



A Review Of Green Building Design, Technologies, And Policies For Environmental Control.

V. Jyothsna¹, Y. Yamuna², Ch. Rajesh Kumar Varma³, K. Sai Siva Chandra⁴, M. Teja⁵.

1,2,3,4,5 - Under Graduate Students,

Department of Civil Engineering,

N.S. Raju Institution of Technology, Sontyam.

Affiliated to JNTUGV, AP, INDIA.

Abstract: The built environment's significant environmental footprint necessitates a paradigm shift towards sustainable development. Green building, a vital strategy for mitigating climate change, has gained momentum globally. This comprehensive review examines the current state of green building, synthesizing research on design strategies, innovative technologies, and policy frameworks. We assess the effectiveness of green building certifications (e.g., LEED, BREEAM) and explore emerging trends, including net-zero energy buildings, green infrastructure, and circular economy principles. Our analysis reveals substantial benefits, including reduced energy consumption, water savings, and improved indoor air quality. However, challenges persist, including higher upfront costs and lack of standardization. We identify key policy recommendations and future research directions to overcome these barriers and accelerate the adoption of green building practices worldwide. The Conventional building effect on greenhouse gases (CO₂), global warming and human health related. 90% of the time we are inside the building, so conventional building great effect on our health as well as environment. The first aim of this study is to existing Apollo Institute of Engineering & Technology (AIET) building convert into green building without their demolition by use of natural source, save energy and green materials. The second aim is to study of Indian Green Building Council (IGBC) Green Existing Building Rating System.

This review paper aims to provide a comprehensive overview of the current state of green building, including its evolution, benefits, challenges, and future directions. We will examine the latest research and trends in green building design, materials, technologies, and policies, highlighting best practices and case studies from around the world.

Keywords: green building, sustainable development, climate change mitigation, energy efficiency, water conservation, indoor air quality, global warming.

I. Introduction:

The built environment has a profound impact on the natural environment, human health, and the economy. The construction and operation of buildings account for nearly 40% of global energy consumption, 30% of greenhouse gas emissions, and 20% of water consumption. As the world's population urbanizes, the demand for sustainable and environmentally responsible buildings has become increasingly urgent.

Green building, also known as sustainable building, refers to the design, construction, and operation of buildings that minimize environmental impact while maximizing human well-being. Green buildings incorporate innovative materials, technologies, and design strategies to reduce energy consumption, water usage, and waste generation. Climate change and its disastrous consequences are stimulating the transformation towards a sustainable development, with its increasing economic efficiency, protection and restoration of ecological systems and improvement of human well-being. The maintenance of natural resources is a subject that often appears when sustainable development is considered. In addition, with increasing world population and economic development of various nations, the strain on resources is increasing. As economic development and environment are linked, the realization has set in to conserve energy and resources. Globally, infrastructure and building construction consumes 60 % of the raw materials extracted from the Earth (Bribian et al., 2011, MMSD, 2002). From this volume, building accounts for 40 %, in other words 24 % of these global extractions. In the US, with 4 % of world's population, the consumption of resources is at a staggering 25 % of total resources available in the world (Teller and Bergman 2010). A majority of these resources (60 % according to USGBC) are consumed in the building industry. In Europe, the per capita mineral extractions for buildings are approximately 4.8 tons per year (Wadel, 2009) Consumption of non-renewable and non-replenishable minerals will be detrimental to the environment and will have catastrophic effect on humans. In addition to that, energy consumption during and in use of building is enormous. In the US, the built environment accounts for 65 % of all energy consumption (USGBC 2010). In the European Union (EU) the corresponding number is 42 % (Nelson 2002). In addition, carbon di-oxide (CO₂) emissions from the built environment accounts for roughly 35-40 % of total emissions, both in the US as well as in the EU (Environmental Information Administration 2008, Nelson 2002). Not only do buildings consist of a multitude of products, and therefore technical and biological nutrients, they also have an important and wide-ranging impact on water and energy cycles, air quality (indoor and outdoor), and fauna and flora, as well as on social and economic factors. The increased use of resources that cause pollution and emissions, highlight the need to save and conserve energy for sustainable development. In engineering, sustainable design is a design ideology, which harbors the notion of sustainable human and societal development. Sustainable development can be defined in various ways. Every individual will approach the issue of sustainability in a different manner depending upon various factors, such as, sustainability goals, background, awareness, and economic conditions. Sustainability is providing opportunity of development to the future generation, in

terms of resources. One of the key aspects in sustainability is sustainable construction. Sustainable construction practices are such that they are based on ecological principles, with no environmental impacts, have a closed material loop, and have full integration into the landscape after the service life of the structure is over. The concept of green buildings is the measure of our efforts in attaining that idealistic sustainable construction practices. According to Environmental Protection Agency (EPA) in the US, Green Building is the “practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building life-cycle from siting to design, construction, operation, maintenance, renovation, and deconstruction.” This definition has evolved over the years. “Green Buildings” is an ever evolving, dynamic term. Green Building is the status of our efforts in attaining sustainability in construction practices. As technology evolves and new materials are developed, the status of our efforts are also changing. Hence, the essence of green buildings is changing. The aim of this paper is to discuss sustainability with respect to green buildings, its importance in one of the world’s leading Green Building program - Leadership in Energy and Environmental Design (LEED) certification from the perspective of sustainable material selection, and governing policies in LEED. Furthermore, the role of life cycle assessment (LCA) in assessing the sustainability claims of green buildings and building materials is introduced. Moreover, the potential for including LCA in the scheme of Green Building rating system is critically evaluated. Over the past few decades, green building has evolved from a niche concept to a mainstream movement, driven by growing concerns about climate change, resource depletion, and public health.

LITERATURE:

Održivi razvoj i zelena gradnja (2012): Global sustainability goals have led to the development of the green building movement. The Green Building Program, stemming from the movement, has had unprecedented success as it provides a quantifiable metric to people’s efforts towards sustainable development. Sustainable development and green buildings are often used interchangeably. Although, sustainable development and green buildings are related, they are not the same. Globally, infrastructure and building construction consumes 60 % of the raw materials extracted from the Earth (Bribianet al., 2011, MMSD, 2002). From this volume, building accounts for 40 %, in other words 24 % of these global extractions. In the US, with 4 % of world’s population, the consumption of resources is at a staggering 25 % of total resources available in the world (Teller and Bergman 2010). A majority of these resources (60 % according to USGBC) are consumed in the building industry. In Europe, the per capita mineral extractions for buildings are approximately 4.8 tons per year (Wadel, 2009) Consumption of non-renewable and non-replenishable minerals will be detrimental to the environment and will have catastrophic effect on humans. In addition to that, energy consumption during and in use of building is enormous. In the US, the built environment accounts for 65 % of all energy consumption (USGBC 2010). In the European Union (EU) the corresponding number is 42 % (Nelson 2002). In addition, carbon dioxide (CO₂) emissions from the built environment accounts for roughly 35-40 % of total emissions, both in the US as well as in the EU (Environmental Information Administration 2008, Nelson 2002). Sustainability is increasingly becoming a key consideration of building practitioners, policy makers, and industry alike, since the world is moving towards zero-energy construction. When buildings have net zero energy consumption, the effect of embodied energy and greenhouse gas emissions become important. A zero-energy house can be built with different materials and construction methods that create different cumulative carbon footprint.

Jian Zuo, Zhen-Yu Zhaob. (2013): Green building is one of measures been put forward to mitigate significant impacts of the building stock on the environment, society and economy. However, there is lack of a systematic review of this large number of studies that is critical for the future endeavor. The last decades have witnessed rapid growing number of studies on green building. This paper reports a critical review of the existing body of knowledge of researches related to green building. The common research themes and methodology were identified. These common themes share the definition and scope of green building; quantification of benefits of green buildings compared to conventional buildings; and various approaches to achieve green buildings. Construction industry has significant environmental, social and economic impacts on the society. As one of key outputs of the construction industry, buildings largely reflect these impacts during its lifecycle. The positive impacts of construction activities include: providing buildings and facilities to satisfying human being's requirements, providing employment opportunities directly or indirectly (through other industries related to the construction industry) and contributing toward the national economy. For instance, the construction industry in Australia contributes 7.5% to the Gross domestic product (GDP) and provides more than 1 million jobs. Similarly, buildings and construction activities play a crucial role in urbanization.

Mohd Yasir Laeeq¹, Dr. Syed khursheed Ahmad², Khubaib Altamash³ (2017) The building industry is one of the major energy consumers and emitters of Green House Gasses (GHG). It consumes 38% of the global energy; and this does not include the usage of other resources such as water. Globally, this has increased the crisis of global warming and has led to development of green buildings. In the Sub-Saharan Africa alone, 56% of energy used is by building operations. Green buildings are marketed as economical, resource efficient and environmentally friendly compared to the conventional buildings. This study investigated the extent of adoption of green building concepts in commercial buildings and the key challenges arising from their adoption with the aim of determining appropriate strategies for implementing them. The study was conducted through a survey method and used questionnaires, interviews, observations for data collection. It also reviewed documented data from available records including journals and books. The study revealed that large percentage of the building construction players and professionals involved in the recently sampled constructed commercial buildings in our country were aware of the green building concepts but only small percentage of the concepts had been incorporated in the buildings. The building industry's sustainability ethics is based on the principles of resource efficiency, health and productivity and realizing these principles involves an integrated approach in which a building project and its components are viewed on a full cycle basis.

G. Anand¹, K. Chiranjeevi² (2018): The term "green building" is used to describe buildings that are designed, constructed, and operated, to have a minimum impact on the environment, both indoor and outdoor. Most discussions of green buildings refer to the importance of providing an acceptable, if not exceptional, indoor environment for the building occupants. Green building (also known as green construction or sustainable building) refers to both a structure and the application of processes that are responsible and environmentally resource-efficient throughout a building's life-cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. It is a practice of increasing efficiency with which buildings use resources-energy, water and materials while reducing building impacts on human health and the environment. Green buildings refer to both a structure and the application of processes that are environmentally responsible and resource-efficient throughout building's life cycle: from planning to design, construction, operation, maintenance, renovation, and demolition. Green building means making healthy and sustainable choices, especially in the way your building uses energy, water, materials, and its site. Green and sustainable buildings are naturally different from conventional buildings. They require special materials and building practices as well as management commitment to sustainability (Anantatmula & Robichaud, 2011). Due to the barriers characteristics reported, the unique of sustainable building project required adjustments to conventional project management practices to minimise risks and improve the chances of delivering the project within acceptable costs and schedule. Realistic financial and time constraints, superior planning, design and construction processes are needed to deliver a green and sustainable building project (Korkmaz et al., 2010). Sustainable and Green buildings will only results from

building professionals working together to achieve this common objective. It is important to explore the strategies for containing cost during the planning phase of a project to reduce developers first cost in delivering the green and sustainable building project (Korkmaz et al., 2010).

Prof Neeraj Gupta (2023): The green building movement has gained significant traction as a means to address the environmental impact of buildings and promote sustainable development. This research paper examines the application of green building practices in the context of sustainable development in India. Buildings in India account for a substantial portion of resource consumption, energy use, and carbon dioxide emissions. Uncontrolled urban development has further intensified these environmental challenges. Recognizing the need for a more sustainable approach, the green building movement has emerged as a solution to minimize the environmental footprint of buildings. The green building movement emerged in response to the significant environmental impact caused by buildings. As stated in the provided research, buildings consume a substantial portion of global resources, energy, and water while contributing to carbon dioxide emissions and indoor air pollution. Uncontrolled urban development has further exacerbated these environmental challenges. The green building movement aims to address these issues by promoting sustainable building practices that minimize resource consumption, reduce energy use, mitigate greenhouse gas emissions, and improve indoor environmental quality. Green building practices encompass various aspects, including design, construction, operation, and maintenance of buildings.

III. CONCLUSION:

Green building is a critical strategy for mitigating climate change, improving human health, and ensuring sustainable development. While challenges persist, emerging trends and technologies offer opportunities for growth and innovation. In conclusion, green building represents a significant advancement in sustainable construction practices, focusing on minimizing environmental impact while enhancing energy efficiency and occupant well-being. The integration of eco-friendly materials, energy-efficient systems, and innovative design strategies not only reduces the carbon footprint of buildings but also promotes healthier living and working environments. As awareness of climate change and resource depletion grows, the adoption of green building practices will be crucial for creating a more sustainable future. By investing in these practices, we can ensure that our built environment contributes positively to the planet and the quality of life for all its inhabitants.

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