

## Review on the Literature Available on Green Buildings

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### Abstract:

From late 20<sup>th</sup> century, the development in construction field has seen a substantial change in itself. Since the demand of housing is ever increasing with increase in population, this need has to be coped up with all the resources available. However, the energy sources available to the mankind are limited and depleting rapidly. This in term will affect the situation enormously since the demand cannot be copied up with available resources. And this will result in depletion of resources at a great extent creating major problems. To tackle this situation, various options are available. Green building construction is one of the effective option and can be used instead of normal construction since it is more energy efficient. In general the cost of construction of green building is high as compared to normal but the overall cost of the building including maintenance is comparatively less. This research study focusses various data available for study about green building and various trends available about the green building and also the comparison between sustainable building and conventional building.

**Keywords —Green building, sustainable building, conventional building.**

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### I. INTRODUCTION

Building facility has been a human need for most of the activities. On the other hand building construction has both positive and negative that not only in construction but also in the operation and maintenance phase. Building operational phase and its life cycle is a significant factor in which it is responsible for the reduction in energy, water and material resources. Today, buildings worldwide account for up to 40% of total end-use energy. Developed countries consume most of their energy in the building sector. There is over 50% saving potential in the building sector and thus it is considered as a potential sector to meet the challenges of global energy and climate change. "Going Green" seems to be the new and popular thing to do. Nowadays everyone is talking about green construction. But there is a way in which common can afford it. It is an easy statement to

make but gives very little detail of how one will address such a global issue.

### II. RESEARCH METHOD

This paper summarizes the existing research on green building based on the literature from 2002 to 2018. This paper can help readers to systematically understand about green building, materials used in green building and the current trends in green building construction. Although there is no detailed analysis of all literature related to green building, this paper quantitatively summarizes the status quo and development trend of green building in view of its high reference value of the sample literature.

Thus this paper following comprises of various literature reviews in detail stating all the necessary information needed for the understanding of concept of green building.

### III. LITERATURE ANALYSIS

#### **1. Cody Fithian and Andrea Sheets Green Building Materials: “Determining the True Definition of Green.” October 2009**

This paper gives information of what green means. This paper describes green labelling program and conditionally green material like bamboo, concrete forms and low VOC paint. There are currently over fifty regional and national green labelling programs throughout the United States. Each of these have similar yet quite different versions of rating systems and qualifying characteristics that they look for in a green building. Some focus on only the end results and completely overlook what happens during the gathering and manufacturing of materials. Others look more heavily at issues of economics and energy savings while deeming other issues like the distance a material travels or the toxins it could emit into the air as much less important. As long as a material has at least one positive impact on the environment, it could be defined as green. However when analysed more carefully, this same material could actually be harming the environment more than it is helping. Therefore it is extremely important to know who is labelling a material as green. Many labelling organizations are sponsored by material industries and will consequently be lenient in granting those materials green status. This complicates the process of determining exactly how green specific materials are. The trouble in identifying the truest definition of green may be that there is no absolute definition. The lack of public unity in a definition has caused the meaning to become convoluted and impossible to distinctly pronounce. However, by examining the problems and corruption of the green labelling industry, one can indeed gain an understanding of the complexity of variables that contribute to the greenness of a material.

#### **2. Fangzhu Zhang & Philip Cooke, Cardiff University. “Green Buildings and Energy Efficiency.” February 2010**

According to study of this paper, today buildings consume 40 % of the total end use energy in developed countries. However, building sector has 50% energy savings potential to meet challenges of global sector. Urbanisation result in development in building industry. It also increases total energy use. Energy use is depends on population and its density as well as energy efficiency. Energy required for HVAC is one of the most important reason for energy consumption. Author took various case studies of various green existing buildings and their energy consumption. This paper describes financial benefits of green building in their operational phase. Building heating and cooling are the most energy-intensive activities, followed by electricity use for lighting and appliances (Harvey, 2009). Greenhouse gas emissions from buildings energy use significantly exceed those from transportation. The increasing demand for residential and commercial building spaces in developing countries will further push up energy consumption from building. It was predicted by International Panel on Climate Change (IPCC) that CO<sub>2</sub> emissions from buildings (including through the use of electricity) could increase from 8.6 billion tonnes in 2004 to 15.6 in 2030 under a high growth scenario (Figure 2) (Levine et al., 2007). Developing countries will contribute substantial increases in CO<sub>2</sub> from the building sector. But such a building boom also offers an opportunity to commercialise energy efficient technologies to reduce CO<sub>2</sub> emission. Improved efficiency in the building sector and decarbonising the power sector could offer significant potential emissions reduction.

#### **3. Usman Aminu Umar, M. F. Khamidi and Hassan Tukur. “Sustainable Building Material for Green Building Construction, Conservation and Refurbishing.” December 2012**

Materials are the essential components of buildings construction. The design of green buildings should thus begin with the selection and use of eco-friendly materials with related or better features than traditional building materials. Building materials are usually selected through functional, technical and financial requirements.

Among the directions for solutions is to be found in new material applications, recycling and reuse, sustainable production of products or use of green resources, Careful selection of sustainable building materials may be the fastest way for builders to start integrating sustainable design concepts in buildings. Ordinarily, price has been the primary consideration when comparing related materials or materials selected for similar purpose. Nevertheless, the price of a building element signifies just the manufacturing and transportation costs, not social or environmental costs. The research community has carried out substantial initiatives globally, in order to discover alternative sustainable building materials and low technology techniques, which result in a more sustainable and affordable construction complying with the comfort standards required today. The purpose of this paper is to highlight how sustainable building material can contribute to lessen the impact of environmental degradation, and generate healthy buildings, which can be sustainable to the occupant as well as our environment.

**4. Shivaji, IIT Guwahati “Green building material and their common use in everyday life.” January 2016**

This research paper is about green building materials and main goals of green building material used in construction industry. Most important goal of green building materials is to reduce energy consumption and improve energy efficiency. Life Cycle Assessment is important target to achieve in green building construction. This research paper also describes the material selection criteria in construction industry on the basis of their cost and properties. Indoor air quality importance is also describes in this paper. Study of carbon neutral technology is one more important topic in this paper. It also states that the practices, or technologies, employed in green building are constantly evolving and may differ from region to region, there are fundamental principles that persist from which the method is derived: Structure Design Efficiency, Energy Efficiency, Water Efficiency, Materials Efficiency, Indoor Environmental Quality

Enhancement, Operations and Maintenance Optimization, and Waste and Toxics Reduction.

The author has also discussed about the essence of green building as an optimization of one or more of these principles. Also, with the proper synergistic design, individual green building technologies may work together to produce a greater cumulative effect. On the aesthetic side of green architecture or sustainable design is the philosophy of designing a building that is in harmony with the natural features and resources surrounding the site. There are several key steps in designing sustainable buildings: specify 'green' building materials from local sources, reduce loads, optimize systems, and generate on-site renewable energy.

**5. Mridu Pavan Chakrabarty and Nitin Lekhwani “Green Building Materials Market-Growth, Trend and Opportunity: South Asian Perspective” January 2016**

The above paper includes that selection of building material is an important issue in building design and construction decision-making and environmental issues need to be incorporated into the evaluation process. Prices vary for different types of green building materials. South Asian Green Building material market has lots of challenges and opportunities ahead. The future prospects are bright, but the South Asian (particularly Indian) customers are yet to get through the Rubicon of opting for Green Building instead of conventional buildings. Greener building standards and the rising energy costs are the market's main propellants. Unfortunately, enforcement of energy standards is uneven and customers are highly price sensitive. There is tremendous potential for construction of Green Building in India. The main objective to concentrate in Green Building is that, green building has a potential to save 30%-40% energy with reduction of operating cost and enhance good health. Through this report, authors studied the Green Building material market in relation to embodied energy and CO<sub>2</sub> emission from building material and analysed the growth and trend of the materials in South Asian perspective over a period.

For analysis, authors have considered the city of Ahmedabad in India.

**6. Bal Ramdas, Prakash Meher, Snehashish Behra, Bibik Rath, GIET Orissa “Comparison between normal building and green building- A case study approach.” International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 05 May-2016**

In this paper two cases for a same building are studied in which one include the conventional approach while the other include relative sustainable approach. This paper states that now-a-days due to excessive population growth, people require more number of houses to stay within but they generally built normal building in which energy consumption is more which inefficient. However, the energy source is decreasing very fast now days, so by implementing green buildings throughout the world, we can reduce the conventional energy consumption and so by reducing pollution. In this paper, an analysis has given to compare between Normal buildings and Green buildings. This research paper studies all parameters of green building and compare them with normal construction techniques. The indispensable waste particles generated by building occupants, Green building is dedicated to the separation and storage of materials including glass, liquids, and metals. 20% to 50% of the building materials and products used are extracted and manufactured within the region, thereby supporting the regional economy and reducing the environmental impacts resulting from transportation. Rapidly renewable building materials made from planks such as bamboo. They are typically harvested within a 10 years of cycle or shorter are used in green building. In Green building, we have used 50% of the total value of wood based materials which are FSC certified. This way we encourage environment responsible for management

**7. Ben Chak-Man Leung, City University of Hong Kong, Hong Kong “Greening Existing Buildings Strategies” November 2018**

This article gives a systematic manner to develop strategies of how to effectively greening the

existing buildings. The findings concluded that using the above GEB strategies can achieve a total of energy savings in a range of 40%–60%. This high-energy savings will contribute to carbon intensity reduction in the range of 20%–30%. A Green Audit Award is postulated to help to identify the green potential/deficiencies of the existing buildings with the aim to wrap up a green improvement plan so that the existing buildings can become green within the constraints of the existing building under the assessment. A pilot test in terms of a case study confirmed that the GAA assessment scheme coupled with the GEB strategies is feasible and cost effective to turn the existing building green.

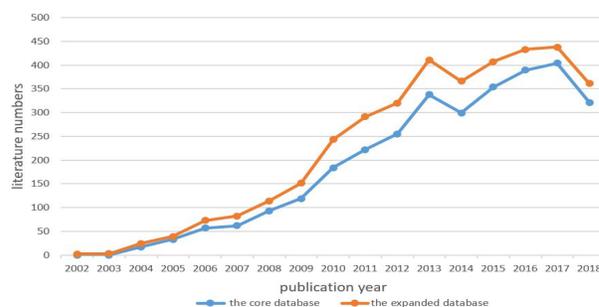


Fig. 1. Number of documents from year 2002 to 2018

## IV CONCLUSION

Green building technique is very effective in energy consumption reduction in life cycle of a building. For achieving effective green building system planning during construction is very necessary. Study on market requirements is also important part of construction industry. Selection of materials in green building is very important step. Materials must be selected after study of their cost and properties. Thermal properties of a materials is very important aspect in material selection. Life cycle cost of green building is essential to predict before construction. It also helpful for attracting buyers. Renewable energy resources have also important role in building energy consumption. The environmental impact and climate change produced in the construction process are also worth noticing. The new-built constructions, reconstructions, and demolition of buildings will result in the waste of resources and energy consumption, as well as a

large amount of solid waste, and finally pollute the environment. The construction industry has been a leading carbon emitter for a long time. The simultaneous growth of building size, volume, and energy consumption intensity will inevitably bring tremendous carbon emission, which will be the focus of the further studies of energy conservation and emission reduction work. Therefore, green buildings fully incorporate the green concept into the construction process, and adopt various kinds of low-carbon and environmentally friendly materials to reduce the energy consumption and improve the construction technical level of the project, which can effectively alleviate the current situation.

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