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Case Study of Green Building and its Accreditation

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ABSTRACT: This paper is based on a review of research that describes different types of energy efficient buildings, focusing on their LEED and IGBC criteria. Green buildings are today the most widely used form of Architecture. Creating green building is an important focus of building owners and even governments worldwide. The paper focuses on green building criteria and comparison between three buildings. They are as given: Esmeralde, Aurangabad; Taipei101, Taiwan; David L. Lawrence Conventional Center, Pittsburgh.

KEYWORDS: Energy efficient building, Worldwide, Criteria

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 (1.4meteric ton) in carbon emission rating in the world. The Indoor Environmental Quality (IEQ) category in LEED standards, one of the five environmental categories, was created to provide comfort, well-being, and productivity of occupants. Concerning usability, there are many aspects in common for all type of energy efficient buildings. The evaluation of energy efficient buildings from a user perspective includes research on the experience of indoor climate, heating, light, ventilation, local energy production and other technical installation, in relation experienced housing quality in general. The research presented includes LEED and IGBC criteria, comparative study between three green buildings in different countries- Esmeralde Aurangabad; Taipei101, Taiwan; David L. Lawrence Conventional Center, Pittsburgh.

II. COMPARATIVE STUDY

2.1Esmeralde, K-2 & K-3 Enigma, Next to Divisional Sports Complex, GarkhedaA'bad- 431005 (M.S.) India The Esmeralde is a 5 star green rating building by IGBC and research facility at Deven group, India on a plot area 9.5 acres. It has been designed in an environment manner and conceptualized and constructed as pollution free zone, walk in gardens, personal lift, façade lighting.In this building project they used various recycled material such as fly ash bricks, wood flooring etc. the area of this project is 9.5 acres.Deven group has launched yet another project in Aurangabad. DevenEsmeralde is located in Nakshtrawadi, Aurangabad, Maharashtra, INDIA. Esmeralde means Emerald in Spanish.
Specifications – DevenEsmeralde

- Exterior
- Door
- Veneer finish polished flush
- Door shutter for main door
- Bed room and toilet doors
- Decorative fittings foe doors
- Interior
- Windows
- Powder coated Aluminium
- Sliding windows with Mosquito net

NATURE AND LANDSCAPE

- Uniquely design entrance and gate with 30 feet height green theme wall
- Around 1 acre landscaped garden visible from every duplo villa
- Individual designer terrace gardens
- Bird bath

Project Highlights

1) Limited Edition Homes **:**
   Only 129 homes, Rare dwellings for a privileged few.
2) Pollution Free Zones :

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Vehicular movement restricted only to the peripheral area.

3) Double Level Parking :
   Ample parking space with two private car for villaments too.
4) Walk in Garden :
   For every Duplo villa in Esmeralde, you can walk in to your own garden or landscaped terrace.
5) Personal Lift :
   A personal lift for units at the upper level of the Duplo villa.
6) Façade Lighting :
   Spectacular façade lighting, something that is rarely seen in India.

(a) 3-D Cut Section View of Duplo Villa, Esmeralde, Deven Group, Aurangabad. First green building in Aurangabad Certified by IGBC (Indian Green Building Council).

2.2TAIPEI101, Xinyi District, Taipei

Taipei101 is the world's tallest green building and formally known as the Taipei101 World Financial Center – is a landmark super tall skyscraper in Xinyi District, Taipei and Republic of China. The building was officially classified as the world's tallest in 2004, but BurjKhalifa in Dubai in 2010 is the world's tallest building. In 2011, the building was awarded the LEED platinum certification, the highest award according to the Leadership in Energy and Environmental Design (LEED) rating system, and became the tallest and largest green building in the worlds.

The Taipei 101 is floor count 101, 5 below ground and floor area is 412,500m^2 (4,440,100sq.ft.).

Construction started 1999 and completed 2004. The total cost of building is NT$58 billion (US$1.934billion).TAIPEI101 is Taiwan's tallest building and the most prominent landmark of the capital city of Taipei.

- TAIPEI 101 Key Achievements:

TAIPEI101 achieves annual savings of 2,995 metric tons in reducing co_2 .The equivalent of preserving over 9 acres of woodland from deforestation. TAIPEI 101's energy consumption is now 30% lower compared to average building. Efficiency gains translate to cost saving of approximately NT$20 million or US$700,000.10% annual reduction from of the following areas:

1. Water use (28,000 metric tons of water saved)
2. Garbage production (1216 metric tons of garbage saved)
3. Electricity consumption (4.8 million kWh saved)

"Buildings account for 40% of the world's energy consumption and 21% of the globalCO_2 emissions". Waste management program, 70% construction waste &55% solid waste are diverted from landfill. Green Investment: NTD60,000,000/USD2, 000,000, about 10,000man hours

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(b) Taipei101 is the business centre in Taiwan also it is world's tallest green building in world with Platinum certification by LEED (Leadership in Energy & Environmental Design).

2.3 David L. Lawrence Convention centre (Downtown Pittsburgh), U.S. North America.

The David L. Lawrence convention centre gold 1st LEED certified in U.S North America & largest green buildingin the world. The Area is 1000Sq-ft. in 2003 awarded gold Leadership energy & environmental Design (LEED Certification by U.S Green building council. In these building 50%of the grey water. Is system is refuse & save 5 million water annually. The building won the 2004 supreme Award for structural engineering excellence from the Institution of Structural Engineering. The DLCC was constructed with public money the DLCC submitted G+20 in (2009).

1. Key sustainable Feature
    - The building has water efficiency is 1.8 million gallons water is saved yearly.
    - DLCC reduced 54-77%of the overall Pittsburgh water system authority bill is saved.
    - In these exterior lighting designed to reduce night time pollution.It is saved about total projected to be 3.8 million kWh of energy or half million yearly.
    - This building transportation 45% of responded has employee. In this building renewable energy is save 33%and it is used solar roof , 1% have solar hot water,
    - 3%of hydroelectric power& 4%have used wind energy.

(a) David L. Lawrence Convention centre (Downtown Pittsburgh), U.S. North America, Largest building in world & is Gold certified by LEED (Leadership in Energy & Environmental Design)

III.GREEN BUILDING RATING SYSTEM

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1. LEED (Leadership in Energy and Environmental Design)

The Leadership in Energy & Environmental Design (LEED) is the rating system developed for certifying Green Buildings. LEED is developed by the U.S. Green Building Council (USGBC), the organization promoting sustainability through Green Buildings. LEED is changing the way we think about how buildings and communities are planned, constructed, maintained and operated. Certification of green building based on the number of points achieved a project then receives one of four LEED rating levels: Certified, Silver, Gold and Platinum. LEED-certified buildings are resource efficient. They use less water and energy and reduce greenhouse gas emissions. As an added bonus, they save money.

2. IGBC (Indian Green Building Council)

The Indian Green Building Council (IGBC), part of the Confederation of Indian Industry (CII) was formed in the year 2001. IGBC is the non-profit research institution having its offices in CII-Shorabji Godrej Green Business Centre, which is itself a LEED, certified Green building. Indian Green Building Council (IGBC) has licensed the LEED Green Building Standard from the USGBC. IGBC facilitates Indian green structures to become one of the green buildings.

IGBC Green Buildings rating system addresses green features under the following categories:

- Sustainable Architecture and Design
- Site Selection and Planning
- Water Conservation
- Energy Efficiency
- Building Materials and Resources
- Indoor Environmental Quality
- Innovation and Development

3. GRIHA (Green Rating for Integrated Habitat Assessment)

Green Rating for Integrated Habitat Assessment (GRIHA) is India's own rating system jointly Green Rating for Integrated Habitat Assessment (GRIHA) is India's own rating system jointlydeveloped by TERI and the Ministry of New and Renewable Energy, Government of India. It is a green building design evaluation system where buildings are rated in a three-tier process.

4. BEE (Bureau of Energy Efficiency)

BEE developed its own rating system for the buildings based on a 1 to 5 star scale. BEE has developed the Energy Performance Index (EPI).

Credit Categories	LEED Goals
Sustainable Sites (SS)	Minimize the impact of buildings on green spaces, wildlife habitat and water resources, protect and restore open spaces while capitalizing on existing infrastructure
Water Efficiency (WE)	Reduce the quantity of water need for a building, and reduce the strain on municipal water supply
Energy & Atmosphere (EA)	Increase energy efficiency and the use of renewable energy in buildings
Materials & Resources (MR)	Reduce the environmental impact on natural resources, and reduce and manage waste
Indoor Environmental Quality (IEQ)	Establish ideal indoor air quality, eliminate indoor air pollution and create healthy environment for building occupants
Innovation in Design/Operations (ID/IO)	Encourage and recognize innovation in green building categories not addressed by the LEED rating system
Regional Priority (RE)	Provide incentive for the achievement of credits that address geographically-specific environmental priorities

Table (1): Table shows the credit categories of LEED (Leadership in Energy & Environmental Design) to achieve a goals for certification.

IV. CONCLUSION

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Some buildings function very well and have a positive impact on well-being and performance, others do not. Some buildings have operational systems that are difficult to understand, or the uses have not received good enough information on how to operate them .These in part contradictory results of the research presented above show that the connection between energy efficiency & user satisfaction in buildings is more complex than is usually assumed. Green building is today the most widely used from of architecture. Creating green building is an important focused off building owner and even Govt. Worldwide. In India some world class green building has constructed. Present work is attempt in the direction to make people, communities and general public aware about the advantages of green building for suitable environmental development and management.

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