a cost - efficient market. This research can further improve the image of green building through marketing, work towards standardized metrics, and increase the public's awareness towards green building.

A major economic challenge to green building techniques is a lack of incentives for builders to invest in green energy technology. Because the benefits of sustainable green building are long term, the owner of the building receives the benefits, leaving the builder with a high up-front cost that may not be recouped when the building is sold.

The few common Hindrances In Implementing Green Building Techniques are

- Decision Makers Mistakenly Assume Green Construction Costs Are Substantially Higher.
- Developers Lack Both Financial And Occupant Benefits.
- Lack Of Awareness Of Benefits, Discourage Developers And Investors.
- Present Day Lease Structures Obstruct Green Buildings Flourishment As Financial Incentives Do Not Flow To Owner And Tenants Simultaneously.
- Tenants Often Focus On Lowest Lease And Build Out Cost Rather Than Lowest Operating Costs.

9. Life cycle analysis and assessment

The concept is straightforward. The cost of any building has two components - its initial purchase cost and its cost of ongoing operation. These two costs together make up the total cost of a building. Considering one of these costs without the other provides an incomplete picture of the true cost of any building.

So, the same reasoning holds true for individual components of your building - specific materials and technologies. Your investment in a particular green technologies or materials has two costs-- the initial purchase price as well as the cost of operation.

When you are comparing the costs of conventional and green building materials or technologies, it's critical to know what their total costs are going to be over their lifetimes. If you don't understand the life cycle costs of the materials and technologies that make up your building, you don't understand your building's true cost.

- ***Initial costs***

Initial Costs of the building is a very crucial cost, which mostly people fail to analyze correctly. One need to identify that in addition to the purchase price of a building material, Initial cost also consist cost of transport and installation.

Considering individual components of a building in relation to other parts of the building is called integrated design…and it's an important way to save money and build green. It is essential to make sure your architect, engineers and builders/installers understand integrated design, have experience with it, and are willing and able to talk to each other and stay on the same page.

- ***Ongoing operational costs***

Ongoing operational costs is what you spend annually for the functioning of your building. There are instances wherein your initial investment would be around 10 – 18 % more for Energy efficient systems in your building over conventional system. But also at the same time, the annual saving you have is around 35 – 42 % in operations. This means the break even would be achieved in 5 years time and thus later on you would continue to save money on that energy

consumption and then free up funds for other purposes.

The organization needs to think about what it would consider an acceptable "break even" period of time in order to understand how much of a "premium" you may be willing to spend for the operating cost savings which green technologies so often offer. One of the advantages religious organizations have, in this regard, is that as the owners and operators of their own spaces they usually will be using their buildings for many decades. Because of this, religious groups can responsibly accept a longer payback period than the 5-year period that is common throughout much of the construction industry.

- ***Life-cycle analysis, and the net present value calculation***

A final step in calculating the costs of various ways of constructing your building is to conduct a life-cycle analysis to understand the cost of your building either over its probable lifetime (or the lifetime of its major component parts) or over a set period of time that you determine (usually a self-imposed "break even" date). This is especially effective in comparing conventional against green options.

Essentially, a Life Cycle Analysis takes the form of a spread sheet listing the items to be compared (like energy monitors/regulators or waterless urinals, etc.). thespreadsheet compares the different initial costs for each item, the annual operating costs or savings (usually on an annual basis) for each item for a certain number of years, and then calculates the "net present value" of the respective items. Such a calculation specifies an interest rate - your "cost of money" - to reflect the effect of inflation on the value of rupee.

10. CASE STUDY

BACKGROUND

This chapter deals with the case study of green building and with its actual computation of cost and benefits considering the various credits of IGBC LEED Green Homes Rating System.

The cost benefit analysis is limited to financial cost only which includes initial cost and Operation & Maintenance cost excluding the construction cost.

10.1 PROJECT DETAILS

Green Grace is a residential multi dwelling project. It is situated at Gachibowli, Hyderabad. Gachibowli today is the fastest appreciating locality and the future CBD (Central Business District) of Hyderabad. The owner and the architect of the project is S & S construction India Pvt. There are 3 blocks with Block A and Block C consisting of ground +14 floors totalling to 150 flats in each block. Block B has 116 flats with ground +14 floors. Altogether there are 416 3BHK apartments, size varying from 2010 sq.ft to 2870 sq.ft. Each flat has 2 covered car parking and has 10×12 spacious sit out with attached lawn

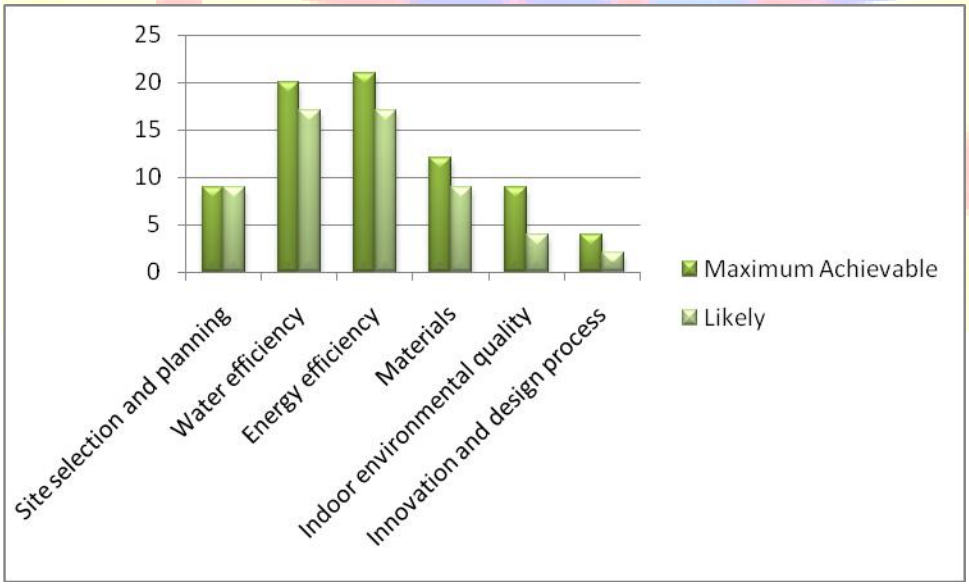
Figure 10.1: Site Plan Of Green Grace

10.2Rating system of the project

Table No. 4: Likely Points Under Various Modules

Platinum Rating Without Interiors	Maximum Points	Most Likely Points
Site Selection & Planning	9	9
Water Efficiency	20	17
Energy Efficiency	21	17
Materials	12	9
Indoor Environment Quality	9	4
Design & Innovation	4	2
Total	75	58

Graph :Representation of points



11. BENEFITS & HINDRANCES AS PER GREEN GRACE –CASE STUDY.

Factors	Green Grace – a Green building	Ordinary buildings	Advantages
Quality Certification	IGBC Platinum pre-certification based on World renounedLeed system	No certification	Green building concepts of international standard
Building Permissions	Construction as per approved plans of HMDA	Incomplete approvals	Construction exactly as per sanctioned permission without any deviations
Ventilation	4-side ventialtion	2-side ventilation	100% improvement in natural lighting and plenty of air circulation in the apartment
Water conservation	Rain water harvesting	In few buildings	Up to 40 % saving in Water consumption
	Rain water storage	No	
	Grey water treatment & recycling	No	
Water Meter	Separate water meter for individual apartment	No	Water bill for apartment only for the actual usage. Wastage of water will be drastically reduced
Energy	Amorphous transformers	Normal transformers	Saves electrictyupto 40%. Savings in monthly maintenance charges

Conservation	Star-rated and well known brands of electrical equipments	Largely unknow brands	
	RFID controlled parking	No	
	Energy saving sensors	In few buildings	
	24×7 Solar water hot water system	No	
Quality of construction	External PMC team to supervise all quality aspects during construction	No	Strict quality control checks, systems and procedures in place
Heat reduction	Reflective tiles on terrece	In few buildings	Considerable reduction of heat
Healthy paints	Use of Low (Volatile Organic Compound) paints	Normal paints	No foul smell, low toxic fumes

Factors	**Green Grace – a Green**	**Ordinary**	**Advantages**

	building	**buildings**	
Quality **Certification**	IGBC Platinum pre-certification based on World renounedLeed system	No certification	Green building concepts of international standard
Building Permissions	Construction as per approved plans of HMDA	Incomplete approvals	Construction exactly as per sanctioned permission without any deviations
Ventilation	4-side ventialtion	2-side ventilation	100% improvement in natural lighting and plenty of air circulation in the apartment
Water **conservation**	Rain water harvesting	In few buildings	Up to 40 % saving in Water consumption
	Rain water storage	No	
	Grey water treatment & recycling	No	
Water Meter	Separate water meter for individual apartment	No	Water bill for apartment only for the actual usage. Wastage of water will be drastically reduced
Energy **Conservation**	Amorphous transformers	Normal transformers	Saves electrictyupto 40%. Savings in monthly maintenance charges
	Star-rated and well known brands of	Largely unknow	

	electrical equipments	brands	
	RFID controlled parking	No	
	Energy saving sensors	In few buildings	
	24×7 Solar water hot water system	No	
Quality of construction	External PMC team to supervise all quality aspects during construction	No	Strict quality control checks, systems and procedures in place
Heat reduction	Reflective tiles on terrece	In few buildings	Considerable reduction of heat
Healthy paints	Use of Low (Volatile Organic Compound) paints	Normal paints	No foul smell, low toxic fumes

More Health

Green Grace provides you with one of the most hygienic and healthy living. Just imagine living in a complex that promises.

- 20% reduction in sickness
- 60% reduction in heat ingress

- 100% improvement in natural ventilation
- Cooler buildings, buildings are designed to have correct sized rooms to let in the fresh air, while cutting out heat
- Improved indoor air quality
- Low VOC paints so that you can breathe easy

More Wealth

Green Grace has a location advantage that adds up to your potential appreciation apart from the superb Green features that further adds to the phenomenal savings. Our Green technology keeps the complex looking new for a longer time.

- Billions of US $ already invested in the infrastructure in the area, matching the best the world has to offer.
- Up to 25% appreciation due to the ongoing economic recovery.
- Premium Green Buildings cost upto 10% more due to their superior certified quality totally absorbed by us.
- Situated between landmark projects bringing in greater appreciation.
- Great operational savings due to the IGBC concept
- Up to 40% savings in water.
- Up to 50% savings in the electricity.

- Recycling of water to meet all your garden and flush tank needs, saving precious water for personal use.

- Solar heaters for 24 hour hot water; no electric consumption.

- Entire complex made energy efficient thru innovative techniques as stipulated by IGBC.

Living in Green Grace makes your investment work harder.

12. Recommendation:

A clear focus on green building is made according to the benefits and hindrances in implementation of it. The major challenge in Implementation of Green Building Techniques for the Real Estate Sector is the increase in Construction Costs resulting the Developers to not taking a step in adopting it because of the Cost Constraint, difficulty in sourcing green building materials, technology implementation and facilitators in India. Paper is according to the IGBC standards and takes into account all the credits for its cost and benefit analysis to form an integral part of the work. IGBC standards prove to be very proficient because it addresses all environmental issues which are related to construction activity. This reduces additional initial cost which could likely lead to cost overrun in the long run. Tis paper follows the IGBC green homes rating system and have to do **Net Present Value(NPV) Analysis** based on the different modules under it to the long term savings for it.

13. REFERENCES :

1) Sanath K Kalidas,2004 . Cost-Benefit Analysis of LEED Silver Certification for New House Residence Hall , Department of Civil & Environmental Engineering , Carnegie Mellon University, Pittsburgh.
2) Stuart D. Kaplow ,june 2010. Green Building Costs Less Than Conventional Building , Baltimore, maryland , United states.
3) Kats, Greg. 2003. *Costs and Financial Benefit of Green Buildings: A Report to California's Sustainable Building Task Force.*
4) Gregory H. Kats 2003. Green Building Costs and Financial Benefits : In USA for Massachusetts Technology Collaborative
5) Mark Lucuik march 31 2005. A BUISNESS CASE FOR GREEN BUILDINGS IN CANADA: MORRISON HERSHFIELD,Canada
6) *Bing Tso&Marc Schuldt* . Preliminary Benefit-Cost Analysis for Two City of Seattle Facilities , SBW CONSULTING, INC , seattle , united states
7) Jennifer Senick may 3 2011. The Financial Benefits of Green Building: Rutgers Center for Green Building, united states
8) xenergyinc.june 18 2000 . "Green city Buildings:Applying the LEED Rating System ", Portland Energy Office , Portland ,Oregon
9) Great River Energy March 2009. "A White Paper on Building for Platinum LEED Certification", Great River Energy' headquarters building in Maple Grove,united states
10) www.leed.com
11) Davis Langdon 2007." The Cost & Benefit of achieving Green buildings", Davis Langdon, An AECOM Company,LONDON
12) www.greengrace.in
13) www.igbc.in