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A CASE STUDY ON GREEN BUILDING FOR QUALITY LIVING

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ABSTRACT

Buildings are found to be both, one of the biggest consumer of energy and producer of greenhouse gases. It has become a global issue. According to the National Institute of Building Sciences(USA), buildings generate 35 percent of the carbon dioxide. Since buildings are accountable for this scenario, it has imposed an immediate requirement to not only think of, but implement sustainability in every new construction instantly. This will render us a sustained environment and a healthy ecosystem. A sustainable or green building produces net zero or smaller carbon footprint or reduces the other harmful emissions. It is a building which does not have adverse effects on the ecological balance these structure don't have a negative impact on the environment as they generate their own energy from solar energy ,wind energy etc. It design and construction is a method of wisely using resources to create high-quality, healthier and more energy-efficient homes and commercial buildings. .It is about finding that balance between high quality construction and low environmental impact. ACH is an acronym for air change per hour and is a measurement of air infiltration.CFM is define as the air flow needed to create a 50 pascal pressure change in the building envelop .some of terminology are air sealing ,blower.

Keywords: cubic feet per minute, air change per hour ,air flow ,air sealing ,blower door.

I. INTRODUCTION

Green building is the practice of constructing or modifying structures to be environmentally responsible, sustainable and resource-efficient throughout their life cycle. This includes efficiently using energy, water and other natural resources, protecting occupant health, improving employee productivity and reducing waster pollution and environmental degradation.Green buildings accounts for improving environmental footprint by reducing energy use by 30%, CO_2 emissions by 35%, waste output by 70% and water usage by 40%.

It design and construction is a method of wisely using resources to create high-quality, healthier and more energy-efficient homes and commercial buildings. It is about finding that balance between high quality construction and low environmental impact. Green building combines both material and processes to maximize efficiency, durability and savings.The growth and development of our communities has a large impact on our natural environment. The manufacturing, design, construction and operation of the buildings in which we live and work are responsible for the consumption of many of our natural resources.

As environmental awareness is growing, the popularity of green buildings is rising too. Sustainable technologies and environmentally responsible construction methods are being extensively used in residential real estate projects[1].

II. COMMON RESEARCH THEMES ON GREEN BUILDING

There have been extensive studies on green buildings, as evidenced in the rapid growing number of papers been published in last decades. These studies have been conducted in bothdeveloped countries and developing countries, indicating this is a global issue. A critical review of the existing body of knowledge revealed that there are generally three common focuses of these studies (see Fig. 1). Similarly, green building can be approached either from process (i.e. how to implement the process) or outcome (i.e. how to evaluate the performance) perspective. Management approaches could be significant different depends on the focus. These common themes are discussed in detail in the following [2]

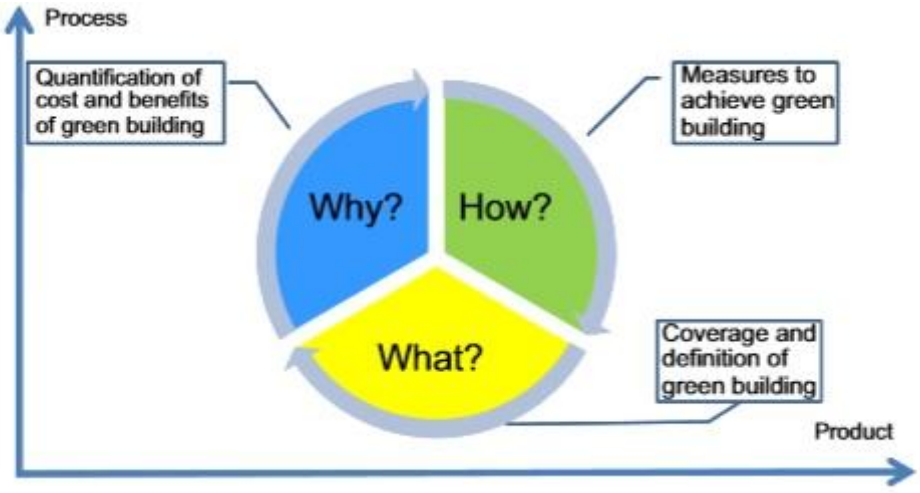

Fig 1: mapping of green buildingrelated studies.

III. REPURCUSSION AT WORLD LEVEL

The pressure that man exerts upon nature for fulfilment of his needs is greater than ever and is escalating at an alarming rate. Whether one considers the availability of fresh water, resources, or ecological balance, the MEA (Millennium Ecosystem Assessment) study of 2005 has found that there has been a 62% decline over the last

four decade, which in turn has brought about the undeniable realization that the system is under the risk of destructive and possibly irreversible changes. Another possible consequence of all this is the escalation of poverty on countries that rely on the resources produced by the collapsing eco systems. According to the reports published by MEA (millennium ecosystem assessment), the ability of the global ecosystem to nurture future generations can no longer be counted upon.From the environmental viewpoint, buildings account for nearly half of all energy consumption and raw material use around the globe. The 2008 Building Energy Data book (USDE 2008) says that commercial and residential buildings are held responsible for 39.7 percent of the energy consumed (residential 21.5 percent and commercial 18.2 percent) globally and 76 percent of the electricity used and 15 percent of the total water consumed (Architecture 2030 2009). Building and Construction sector takes up the lion share of resources for land use and material extraction, 50 percent of the world's raw material wealth – many of which are non-renewable resources – and are responsible for 36 percent of all waste generated worldwide.Some of the non-recyclable materials such as lead-based paints, asbestos, mould, wastes containing mercury, fluorescent bulbs, batteries pose serious environmental and health problems[3]. Hazardous waste must be disposed of in a separate landfill at a very high cost[4].

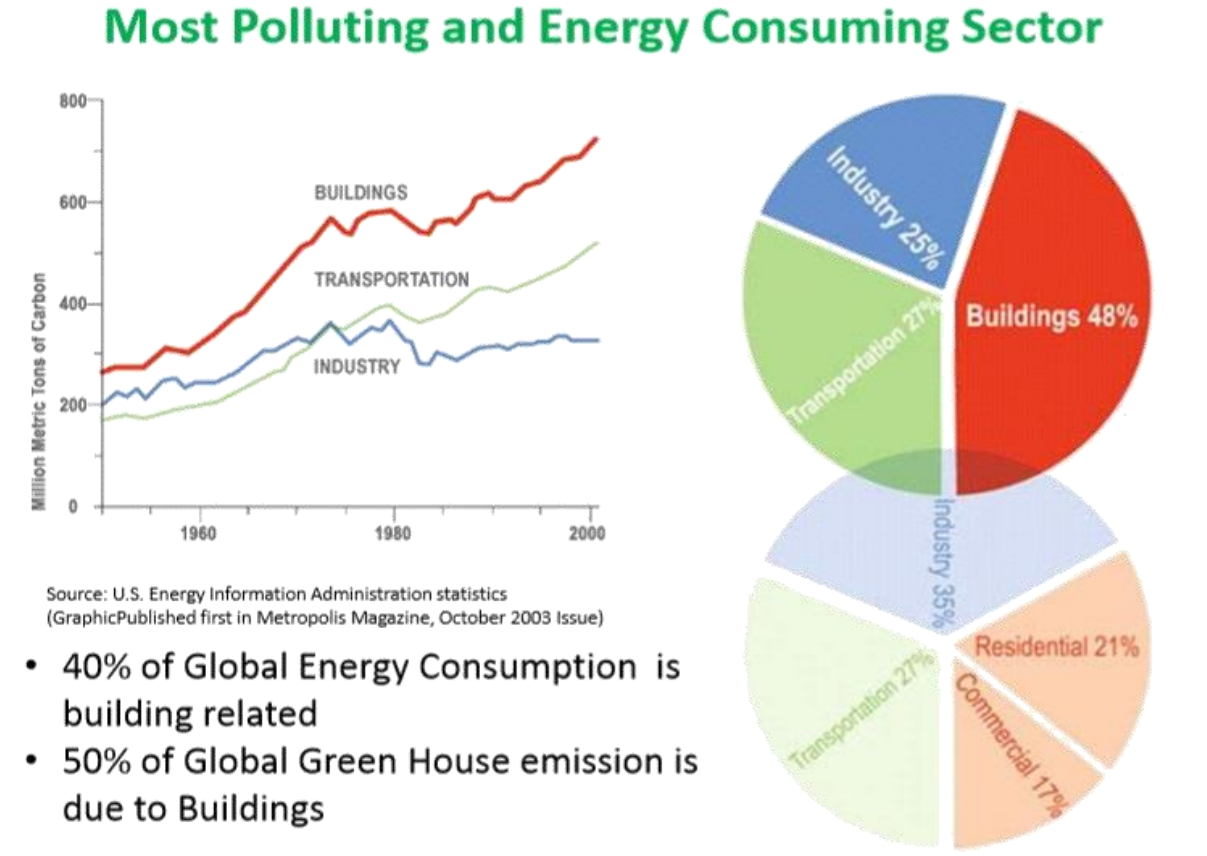

Fig 2: global energy consumption chart

IV. GREEN BUILDING RATING SYSTEM

GRIHA (Green Rating for Integrated Habitat Assessment), TERI (The Energy and Resources Institute) & SVAGRIHA (Small Versatile Affordable GRIHA) are green building rating system developed for Indian construction sector. GRIHA is a rating system which assesses the environmental performance of buildings on scale of 0-104. On the basis of number of points scored, a building can be rated between 1 & 5stars. GRIHA was developed by TERI and has now been adopted by the Ministry of New and Renewable Energy (MNRE) as the National Rating System for green buildings in India and to promote green buildings in India and to oversee the various activities associated with it, MNRE and TERI jointly established an independently registered society called ADARSH (Association for Development and Research of Sustainable Habitats). ADARSH functions as a platform for interaction between various stakeholders as well as promotes GRIHA, SVAGRIHA and other similar green building rating systems in India whereas SVAGRIHA is a recently designed system especially for small scale projects i.e. buildings with built up area less than 2500 sq.mt [5].

V. DESIGN TECHNIQUES VIA CASE STUDY

Centre for Environmental Sciences & Engineering Building, IIT, Kanpur, India

Introduction

The CESE is a 5 star green rating building by GRIHA(India) and research facility at the IIT (Indian Institute of Technology), Kanpur on a plot area of 175, 000 square metre . It has been designed in an environment friendly manner and conceptualized and constructed as a "building in the garden" that is sustainable.

Key Sustainable Features

•The building is fully compliant with the ECBC (Energy Conservation Building Code).

•Sustainable site planning has been integrated to maintain favourable microclimate.

•The architectural design has been optimized as per climate and sun path analysis.

•The building has energy-efficient artificial lighting design and daylight integration.

•Water body to cool the micro climate.

•Orientation of building: North – South.

•It also has energy-efficient airconditioning design with controls integrated to reduce annual energy consumption

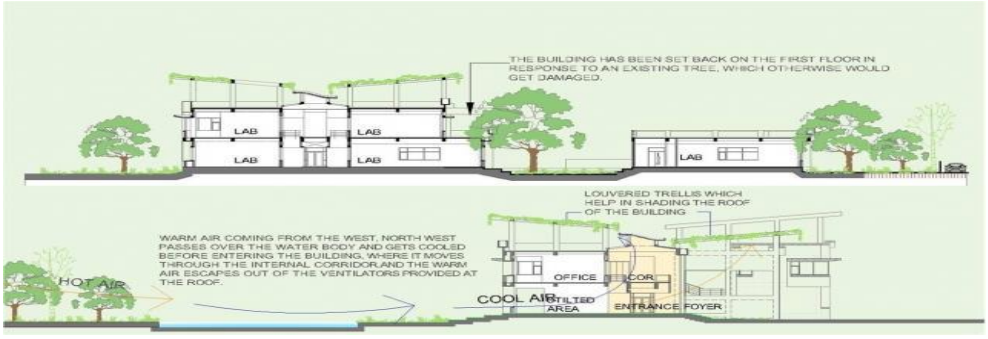

Fig 3: Existing Site Features green building.

•Passive strategies such as an earth air tunnel have been incorporated in the HVAC design to reduce the cooling load.

•Optimized window design by selection of Low E glass and external shading

VI: TECHNICAL AND ENVIRONMENTAL ASPECTS

Traditionally the focus of green building studies is placed on environmental aspect of sustainability. Taking the GBCAGreen StarHealthcare V1 as example, 87% of unweighted points are related to environmental sustainability. It is also evidenced in the extensive studies on environmental sustainability of buildings, e.g. energy efficiency, water efficiency, resource efficiency and greenhouse gas emission reduction **[6–11].** For instance, flyashes could be used for structural components of green building designwhich helps to not only save the energy but also reduce the waste to the landfill. Similarly, the utilization of precast or prefabrication technologies helps to reduce the amount of construction and demolition waste to a large extent Indeed, utilizing precast slabs in temporary construction works have a number of benefits such as mitigation of obsolescence and cost savings. Rajagopalan and Leung's study found that the acoustic performance (measured by sound absorption and reverberation time) of precast panel which is made of concretewaste, is satisfactory in sports hall buildings. In addition, prefabrication is recognized by both design and construction professionals as one of most common methods to prevent injuries particularly related to hazards of sustainable elements such as “construction at height, overhead, with energized electrical systems, and in confined spaces”. Precast reinforced concrete panel and prefabricated steel are most common sustainable technologies in building 386 schools in Catalonia, Spain **[12].**

VII: INDOOR ENVIRONMENTAL QUALITY

One of most critical components of human benefits associated with green building is the indoor environmental quality (IEQ). The IEQ, including volatile organic compound emissions and other contaminants is another critical issue in buildings. Therefore,IEQ features in all leading green building assessment tools . Extensive studies have suggested that green building can achieve higher level of IEQ than conventional buildings, which helps to improve the health and productivity of occupants. As a result, the level of satisfaction of building users is enhanced. In fact, Leaman and Bordass's study found that users of green building tend to be more tolerant than those of conventional building in terms of indoor environmental quality [13].

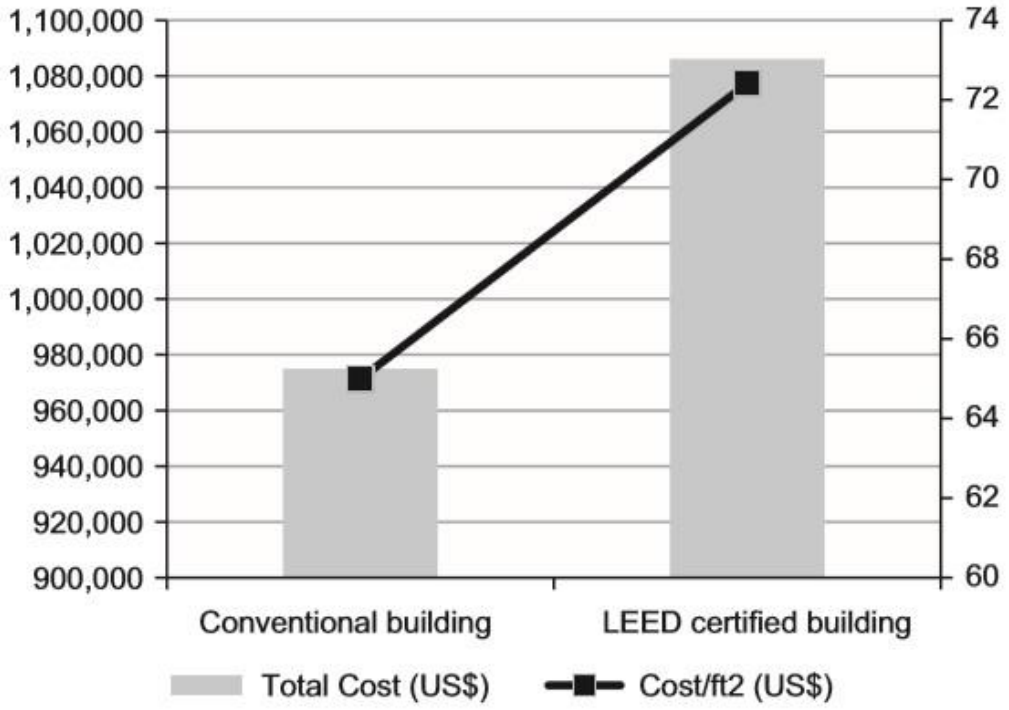

Fig. 4. Total cost and cost per unit floor area, conventional building vs. LEED certified building

VIII: METHODLOGY

This study is aimed at research, study and development of the green building construction techniques in order to save our planet from pollution and global temperature rise. Also, it aims at spreading awareness among the people all over the world, about the advantages and also the long term cost savings from green buildings. Further, the structural methodology is structured as below:

1. Introduction

2. Literature survey

3. Study of the research topic in detail

4. To study the research papers, articles and magazines related to the topic of study.

5. Data collection from the proposed areas of study which includes large, medium and small scale construction projects.

6. Collection of information with the help of web surveys.

7. Finding out new ways and techniques for development of green construction.

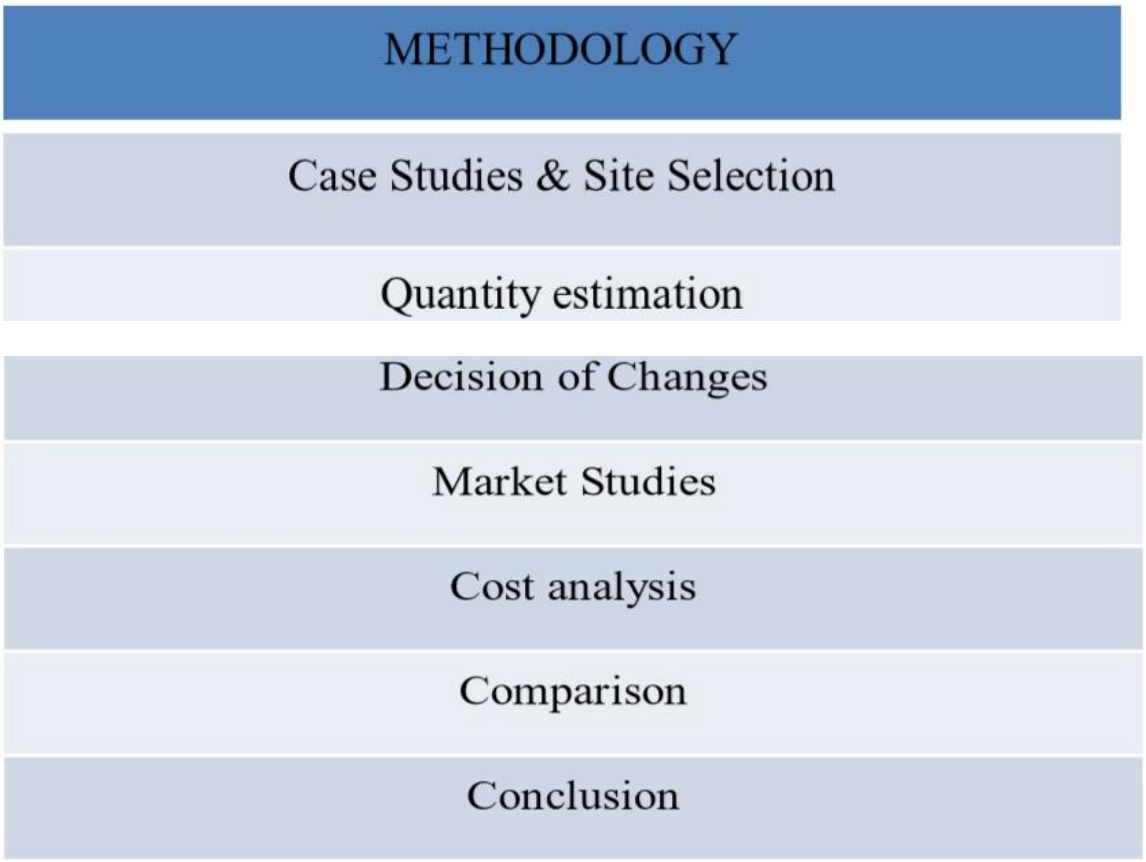

Fig 5: Flow chart of methodology

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IX: CONCLUSIONS

This paper study reported all the technical and also the economic aspects related to green buildings worldwide. Also, through this live case study of a small residential bungalow in a small town of India it is expected to attract at least the researchers all over the world especially in India and also to all the readers towards planning of their new homes or retrofitting their old ones by simple modifications and converting it into a green or a sustainable building for future long term savings (economic aspects) and also for saving our environment (environmental aspects). The conclusion for the studies can be classified into three different categories i.e. definitions and scope of green building, benefits and costs of green building and ways to achieve green building. It has been observed that in most of the literature reviews, the focuses are on environmental aspects of sustainability such as energy consumption, water efficiency and greenhouse gas emissions and also with their technical solutions. Also, the life cycle assessment approach, which is extensively applied in the environmental aspects of green building can be a useful tool for social sustainability. New rating tools are developing rapidly

worldwide. But more studies in these fields are required to support these new rating tools and also help in assisting the decision-making for the investors and the developers. Also, awareness amongst the people should be spread about the green building concepts and its long term profits. Current scenario is that people in countries like India are ignorant about this concept and also lack of awareness can be observed. Government initiative will help largely in spreading awareness. Also, provisions of educating and training people or the occupants will help to regulate their behaviour of using the green building which may affect the building performance significantly. Also, the discussion on cost and benefits of the green building are quite noticeable. It is also worth noticing that all the leading green building assessment tools are designed according to their local climatic and geographic conditions. Thus to set benchmarks for the world with references to green building, this point needs to be taken into considerations when comparing the effectiveness of these green building rating tools. The case study considered into this research paper is specially selected, designed, and constructed keeping in mind the green building concepts and its necessity to the environment and also to our pockets in the long term considerations. Also, this case study will help in studying awareness about the green building concepts amongst the people of towns and villages of India and help them develop their own green home and promote them to after building it. It is important to spread awareness amongst the people of the villages and towns in a country like India as the majority population of India lives in villages and towns and not in cities. Also, special population such as aged people, students and teachers could be paid more attention. Aged people tend to be more vulnerable to the overheating and the indoor environmental quality. Students will become practitioners in the future, also leaders in various sectors. Teachers play a critical role to shape the attitude and behaviour of students towards the sustainability related issues such as the matter of using buildings. Thus, the above mentioned issues serve as items of future agenda for green building related research and also promoting amount of green and sustainable development.

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