

Green Building Architecture: A Literature Review on Designing Techniques

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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 (the primary greenhouse gas associated with climate change), 49 percent of the sulphur dioxide, and 25 percent of the nitrogen oxide found in the air. 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. Green Buildings are buildings that subscribe to the principle of conscientious handling of natural resources, which means causing as little environmental interference as possible, using environment friendly materials, requires low operational energy, utilizes renewable sources of energy to fulfil its requirements, follows high-quality and longevity as a guideline for construction and last but not least, must be economically viable. Albeit the problem is common in developing nations. The paper focuses on green design as a vital transformation of contemporary architecture practiced in developing nations. It endeavours to present some environmental and physical design approaches for green buildings in promptly developing countries chiefly India. In this regard, the study presents hands on analysis of basics and principles of green architecture, theories and viewpoints outlined in the field and also the analysis of efficacious cases of environment friendly buildings in India.

Index Terms- Greenhouse gases, Sustainability, Ecosystem, Green Buildings, Renewable, Green Design, Contemporary Architecture

I. INTRODUCTION

Buildings account for more than 40% of all global carbon dioxide emission, one of the main culprits implicated in the phenomenon of global warming in which India comes on 144th position (1.4 metric ton) in carbon emission rating in the world. 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 waste, pollution and environmental degradation [1]. Green buildings accounts for improving environmental footprint by reducing energy use by 30-5-%, CO2 emissions by 35%, waste output by 70% and water usage by 40%.

II. 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[2]. 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].

III. 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 2500sq.mt [5].

IV. DESIGN TECHNIQUES VIA CASE STUDY

4.1 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 complaint 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 air conditioning design with controls integrated to reduce annual energy consumption.

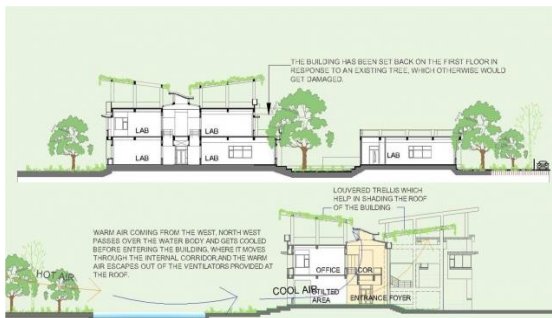


Fig 1: Existing Site Features

- 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.

4.2 The Dallas Middle School, Portland, Oregon

The Dallas Middle School is the LEED Gold certified green building. Architect of the building is Heinz Rudolf, BOORA

Key Design Features

- The school is oriented so classrooms face north and south. They do not get direct western sun during the hottest time of the day.
- The large windows have a special glazing to minimize glare and heat, but bring lots of natural light inside the room.
- The operable windows pull fresh air into one side of the classroom, while ventilation stacks (chimney-like devices) pull the air out on the opposite side of the classroom.
- Building materials were specified to contain post-consumer recycled content.
- Used light-coloured concrete for the parking area to reduce heat "islands."
- Directed the exterior lighting downward to reduce night light pollution.
- Used local building products when possible to avoid transporting materials long distances and consuming more fuel.
- Stained the concrete walls to look like basalt rock and to blend with the colours of the natural landscape.

V. CONCLUSIONS

Green building are today the most widely used form of architecture. Creating green buildings is an important focus of building owners and even governments worldwide. In India some world class Green Buildings have constructed in past few years, but still the concept of green buildings for general masses is in infancy stage. Present work is an attempt in the direction to make people, communities and general public aware about the advantages of green buildings for sustainable environmental development and management.

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