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STEPPING TOWARDS ENERGY EFFICIENT CAMPUS THROUGH A GREEN RATING SYSTEM

Case Study of Faculty of Architecture and Planning, Lucknow

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Abstract: *In India, building energy efficiency receives very little attention, resulting in excessive energy usage. These data demonstrate that energy conservation has many excellent potentials. In India in the last past decades, the number of educational campuses for higher education and their enrolment has witnessed a tremendous increase of 74 times with just 500 in 1950 growing to 37,204, as of 31st March 2013. (Ahmad et al., 2018) These institutions are monitored and regulated by the various apex level bodies like AICTE, COA, CSSR, ICHR UGC etc. focusing on the quality and improvement of the educational system. It is very obvious that with the increase in educational campuses there will also be an increase in built spaces and energies to fulfil the daily needs, operations in teaching and research thus completely relying on the environment for its survival and degrading the environment which is hardly seen and considered a matter of concern. The objective of this paper is to analyze and put remarks on the energy-efficient features of the existing campus of the faculty of architecture and planning as a case study. The criteria considered are through IGBC green campus manual for the new and existing campus.*

IndexTerms **– IGBC, Green Campus, Energy Efficient, Educational Campus.**

I. INTRODUCTION

Educational campuses have always been considered the main societal hub for knowledge and learning with plenty of built spaces around. Now, to ensure energy efficiency and environmental sustainability, these developments and activities need to be on green campus concepts (MNRE). A green building is a building that does not put or reduce the negative impact on the environment. Campuses of higher education are also a part of the urban ecosystem. They are structures that can maximize resource efficiency (including energy, land, water, and materials) while reducing environmental loads throughout the building lifecycle, from construction and fabrication to operation and even demolition. Green buildings are always made of natural harmonious coexistence with a series of advanced resource-saving technologies such as renewable energy utilization, natural ventilation, low carbon intervention, natural lighting, water recycling and reuse, green building materials, intellectual control, and green. coexistence to preserve the environment and reduce pollution, and further provide humans with healthy, applicable, and high-efficient living space.

According to NBC green buildings save water (36-40%), save energy (30-40%) and save material (25- 40%) compared to conventional buildings. (Parvez & Agrawal, 2019) Making a green campus would reduce utility costs by becoming more energy and resource-efficient. It would improve campus management of resources and facilities and promote the concept of sustainability. To increase building efficiency, we need to cut energy consumption. Recently, there has been a lot of focus on improving energy performance in existing buildings, which means lowering energy consumption for building operations without compromising occupant health and comfort. This strategy calls for more than just technical improvements. Energy efficiency may be substantially increased by efficiency strategies like building retrofitting. In some aspects, they represent a "lost opportunity" for savings - design and construction choices that were not made but may have resulted in significant reductions in energy usage and carbon emissions during the building's lifetime. To "unlock" such great potential and take advantage of a constructed environment that is comfortable, effective, and economical is the challenge for existing structure efficiency.

II. CONCEPT OF A GREEM CAMPUS

In comparison to a conventional building, a green school is a resource-efficient structure that consumes less water, maximizes energy efficiency, reduces waste production, captures and recycles water, and offers healthier living space for its residents. While the Rio Earth Summit in 1992 acknowledged the need to take action in "any area in which human impacts on the environment," the notion of green schools was first promoted in Europe in the 1990s. A campus can be interpreted as an educational setting, while green can be interpreted as environmentally conscious. The idea of a "green campus" integrates environmental concerns with the campus world. Understanding the term "Eco Campus" or "green campus" in the context of environmental preservation goes beyond simply noting that the campus is covered in green trees or paint, or that the alma mater jacket is green; rather, it refers to how effectively and efficiently campus residents use the resources available in the campus environment, such as stationary, use of natural resources, water, and waste. Green Building (GB) is a phrase that refers to a comprehensive approach to design and construction. It is also known as "high-performance buildings," "green construction," "sustainable design and construction," and other meanings. Environmental responsibility, resource efficiency, human comfort, well-being, and community sensitivity are all factors in green building design. The design team (building owners, architects, engineers, and consultants), building and construction team (material producers, contractors, suppliers, and waste hauliers), maintenance staff, and building occupants are all involved in the Green Building design process.

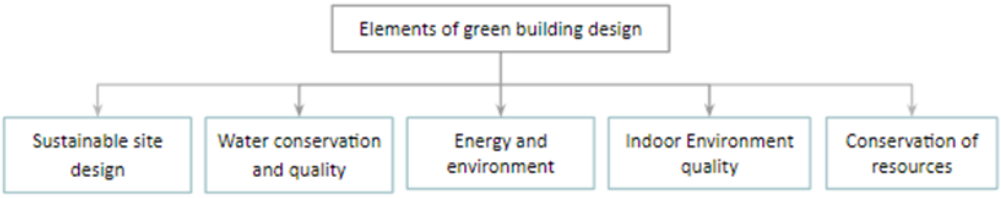

Figure 1 Elements of green building design (Ragheb et al., 2016)

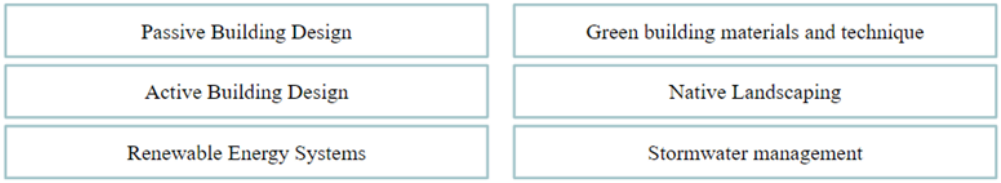

Figure 2 Green building strategies (Savitri, 2021)

III. GREEN BUILDING CONCEPT AND PATTERN IN INDIA

Green Building (GB) is a phrase that refers to a comprehensive approach to design and construction. It is also known as "high-performance buildings," "green construction," "sustainable design and construction," and other meanings. Environmental responsibility, resource efficiency, human comfort, well-being, and community sensitivity are all factors in green building design. The design team (building owners, architects, engineers, and consultants), building and construction team (material producers, contractors, suppliers, and waste hauliers), maintenance staff, and building occupants are all involved in the Green Building design process. Since the CII-Godrej GBC set out to get the famous LEED platinum accreditation for its centre in Hyderabad 5 - 6 years ago, the sustainable and green construction movement has acquired significant traction. The building's rating caused widespread excitement throughout the country. Residential complexes, exposition centres, hospitals, educational institutions, labs, IT parks, government buildings, airports, and corporate offices are among the green building projects now under construction in India. (Geoffrey et al., n.d.)

In comparison to the developed world, green buildings and their acceptance are a relatively new trend in developing countries. Though governments and other bodies in developing countries have taken several initiatives to address sustainability in the construction sector, these initiatives have either run into economic and social problems or lack a proper implementation strategy to ensure their successful adoption in society. However, a recent trend in India shows that green buildings would be rapidly adopted in construction. In India, 32 (37%) of the 85 internationally recognized LEED NC-USA projects are located (USGBC, 2007). (Geoffrey et al., n.d.)

Green building isn't just about increasing efficiency; it's about designing structures that benefit the local ecology, make use of local materials, and, most significantly, use less energy, water, and materials. The rating tool has various essential factors grouped into criteria, including a sustainable site, energy, waste management, water, material resources, indoor quality, innovation, transportation, and social economy. Each criterion is rated a certain number of credits. The use of green building rating in the construction sector aimed to promote and enable better implementation of environmental issues with cost and other traditional decision factors, resulting in more sustainable design, construction, and operations.

IV. METHODOLOGY

Based on the overall understanding of the existing conditions of infrastructures at the Faculty of Architecture and Planning, Lucknow (AKTU) and various information gathered available, the case studies are taken and identified for this study. To address make this campus energy efficient IGBC green campus (new/existing) manual is referred to. This case study details the criteria set by the IGBC for existing campuses. The analysis is done guidance is written to further improve the IGBC rating. The study is done on all the building blocks on the campus that includes Both old and new academic blocks, Administration/Library blocks, Hostels and faculty residences.

About the Campus

The study area for this paper is the Faculty of Architecture and Planning, AKTU, Lucknow. The started as a part of the Government College of Arts & Crafts in 1911 and is one of the oldest in the country. The Institution separated from the Government College of Arts and Crafts in 1976, with its new name 'Govt. School of Architecture was later renamed in 1980 as 'Govt. College of Architecture, Lucknow' (Popularly called GCA, Lucknow) as it acquired the status of the constituent college of Lucknow University. The campus is located in Lucknow in the north Indian state of Uttar Pradesh which experiences a Composite type of Climate. Here climate ranges from harsh winters to extremely hot summers and falls.

The campus is spread over 6 acres of land in lush green surroundings with an extensive Building Footprint and Open spaces. Solar panels are installed in the building to reduce dependency on non-renewable resources.

Figure 3 Site image, FOAP Campus (Author)

Various criteria under the energy efficiency category. (IGBC, 2017)

EE Credit 1 Energy Efficiency in Infrastructural Equipment
EE Credit 2 On-site Renewable Energy
EE Credit 3 Off-site Renewable Energy
EE Credit 4 Energy Metering

Credits for the Campus and remarks

Energy efficiency in infrastructural equipment (EE Credit 1): To determine the existing situation, the illumination levels in both academic buildings on campus were checked and reviewed. It was observed that some classes did not meet the standards for suggested illumination levels. All the electrical equipment within the campus must achieve energy efficiency for the following systems according to ASHRAE standards:

1. Lighting Systems: Lighting Power Density should be reduced by 30% over ASHRAE standards. This can be done by the proper selection of efficient lighting equipment. The exterior campus lighting is installed in a manner which faces downwards and does not interfere with the nocturnal environment.
2. Lighting Controls: Motion sensors, time-based controllers, CO2 sensors etc should be used to save savings in energy.
3. Pumps and Motors: Pumps and motors (>3.5HP) must have an efficiency of at least 85%.
4. HVAC system: Centralised HVAC systems should be installed if required and they must have an efficiency of 10% over ASHRAE standards.

V. CONCLUSION

The buildings sector is a large consumer of electrical energy. Energy efficiency is one of the simplest, quickest, cheapest, and cleanest approaches to addressing resource and environmental challenges. The paper focuses on the principles of an energy-efficient campus through a green rating system. The criterion applies to green campuses focusing on any rating system. The campus can deploy some innovative ways to make energy usage on campus more efficient.

1. Switching high lighting fixtures such as high-pressure sodium (HPS) lamps with LED luminaires can save 10-25% of total greenhouse energy demand and proves to be an effective and easy way to reduce energy costs, and operations and maintenance costs.
2. Establish a green campus initiative by aiming for students and faculty to engage in energy conservation efforts. (Miller Laura, n.d.)
3. Deploy a team or particular depart for regular energy audits.

4. By changing, glazing to Low-e glazing would reduce solar heat gain and keep the interiors cool hence cutting on the energy consumption.
5. Replacement of electrical appliances to 4-5 star rated appliances that are more energy efficient.
6. Use of Bureau of Energy Efficiency (BEE) rated electrical equipment is encouraged.

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