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COMPETITIVE STUDY OF TRADITIONAL BUILDING WITH GREEN BUILDING - A CASE STUDY OF GOVERNMENT HOUSING PROJECT

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ABSTRACT - *This study throws light on building's efficiency like energy efficiency, material efficiency and water efficiency performance in residential housing project of India without compromising occupants comfort conditions. The Green Building Studio, Openstudio, EnergyPlus and Insight 360◦ software has been used for building energy modeling and simulation as a tool to improve energy efficiency of residential building of India by investigating appropriateness of proposed energy efficiency, material efficiency and water efficiency measures. The steady increase in energy consumption and demand will eventually require further investment in energy generation; otherwise serious shortage may occur. In most countries including India, building sector consumes major portion of the electrical energy generated. The use of probable water increase due to lack of public awareness about the availability of drinking water in India and peoples having lack of knowledge about the rain water harvesting system. In material management also contractors having no idea about the carbon emission rate has been increase day by day due to less use of green and sustainable product. Therefore, this study has focused on selection of residential housing project in India which were under design phase for assessment of building performance in energy, water and material efficiency. To achieve this goal, data regarding building envelope, building comfort condition and criteria for sustainable building, etc. were collected through a literature review and journals related to building rating system. Form selected residential housing project located in India. The selected residential housing building 3D model prepared in Revit architecture. The proposed energy efficiency measures for building envelop, building comfort condition and criteria for sustainable housing building were categorized and proposed on their economic value such as initial capital investment and payback period. The energy efficiency measures related to building envelop such as solar water heater, solar panels, street lights using solar energy.*

Keywords: *- sustainable building, energy analysis, green building studio, EnergyPlus, openstudio, insight360◦.*

1. INTRODUCTION

Green is not just a colour! It is much more than the colour. Green symbolizes environment friendly practices in all facets of human endeavor. "Green" is the voluntary pursuit of any activity, which encompasses concern for energy efficiency, environment, water conservation, use of recycled products and renewable energy.

Green building known as sustainable or high performance building increase the efficiency with harvest natural energy, rain-water, and natural materials. Green building refers to both a structure and the using of processes that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, operation, maintenance, renovation, and demolition The "GREEN BUILDING" concept is gaining importance in various countries, including India. These are the buildings that ensure waste is minimized at every stage during the construction and operation of the building, resulting in low costs, according to expert in technology. The appearance of a Green Building will be similar to any other building. However, the difference is in the approach, which revolves round a concern for extending the life span of natural resources, provide human comfort, safety and productivity.

The concept of Green Buildings is at a nascent stage in India, in the formal or contemporary sense. However, given our heritage in buildings and in the context of sustainability of our built environments, environment friendly construction with respect to buildings as well as towns has not been new to India. These concepts have been practiced since times immemorial. What we have lacked is our ability to document our processes and be scientific in repeating them under varying circumstances. This approach results in reduction in operating costs like energy and water, besides several intangible benefits.

The principles of green and sustainability are fortunately or unfortunately community-agnostic, in the sense that they also need to handle wastages a bit more carefully, be thrifty in the usage of energy & water, handle waste in a hygienic manner to avoid outbreak of epidemics, reduced use of virgin materials and above all enhance their own quality of lives.

2. OBJECTIVE OF STUDY

The overall objective of this research was to demonstrate how a holistic approach in refurbishment of proposed residential housing project and the residential building under design phase can provide energy efficient system like solar panels for solar energy, solar water hitter, and rain water harvesting system to minimize the use of probable water in our daily life style. & minimize the carbon emission due to use of cement and natural material. So for the residential building find the energy efficiency, material efficiency and water efficiency to make traditional building to sustainable building. The specific objectives of the study were as follows.

1) Redesign the housing project for increasing productivity & energy efficiency.
2) Comparative study of traditional housing project and sustainable housing project.

The main purpose of this study was to identify appropriate efficiency for sustainable building with the cost saving and comfort criteria of any low budget housing project. It is expected that the case study of housing project used for other government traditional housing project and makes sustainable housing by increasing the use of natural energy like solar energy, rainwater harvesting system to minimize the wastage of drinking water.

In particular the research has aimed to evaluate energy and environmental performances of the existing building and comparing that building with sustainable building criteria and estimating the cost analysis for both building. Use of different software available in market like green building studio, open studio, Revit architecture, EnergyPlus, insight 360◦. For energy simulation and energy analysis. And some criteria use for estimating the cost of rain water harvesting model.

3. LITERATURE REVIEW

The energy problem in residential building of India exists due to lack of theoretical framework and uncertainty toward design and energy analysis methods. The conservation of rain water is decrease due to lack of public awareness about rain water harvesting system and their benefits. Also in construction phase material used are harm to environment. This chapter outlines the existing problems, the current developments in achieving energy savings and batter understanding the material management in the field of sustainable construction.

2.1 Sustainability of Building

That is **house** which is energy efficient by itself, environmentally healthy, respectful for the natural environment, comfortable for family life, in other words to be **sustainable** designed, built of green or recycled materials, and this **house** should use alternative energy resources. It is fact, that now days households and other living areas in which people live, or reside most of the time, contribute CO_2 emission and green house effects as much as global warming, which threatens to all humans and their health, as well as natural resources which balance is disturbed a long time ago. Sustainable house or Green house or Eco House is one of possible solutions, which with one part can contribute in solving of this global burning issue.

2.2 National Benefits Anticipated

People need homes. But with pressure on natural resources and the uncertainty of climate change, it is important that homes are built in ways that provide benefits for both residents and the environment. Evidence is growing that sustainable buildings provide financial rewards for building owners, operators, and occupants. Sustainable buildings typically have lower annual costs for energy, water, maintenance/repair, churn (reconfiguring space because of changing needs), and other operating expenses. These reduced costs do not have to come at the expense of higher first costs. Through integrated design and innovative use of sustainable materials and equipment, the first cost of a sustainable building can be the same as, or lower than, that of a traditional building.

1) Reduction in energy and water consumption

The main concept of green housing project are reduction in energy use in building and the consumption of water. To minimize the use of energy solar panels and solar water heater are used. Other material and techniques like thermal insulated walls, roof etc. for minimizing the carbon emission in building. For minimizing the consumption of water rain-water harvesting system used to collecting the rain water from roofing area. Energy efficiency is made to be introduced by energy requirement building standards. The average annual energy requirement for space heating is described in the form of thermal-energy consumption coefficients for space heating expressed in energy [kWh] per square metre of heated area (or cubic metre of heated volume) per year. According to Polish thermal-efficiency standards for residential buildings, the coefficients are required to be in the range 90–120 kWh/m2 /year. Application of new technologies and materials for the building envelope have become more widespread recently.

2) Improved health and hygiene

The healthcare sector in India is growing at a rapid pace and contributing immensely to the growth of the quality of services. The sector is expected to grow several-fold in the next decade. While this augurs well for the country, there is

an imminent need to introduce green concepts and techniques in this sector, which can aid growth in a sustainable manner. Introducing green concepts in the healthcare facilities can help address National issues like infection, epidemics, handling of bio-medical waste, water efficiency, energy efficiency, reduction in fossil fuel use for commuting, consumer waste and in general conservation of natural resources. Most importantly, these concepts can enhance patients' health, recovery and well-being.

3) Better sanitation

Segregate municipal waste generated in healthcare facilities at source, so as to prevent the waste being sent to land-fills. Provide separate bins to collect dry waste (paper, plastic, metals, glass, etc.,) and wet waste (organic), at all floors and common areas of the facility, as applicable. Divert the collected waste to a centralized facility, which is easily accessible for hauling. Segregate bio-medical waste at source, so as to prevent direct exposure, thereby improving sanitation & hygiene. Provide appropriate infection control parameters & systems in healthcare facilities, thereby reducing the nosocomial infections. Ensure adequate & well designed isolation rooms, thereby eliminate the risk of Hospital Acquired Infections (HAI). Ensure good sanitation & hygiene, design & maintenance practices, to reduce cross infections, thereby reducing risk of Hospital Acquired Infections (HAI). Facilitate automatic waste collection system to reduce human intervention & exposure in handling hospital waste, thereby improving sanitation & Hygiene.

4) Better ventilation and light in the dwellings

A sustainable house design can not only have accomplished building materials and layout of the building but it also needs to have good amount of professionalism offered towards achieving maximum satisfaction from the targeted design which has proper consideration for light and ventilation. In order to come up with a good house plan, you will need to put a certain amount of consideration as well as number of features to look out for in order to ensure that you attain proper lighting and ventilation within the houses. Among the many tips to look out for in order to make a proper plan for a house would include the following ten features to achieve proper ventilation and lighting.

5) Fuel savings in transit of people to work places & associated pollution

Climate change is rapidly becoming known as a tangible issue that must be addressed to avoid major environmental consequences in the future. Recent change in public opinion has been caused by the physical signs of climate change– melting glaciers, rising sea levels, more severe storm and drought events, and hotter average global temperatures annually. Transportation is a major contributor of carbon dioxide (CO_2) and other greenhouse gas emissions from human activity, accounting for approximately 14 percent of total anthropogenic emissions globally.

Firms expecting to have **60% more projects to certify as green** are anticipated more than double from 18% currently to 37% by 2018. **Mature markets in the US and Europe reports moderate level of growth**. **In 2012, green activity is 35% and in 2015, green activity is 40%.** Green building is already widely adopted globally, with strong growth expected in most countries but most particularly in the developing world.

4. DIFFERENT SOFTWARE USED FOR ENERGY ANALYSIS

In construction industry different type of software used for energy analysis of comparative study of building performance. Sustainability has become a significant aspect of real estate and has been integrated into the design, construction and operation of buildings. A typical building energy model has inputs for local weather; building geometry; building envelope characteristics; internal heat gains from lighting, people and plug loads; heating, ventilation, and cooling (HVAC) system specifications; operation schedules and control strategies. A building energy simulation then uses mathematical models to represent building systems and their interactions in order to calculate thermal loads, system responses to those loads, and the resulting energy use, along with related metrics such as occupant thermal comfort, energy use and carbon emissions.

1) GREEN BUILDING STUDIO

To perform whole building energy simulation for your Revit models, use Energy Analysis for Autodesk Revit. This add-in connects the design power of Revit to the analysis power of Autodesk Green Building Studio. Green Building Studio is Autodesk's core whole building energy simulation engine. This flexible cloud-based service uses the DOE2 simulation engine. It allows you to run building performance simulations to optimize energy efficiency and to work toward carbon neutrality earlier in the design process. Green Building Studio helps extend your ability to design high performance buildings at a fraction of the time and cost of conventional methods.

2) AUTODESK ECOTECT ANALYSIS

Autodesk Ecotect Analysis sustainable design analysis software is a comprehensive concept-to-detail sustainable building design tool. Online energy, water, and carbon-emission analysis capabilities integrate with tools that enable you to visualize and simulate a building's performance within the context of its environment. Building Performance Analysis during conceptual design, Autodesk Ecotect and the Revit design model can be used for a variety of early analysis. For

example, the designer can perform overshadowing, solar access, and wind-flow analyses to iterate on a form and orientation that maximizes building performance without impinging on the rights-to-light of neighboring structures.

3) AUTODESK INSIGHT 360

1. Energy Cost Range and Performance Factors: - Insight 360 features two exciting new factors that expand understanding of overall performance; window-wall ratio and photovoltaic energy generation. These factors help you quickly identify key energy performance drivers such as lighting power density, HVAC systems, or glazing properties.

2. Quickly Compare Design Scenarios: - Insight 360 allows you to save and compare your design scenarios to track performance spanning the building lifecycle in a consistent and cohesive manner. Share your insights with project stakeholders and access all your outcomes anywhere.

3. Heating and Cooling Loads – with Energy Plus: - Insight 360 is harnessing the power of EnergyPlus Cloud to deliver dynamic thermal heating and cooling loads for models created in Revit and FormIt 360 Pro. Generate tabular reports from Revit, or visualize heating and cooling loads in the Insight 360 web interface to instantly call attention to spaces that will be susceptible to higher loads.

4. Solar Radiation & Photovoltaic Energy Production: - Solar analysis now includes an automated workflow for understanding PV energy production and value added. New settings such as panel type, percent coverage, and payback period make it easy to communicate performance expectations and feed this information back to the Energy Cost Range. PV energy production is accessible in Revit as well as through the Insight 360 web interface.

4) ENERGY PLUS

EnergyPlus is DOE's whole-building energy simulation engine. EnergyPlus includes advanced simulation features including sub-hourly time steps, simultaneous solution of zone conditions and HVAC system actions, a modular HVAC structure that accommodates a wide range of system configurations, and a runtime scripting language for user-defined control strategies.

EnergyPlus supports a variety of use cases including integrated design of new buildings and retrofits, design guide development, development of and compliance with energy-efficiency codes like ASHRAE 90.1, asset ratings like DOE's Commercial Energy Asset Score, green certificates like USGBC's LEED, performance documentation for financial incentives from utilities and governments, and dynamic applications like automated fault-detection and diagnostics (AFDD) and model-predictive control (MPC).

5. CONCLUSION

The gap between energy demand and energy supply be likely to a bigger issue mainly in developing countries like India and an effective way is needed to tackle that problem, another challenging part is selecting the energy Efficiency resources. Indeed, sustainable building has the potential for a self-energy efficient building. If it applies to construction Sector energy production would be both profitable and economical which would also be according to the norms and Standards of environment, health, and safety. And in housing project increase the facility of household with minimum cost.

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