RETROFITTING OF AN EXISTING BUILDING INTO A GREEN BUILDING

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Abstract

Retrofitting of an existing building into a green building taking into account the aspects of energy, water and materials along with cost considerations such that the occupant well-being, environmental performance and economic returns are improved. In the present project we have proposed to give credits to rate the chosen building for its various green features according to the rating system of LEED and suggest measures to improve the green performance of the building.

***Keywords**: Retrofitting, green building, Heat island effect, indoor air quality*

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1. INTRODUCTION

As the population is increasing, more and more buildings are required to fulfil their needs, trashing more natural resources, and impacting the environment. Hence a new concept of eco-friendly building or 'Green Building' is emerging rapidly. Green building on college campuses is the purposeful construction of buildings on college campuses that decreases resource usage in both the building process and also the future use of the building. The goal is to reduce CO2 emissions, energy use, and water use, while creating an atmosphere where students can be healthy and learn. According to the USGBC, with an upfront investment of 2% in green building design, the resulting life savings is 20% of the total construction costs. Along with this increase in monetary savings, green building and architecture has been proven to make the occupants more productive. Studies have shown a link between improved lighting design and a 27% reduction in the incidence of headaches. Also, students with the most day lighting in their classrooms progressed 20% faster on math tests and 26% faster on reading tests in one year than those with less day lighting. The common objective is that green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by: 1)Efficiently using energy, water, and other resources 2) Protecting occupant health and improving employee productivity 3)Reducing waste, pollution and environmental degradation.

2. METHODOLOGY

We are carrying out study of introducing green retrofitting in any existing building; and for that purpose we have selected the campus of Government Polytechnic for Girls, Ahmedabad, India. In the present project we have proposed to give credits to rate the chosen building for its various green features according to the rating system of LEED and suggest measures to improve the green performance of the building; thereby increasing its rating on implementation.

3. SCOPE OF WORK

Assignment of Credits: Based on the LEED_RS_V2.1 standards, the building has been rated as following:

Table-1: Assignment of Credits [3]

PARTICULAR	MAX. POINTS	OBTAINED POINTS
Sustainable Sites	14	7
Water Efficiency	5	1
Energy & Atmosphere	17	9
Materials & resources	13	6
Indoor air Quality	15	6
Innovation &Design Process	5	3
TOTAL	69	32

Certified: 26-32 points
Silver: 33-38 points
Gold: 39-51 points
Platinum: 52-69 points

The building under consideration has obtained in all 32 credits.

Hence it is eligible to fall under the 'CERTIFIED' category according to LEED standard (26-32).

4. RECOMMENDATIONS FOR RETROFITTING

4.1 Sustainable Sites

4.1.1 Storm Water Management

- The rainwater collected on the terrace of each block is let to runoff and drain into the drainage pipeline.

This water can be diverted to the garden and to the toilets through a suitable system of pipelines.

- Rainwater pipes from the terrace can be connected into the overhead tank above the toilet for storage of water. The overhead tanks are already designed for enough capacity.

4.1.2 Heat Island Effect

- Provide shade on at least 30% of non-roof impervious surfaces on the site, including parking lots, walkways, plazas, etc.
- Use/maintain an open-grid pavement system (net impervious area of LESS than 50%) for a minimum of 50% of the parking lot area.
- Painting roof tops with white paint and plantation on roofs.

4.2 Water Efficiency

4.2.1 Water Use Reduction

- Repair all the leaking faucets and pipes in the toilets, wash areas and laboratories.
- Select low flow shower, water closet, Urinals and wash basin.

4.2.2 Water Efficient Landscaping

- Use 100% STP Treated Water for Landscaping
- Drip Irrigation
- Sprinkler Irrigation

4.3 Energy and Atmosphere

4.3.1 Renewable Energy

- SOLAR PANELS: As per the conditions and suitability of the site along with the current rates of solar panels for generating power, we do not recommend installations of solar panels.

4.3.2 Optimise Energy Performance

We have surveyed the total number to gadgets consuming electricity (lights, fans, A.C.s, computers, etc.) in the buildings of the campus.

Total no. of Tube lights=407

Energy optimization is possible if we replace the tube lights with L.E.D. The present tube lights are of 45 Watts. If they have to be replaced by LED lights for same illumination; then each tube light will have to be replaced by 2 L.E.D.s of 10 Watt each.

Thus, there will be a saving of 45-10-10 = 25 Watts per tube light.

4.3.3 Building Operations & Maintenance: Staff Education

- Support appropriate operations and maintenance of buildings and building systems so that they continue to deliver target building performance goals over the long term.

4.4 Material and Resources

4.4.1 Construction Wastes Management

As the building is now already constructed, construction waste produced will only be that from the repair or renovation work and also alteration work if any. Such waste materials or the leftover construction materials should be reused if possible or sent to a recycling plant. We conducted survey of the various wastes produced in the laboratories of various departments. The major waste produced is in the concrete laboratories. These wastes are utilized in the filling of plinths in the various construction projects going on in campus.

4.4.2 Resources Reuse

- Sustainable stationeries such as Office paper, office equipment should be used. For e.g. Eco buddy notebooks (of navneet) available in the market are made from the sugarcane pulp which is otherwise a waste.

4.4.3 Sustainable Cleaning Products & Materials

Green cleaning techniques and products avoid the use of chemically-reactive and toxic cleaning products which contain various toxic chemicals, some of which emit volatile organic compounds causing respiratory problems. Names of some products available in market- All Purpose Cleaner & Degreaser, High Performance Carpet Pre-Spray, Carpet Extraction Cleaner, High Performance Cleaner & Degreaser. Restroom, Tile & Grout Cleaner

4.5 Indoor Air Quality

4.5.1 Environmental Tobacco Smoke (ETS) Control

Prevent or minimize exposure of building occupants, indoor surfaces and systems to Environmental Tobacco Smoke (ETS).

Painting Interiors with light-coloured eco-friendly paints
Total area: 57643 sq.ft.
Product cost: 2, 20,894 Rs.
Labour Cost: 6, 12,727 Rs.
Total Cost: 7, 68,360 Rs.

4.5.2 Ventilation Effectiveness

Ensure that the stoppers of windows are working properly. Trimming of trees timely so that it does not interfere with the circulation. Due to dampness in most of the classes and staffrooms the inside air is humid and it induces bad odour. Thus, exhaust fans should be installed for ventilation.

5. CONCLUSIONS

Table -2: Earned Points [3]

PARTICULARS	POINTS EARNED AFTER RETROFITTING
Sustainable Sites	3
Water Efficiency	1
Energy & Atmosphere	2
Materials & resources	1
Indoor air Quality	2
Innovation &Design Process	0
TOTAL	9

Hence, total points obtained after retrofitting will be 32+9=41.

Hence, the building will fall under 'GOLD' category.

Approximate cost pertaining to the recommendations given for retrofitting turned out as follows:

Table -3: Cost Calculation

ELEMENTS	ESTIMATED COST
LED lights	Rs. 13,83,800.00
Storm water management	Rs. 8100.00
Eco-friendly paints	Rs. 7,68,360.00
Solar panels	Rs. 1,00,000.00
Green roof top	Rs. 1000.00
Exhaust fans	Rs. 550 per fan
Materials waste and management	Rs.10,000

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