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A case study in green building

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ABSTARCT

Nowadays, the sustainable development is the necessary and urgent trend for the global environment. Acting as one of themain parts of economic. construction industry also take part in responsibility for protecting the environment through the buildingdesigned with low-impact to environment. With the green building, there are many benefits to the environment and as the result; it's also good for human working and living in life. India is experiencing an incredible growth in the construction andreal estate industry. Due to this rise in the construction sector raised many issues related to the environment and sustainability. As per economic policy forum, in its report mentioned that in India the energy consumption in buildings is for heating, ventilation and air Conditioner accounts for between 45% and 65% of total electricity consumption. Another study states that theconstruction sector of India emits about 22% of the total annual emission of CO2 which is very harmful for the environment. Soto handle the adverse situation a new and important concept is emerging in India that is Green Building. Energy efficiency is the key to achieve sustainability in green building. Lowering the energy consumption in construction isstarting to become a significant improvement chance for many organizations. This research will identify the benefits of energy efficiency, explore the methods to apply efficient energy usage in green building, and explore the obstacles in attaining energy efficiency in green building. Even though green buildings use a lesser amount of energy compare with usual building, energyefficiency still hard to achieve, due to some barriers to put into practice energy efficiency. This study will interview a property development company in Malaysia. After analysis, energy efficiency contributed two main benefits in the company such as reduced greenhouse gases emission and lower the air pollution problem, and energy saving. The company implemented electricalfeeding and sensor system in lighting system. passive design, and cross ventilation to achieve energy efficiency in theirdevelopment projects. However, cost barrier, information barrier, and outdoor condition and climate barrier are the obstacles in attaining energy efficiency practices. Due to the time constrain, this research only able to interview one company. With the aim ofgetting more accurate result, should be interview more companiesin the future research because of the energy efficiency cover a wide area in the construction field.

Keywords: *Green Building, Energy Efficiency*

1. INTRODUCTION

Green building (also known as green construction or sustainable building) refers to both a structure and the using of processes that efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition in other words, green building design involves finding the balance between homebuilding and the sustainable environment. This requires close cooperation of the design team, the architects,the engineers, and the client at all project stages. The green building practice expands and complements the classical building design concerns of economy, utility, durability, and comfort.

Leadership in energy and environmental design (leed) is a set of rating systems for the design, construction, operation, and maintenance of green buildings which was developed by the u.s. Green building council. Other certificates system that confirms the sustainability of buildings is the british breeam (building research establishment environmental assessment method) for buildings and large scale developments. Currently, world green building council is conducting research on the effects of green buildings on the health and productivity of their users and is working with world bank to promote green buildings in emerging markets through edg.

2. GOALS OF GREEN BUILDING

Although new technologies are constantly being developed to complement current practices in creating greener structures, the common objective of green buildings is to reduce the overall impact of the built environment on human health and the natural environment by: Efficiently using energy, water, and other resources.

Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high-performance building.

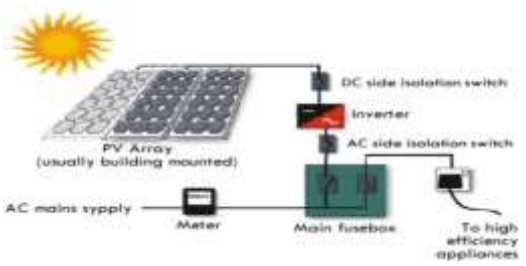
3. ENERGY EFFICIENCY

Green buildings often include measures to reduce energy consumption - both the embodied energy required to extract, process, transport and install building materials and operating energy to provide services such as heating and power for equipment.

As high-performance buildings use less operating energy, embodied energy has assumed much greater importance and may make up as much as 30% of the overall life cycle energy consumption. Studies such as the U.S. LCI Database Project show buildings built primarily with wood will have a lower embodied energy than those built primarily with brick, concrete, or steel.

To reduce operating energy use, designers use details that reduce air leakage through the building envelope (the barrier between conditioned and unconditioned space). They also specify high-performance windows and extra insulation in walls, ceilings, and floors. Another strategy, passive solar building design, is often implemented in low-energy homes. Designers orient windows and walls and place awnings, porches, and trees to shade windows and roofs during the summer while maximizing solar gain in the winter. In addition, effective window placement (day lighting) can provide more natural light and lessen the need for electric lighting during the day. Solar water heating further reduces energy costs.

3.1 Solar System Installation atTerrace Level



➢ **Components for your solar panel (photovoltaic) system**:-

- Photovoltaic Modules (aka Solar Panels, Solar ElectricPanels, or PV Modules).
- Balance of System (BOS).
- Solar Panel or PV Module Mounting Systems.
- Combiner Box.
- Solar Charge Controllers.
- Batteries for Solar Electric Systems.
- Solar Inverters.
- DC and AC Disconnects.

➢ **Module mountaining structure as a partof solar pv system:-**

The solar PV module mounting structures are placed on a flat roof. The slope mounted is mounting the solar PV module in sloppy regions. It can be a Concrete RCC roof, metal roof or a asbestos roof. It should be ensured that the roof should be at least 0.7m thick to go ahead with the solar PV installation. principle of direct conversion of sunlight to electrical.

➢ **Site survey details:-**

- Site Name: Vidya Vikas Pratisthan
- Address: G.No.72/3/1,Pratap Nagar, Tal.Solapur,Solapur
- Floors: 5
- Roof type: RCC Terrace
- Latitude and Longitude:
- Total System Capacity to Install: 73 KW
- Structure Mount Type: Ground Mounted

➢ **Electricity Bill Details**

Sr.no.	Description	Details
1.	Consumer Number	330060500525
2.	Sanction Load	73 KW
3.	Monthly consumption of KWh	6015 kWh
4.	Annual consumption of kWh	72150 kWh

➢ **Proposed solar PV system details:-**

Sr.no.	Description	Details
1.	Proposed Solar PV system	73 KW
2.	Monthly Solar Generation	10512 kWh
3.	Annual Solar kWh Generation	115632 kWh

➢ **Payback Period For Investment Amount:-**

SR.NO	DESCRIPTION	DETAILS
1.	Invested Amount for theproject	Rs. 33,38,874.00
2.	Payback Period in years (Approx)	3 years
3.	Revenue generation afterpayback period for next (Approx)	Rs.3,38,33,923
4.	ROI (approx)	45%

➢ **Standard Assumptions:-**

1. South facing shadow free area of approx.100 Sq.ft. /kW is required.
2. Area should easily accessible for installation and maintenance by Contractor.
3. The Client/client shall make available, prior to coming into force,full "right of access", "possession" and "right of easement" of the Site to the Contractor and all its assigned sub Contractors during the complete tenure of the Contract. Client may visit and inspect site at any time. The Client shall ensure to maintain proper approach to site for smooth movement of men and material.
4. Roof/area of installation shall be suitable to bear load of around 70Kg/M2.
5. Sunlight: Peak sunlight availability 5 Hrs average as per geographical site conditions.
6. Insurance : Insurance for safe custody of supplied material or after Installation of whole system is in client's scope.
7. Schedule : The installation of project shall be completed in 90 days from the date of clear PO along with necessary advance payment. The duration of commissioning of project (installation of net –meter) will be approx 90 days after complete installation of system . This duration may be increased if any type of approval / inspection by Government/ third party is not given. In such case, for delay in the completion of project company will not be responsible.
8. Height of structure: Ground Mounted Structure suitable for RCCTerrace.

4. WATER EFFICIENCY

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas, the demands on the supplying aquifer exceed its ability to replenish itself. To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site. The protection and conservation of water throughout the life of a building may be accomplished by designing for dual plumbing that recycles water in toilet flushing or by using water for washing of the cars. Waste-water may be minimized by utilizing water conserving fixtures such as ultra-low flush toilets and low-flow shower heads. Bidets help eliminate the use of toilet paper, reducing sewer traffic and increasing possibilities of re-using water on-site. Point of use water treatment and heating improves both water quality and energy efficiency while reducing the amount of water in circulation. The use of non-sewage and greywater for on-site use such as site-irrigation will minimize demands on the local aquifer. 21 realized its true valne Now a days this subsidy on water is being decreased, this the charges of water supply in cities are increasing rapidly.

Water scarcity is also eminent and hence the urgent need of water harvesting Hoe we have to adors "Rooftop cainwater harvesting

In this project the water is collecteil during the monsoon from roof through down take pipes Roof water is allowed to enter into basement tank. It take some days to fill up.

Changes in atmosphere, interference of human being in nature. Central and State government have gives first priority to Rain Water Harvesting Govt of Maharashtra hus already started to the Shivkalin water storage scheme as per govt resolution dated 14" Feb 2002.

Also the town planning department has done it mandatory to implement Rain water Harvesting system for all the new building admeasuring more than 1000 sq.m..

➢ **Need Of Rain Water Harvesting:-**

1. To provide for increasing demand of water
2. To increase ground water
3. To avoid ground water pollution.
4. To avoid submergence of mad from rain water.5.To improve percentage of ground water.
6.To avoid erosion of soil.

➢ **Advantages Of Rain Water:-**

1. The level of ground water goes on increasing.
2. Due to rain water harvesting soil level & soil particles remainit is. They do not flow with water.
3. Quality of ground water increases.
4. Irrigation process becomes very easy,
5. To provide for increasing demand of water.
6. The distribution of water is easy because the storage tank islocated at the centre.
7. The water coming from this storage is high quality than that ofthe undeveloped conventional storage.
8. Storage of water is wells increased.

Rain water in our area is nearly pure so there is no need of treating in different manner. If we harvest the rain water, we can use this water for flushing & gardening.

➢ **Design Calculations:-**

Q=AIR

Where,

Large commercial buildings with water and energy efficiency canqualify for an LEED Certification. Philadelphia's Comcast Centeris the tallest building in Philadelphia. It's also one of the tallest buildings in the USA that is LEED Certified. Their environmental engineering consists of a hybrid central chilled water system which cools floor-by-floor with steam instead of water. Burn's Mechanical set-up the entire renovation of the 58 story, 1.4 million square foot sky scraper.

4.1 Rain Water Harvesting System For Entire Building

➢ **Introduction:-**

In some of the developed countries water is recycled alinost 6 in 7 times before being med finally, but in our country it is not used even once properly and is wasted The charges of water is also very less since it is subsidized and therefore people do not
Q= Available Total Discharge In Lines
A= Roof Area In Sq.M.
I = Average Annual Rainfall In MmR= Runoff Coefficient

➢ DESIGN VALUES:- A=Available Roof Area is 55 mm
1=Average Annual Rainfall of Solapur City is 350 mmR=Ranff

Coefficient for cement concrete roof is 0.76

Q=550x350 x 0,70

Q=134,500 liter Available total discharge 134.500 liters Storage Tank Capacity=1.50 lac liters

Dimensions of Storage Tank (L x B x H) in m- 10 x 5 x3

The total quantity of rainwater which can be obtained by this system is accounted as 1, 34,50 liters. Hence it can be said that total requirement of gardening can be fulfilled with roof top.

The topography of land at VVPTET premises is a sloping land; so a huge quantity of surface run off is observed during rainy seasons. If this runoff is arrested, a huge quantity of water can be collected and recharging of ground water can be achieved. A study report prepared by Department have suggested constructionof Continuous contour trenches with plantation on all possible existing slopes in the Continuous contour trenches with plantation on all possible existing slopes in the college campus.

4.2 Green Land Scape Design

1. Green Audit:-

Green audit is the study of various natural resources. It is the study of the available natural resources, their utilization and the various measures adopted for minimization of the use of these natural resources. Green audit studies the following natural resources:

1. Energy in all forms
2. Water and waste water
3. Solid Waste generated
4. Air Environment
5. Flora and Fauna
6. Conservation of Bio Diversity

VVPIET Collage of Engg. being situated at Soregaon, Solapur covering a total land area of 40525 Sqm and the constructed area of 11261 Sqm. The constructed area consists of collage building consisting of various laboratories, classrooms, seminar rooms, administrative blocks, boys and girls hostels, workshops, canteens etc. There is also open space of 10,000 Sqm. This open space is under playground, approach roads and open ground spaces,

2. Energy Conservation:-

Energy is mainly used in the form of electrical energy. Energy is used for different purposes. It is used for lighting and ventilation, air conditioning, for running various laboratory and office equipments, for kitchen activities in mess, for water heating, etc. The average electricity consumption of VVPIET premises is 2500 KWH per month accounting Rs. 2, 50,000/- per month. The electricity is supplied from with the tariff of Rs. 10/- Per KWH. As this amount is too high, the cost and shortage of electricity is increased day by day, it is necessary to reduce electricity consumption by adopting various measures. Following are the various measures, which were studied and suggestions were made.

Reduction of energy consumption for lighting purpose: For lighting purpose, various electrical installations are used in classrooms, laboratories, offices workshops, computer rooms. A survey of the total electrical lighting devices was made and it is found that following are various lighting devices:

1. Fluorescent Tubes
2. Fluorescent Lamps
3. LED Lamps

There is a no. of ways by which this consumption can be reduced by changing the conventional applications by LED. It is suggested to replace this by LED so that the electrical consumption can be reduced

Some of the class rooms are facing the problem of poor lighting. It is found that the day lighting factor is very less in these and so artificial lighting becomes essential. By studying various alternatives, some remedial measures are suggested to improve day lighting factors. A detailed project report prepared by Mr. A.A.Patil and Mr.D.B.Dhavale Suggests following measures.

Electrical energy is needed for water heating in hostels. To reduce this consumption of electricity there is installed solar water heating systems of capacity 500 litre per day on girls hostels. These systems provide hot water to the students for their bathing purpose.

Energy either electrical or fuel based is need for cooking operations in canteens and mess. A project developed by Dept. ofBasic Sciences and Humanities, energy in the form of methane gas was generated from the canteen food waste and was supplied to kitchen of the canteen. Due to such Biogas plant reduction of fuel and accordingly minimization of consumption of natural resources is achieved.

Energy can also be obtained from renewable sources like solar radiations, biomass. VVPIET had also provided these systems forgeneration of energy from such sources. Solar street lights of 09 WT capacity - 5 nos are installed at the entrance so that nighttime lighting is done from generated electrical energy from these units.

3. Conservation Of Water:-

Water is one of the essential requirements for college activity. Water is needed for domestic purpose, in laboratories and workshops. Also huge quantity of water is required for gardening purpose. The total daily requirement of VVPIET premises is 300000 litre per day. It is necessary to reduce this water consumption and adopt various methods by which water can be recycled and reused. Various methods like rainwater harvesting for roof top and surface water, RO Plant reject water, small ponds for arresting surface run offs and recharging the ground water table, Drip Irrigation, Sprinkler Irrigation.

4. Operations And Maintenance Optimization: -

No matter how sustainable a building may have been in its design and construction, it can only remain so if it is operated responsibly and maintained properly. Ensuring operations and maintenance(O&M) personnel are part of the project's planning and development process will (411 help retain the green criteria

designed at the onset of the project. Every aspect of green building is integrated into the O&M phase of a building's life. The addition of new green technologies also falls on the O&M staff. Although the goal of waste reduction may be applied during the design, construction and demolition phases of a building's life-cycle, it is in the O&M phase that green practices such as recycling and air quality enhancement take place. O&M staff should aim to establish best practices in energy efficiency, resource conservation, ecologically sensitive products and other sustainable practices. Education of building operators and occupants is key to effective implementation of sustainable strategies in O&M services.

5. REGULATIONS AND OPERATION

As a result of the increased interest in green building concepts and practices, a number of organizations have developed standards, codes and rating systems that let government regulators, building professionals and consumers embrace green building with confidence. In some cases, codes are written so local governmen can adopt them as bylaws to reduce the local environmental impact of buildings..

Green building rating systems such as BREEAM (United Kingdom), LEED (United States and Canada), DGNB (Germany), CASBEE (Japan), and VERDEGBC (Spain) help consumers determine a structure's level of environmental performance. They award credits for optional building features that support green design in categories such as location and maintenance of building site, conservation of water, energy, and building materials, and occupant comfort and health. The numberof credits generally determines the level of achievement.

Green building codes and standards, such as the International Code Council's draft International Green Construction Code, 1591 are sets of rules created by standards development organizations that establish minimum requirements for elements of green building such as materials or heating and cooling.

6. LEED

LEED, or Leadership in Energy and Environmental Design, is changing the way we think about how buildings and communitiesare planned, constructed, maintained and operated. Leaders around the world have made LEED the most widely used third- party verification for green buildings, with around 1.85 million square feet being certified daily.

LEED works for all buildings-from homes to corporate headquarters-at all phases of development. Projects pursuing LEED certification earn points across several areas that address sustainability issues. Based on the number of points achieved, a project then receives one of four LEED rating levels: Certified, Silver, Gold and Platinum.

LEED-certified buildings are resource efficient. They use less water and energy and reduce greenhouse gas emissions. As an added bonus, they save money. Learn more about why LEED continues to be the leading benchmark in green building.

6.1 IGBC Green New Building

For example, LEED is changing the way we view runoff from precipitation. "Rainwater" is now seen as a resource that providesmany environmental and economic benefits. Managing rainwater on site restores natural hydrologic conditions, reduces the possibility of flooding, and creates opportunities for onsite water reuse in applications like irrigation and landscape features.

Another example is found in the streamlined requirements of the Heat Island Reduction credit. A building's roof and a building's site area both influence the heat gain and retention of a project's surroundings. By combining these elements into one credit, LEED holistically addresses microclimates impacted by heat islands.

7. CERTIFICATION LEVELS AND BENEFITS

The threshold criteria for certification/pre-certification levels are as under.

Certification level	Owener occupied buildings	Tenent occupied buildings	Recongition
Crtified	40-49	40-49	Best practices
Silver	50-59	50-59	Outstanding performance
Gold	60-74	60-74	National excellance
Platinum	75-100	75-100	Global leadership

7.1 Benefits Of Green Existing Buildings:-

- Green existing buildings can have tremendous benefits, bothtangible and intangible. The most tangible benefits are the reduction in water & energy consumption.
- Through energy & water efficiency could range from 15-30 %. The consumer the building can also be substantially reduced. Intangible benefits of green waste generated in
- Operational savings
- Bosting buildings

7.2 Certification

1. To achieve the igbc green existing building o&m certification, the project must satisfy all
2. The mandatory requirements and the minimum number of credit points.
3. The project team is expected to provide supporting documents at preliminary and final stage of
4. Submission for all the mandatory requirements and the credits attempted.
5. Projects need to submit the following: a brief stating projecttype, age of building, different type of spaces, number of floors, area • statement, occupancy, building photographs etc.,
6. Filled-in master template (in excel format) narratives and supporting documentation such as calculations (in excel sheets), plans, • declarations/ contract documents, utility bills, purchase invoices, manufacturer cut-sheets/
7. Letters/material test reports, etc., for each mandatory requirement/ credit
8. The necessary details are mentioned in this guide, under each mandatory requirement and
9. Credit. Documentation is submitted in two phases - preliminary submittal and final submittal:
10. The preliminary submission involves all mandatory requirements and minimum number of • credits.
11. After preliminary submission, review is done by third partyassessors and review
12. Comments would be provided within 30 days. The next phase involves submission of clarifications to preliminary

review queries and final submittal.
13. The final review will also be provided within 30 days, indicating the ratingachieved.
14. It is important to note that the mandatory requirements/ credits earned during the preliminaryreview are only considered as anticipated. These mandatory requirements/ credits are not
15. Awarded until the final documents are submitted. If there arechanges in any 'credit
16. Anticipated' after preliminary review, these changes need tobe documented and resubmitted
17. During the final review.
18. The threshold criteria for certification levels are as under**.**

8. RESULT AND CONCLUSION:-

Adopting an iterative and incremental development approach is afundamental change in working practices for the management team and everyone else involved in the project. Successful iterative and incremental development requires a progressive and adaptive approach to be taken to the management of the project and requires the whole team to embrace change and the continual improvement that this change will hopefully produce.

In any change effort, it is essential to demonstrate the value ofthe change as soon as possible to overcome resistance and build support for the change. The only way that can be done is by achieving the desired technical and business results quickly and efficiently. The fastest way to reach these results is to introduce the change as part of getting real work done; if the change is considered separate from the "real work, it will never produce results. With the guidance and leadership of an effective coach, and with the support of management to measure and rewardpositive results and positive change, teams can improve theirprocess while getting real work done. Process improvement and getting results should not be considered mutually exclusive.

To expand beyond individual projects, you will need enlightened but benevolent dictatorship coupled with the demonstration through real results to all involved that the future can be better. It also requires leadership, real leadership-not the phony slogans of motivational posters, but roll-up-your-sleeves, hands-on leadership from the front that shows that you have a stake in the outcome. No one is going to believe you if you sit on the sidelines cheering; you have to be in the game.

Iterative development is not hard, but changing the way that people work is. In this book we have provided you with the background information and the practical guidance necessary to deliver better results through your software development efforts. The next step is yours: you now get to put these concepts into action. We hope that the approaches and techniques we have presented in this book will help you and your organization to succeed and thrive by achieving the full promise of iterative development.

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