Assessment of SATI Civil Engineering Department Building Using EDGE Software

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Abstract : Buildings contribute a lot in energy consumption as well as in water consumption .It Is a big challenge for engineers to design a building which use optimum amount of energy as well as water. This study has been done to reduce the Energy and Water consumption of the SATI Civil Engineering Departmental Building by using EDGE software . The software provided some suggestions for the same .This in turn reducing the amount of energy consumption as well as water consumption.. Cost analysis is also provided by the software ,initial cost and recovery period are also predicted by the EDGE software.

IndexTerms **– Green Building, EDGE Software, IGBC.**

INTRODUCTION

In the next few decades, rapid urbanization will change the economies and lifestyles of people living in emerging markets across the globe. Rapid urbanization can threaten infrastructure and can lead to energy shortages, waste accumulation, water scarcity, air quality crises and other serious environmental issues. Buildings directly contribute to these challenges. They consume 35% of global energy, 5% of global water and produce 15% of all greenhouse gas emissions. Conventional designs consume huge quantities of material and natural resources, depleting non-renewable resources. This has necessitated the need for designing buildings that are efficient and sustainable, and integrated with the local culture. To determine sustainability, performance assessment of buildings is carried out worldwide using different rating systems to meet the goal of Triple Bottom Line (TBL). This can be achieved by any of the green rating assessment tool.

EDGE Software

Based on a building's parameters, the EDGE software discovers energy- and money-saving design opportunities through region-specific and use-based analysis. As a free design tool, EDGE presents hypothetical costs, savings and payback periods for green building measures (e.g., low-flow taps and solar connectors), helping developers and buildings make the business case for green building.

EDGE is a green building certification system that allows design teams and project owners to assess the most cost-effective ways to incorporate energy and water saving options into homes, hotels, hospitals, offices and retail spaces. Projects that achieve a 20 percent projected reduction in use of energy, water and embodied energy in materials compared to conventional buildings are eligible for EDGE certification**.** Certification is offered at a modest cost by GBCI in order to validate project achievement for financial and community stakeholders.

Case Study: Samrat Ashok Technological Institute, a premier institute of the region was established by Late Maharaja Jiwaji Rao Scindia on November 1, 1960 with a donation from Gangajali Trust fund. The Institute started with B.E. in Civil Engineering, Mechanical Engineering & Electrical Engineering. The Institute offers 9 full time Under Graduate and 17 full time Post Graduate Courses (11 M.E/M.Tech., MCA, MBA And four Applied Sciences) leading to degree in Bachelor of Engineering and fifteen Postgraduate courses in the areas of Engineering, Science and Management. It is an autonomous institute, which is fully funded by Government of Madhya Pradesh and managed by the Maharaja Jiwaji Rao Education Society chaired by Hon'ble Shrimant Jyotiraditya M. Scindia. The college campus is spread over an area of 85 acres of lush green land with natural surroundings.

EDGE Software Interface:

LOGIN ENGLISH SIGN UP HOMEPAGE

Excellence In Design For Greater Efficiencies — Edge

IFC International Finance Corporation WORLD BANK GROUP

Creating Markets, Creating Opportunities

Homes | Hospitality | Retail | Offices | Hospitals | Education

RESULTS								
Final Energy Use	10,829.19 kWh/Month	Operational CO_2 Savings	0.00 tCO_2/Year	Base Case Utility Cost	22,314.09 ZAR/Month	Incremental Cost	0.00 ZAR
Final Water Use	1,835 m^3/Month	Embodied Energy Savings	0.00 MJ/m^2	Utility Cost Reduction	0.00 ZAR/Month	Payback in Years	N/A Yrs.

Save Version 2.1.1

Design | Energy: 0.0% | Water: 0.00% | Materials: 0.00% | File

Location Data

Enter Context Data

Country: South Africa

City: Bloemfontein

Basic Parameters

Type of Educational Facility*: Pre-School

	Default	User Entry	
Occupancy Density	3		m^2/Student
Operational Hours	2		Hours/Day
School Days	5		Days/Week
Holidays	60		Days/Year

☑ Irrigated Area 1,000.00 m^2

☑ Swimming Pool 1,000.00 m^2

World Bank Group [US] | https://app.edgebuildings.com/?_ga=2.53063722.347793968.1561096621-944020952.1560167964#/

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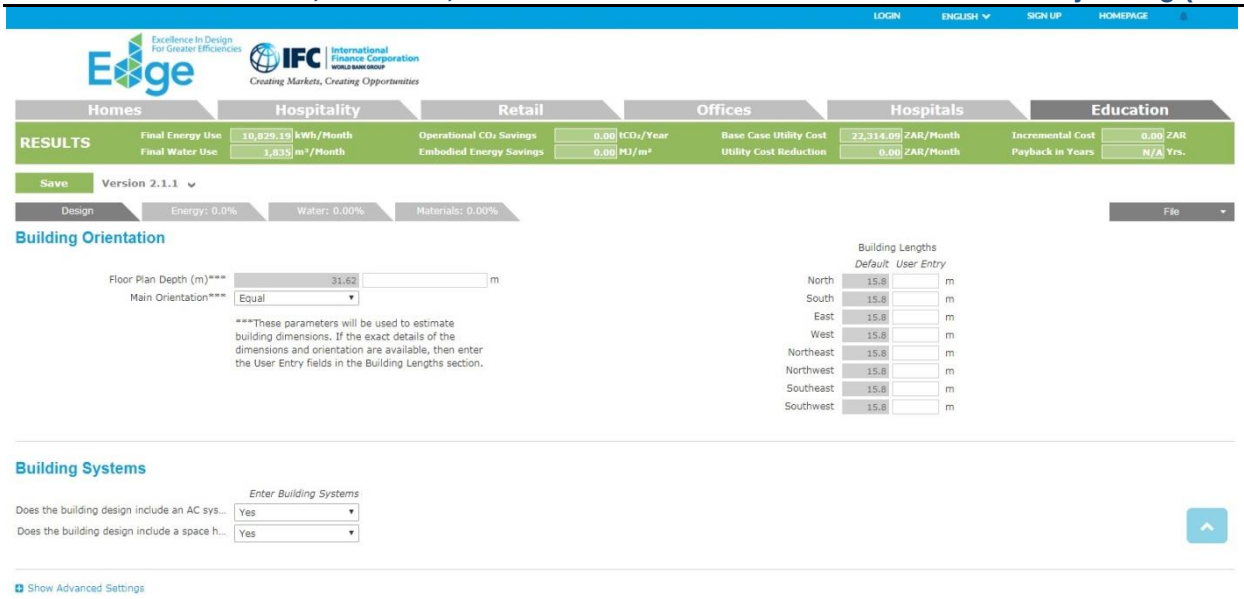
Building Data

Floors Above Grade	4.00	no.
Floors Below Grade	1.00	no.
Floor-to-Floor Height	4.00	m
Gross Internal Area (m^2)	5,000.00	

	Default	User Entry	
Classrooms	1,250		m^2
Meeting Rooms	500		m^2
Play Rooms	500		m^2
Offices/Administration Rooms	750		m^2
Restrooms	250		m^2
Cafeteria	250		m^2
Corridors	250		m^2
Staff Rooms	250		m^2
Other Space Types	500		m^2
Indoor Car Parking	250		m^2
Worship Places	250		m^2
Gross Internal Area	5,000		m^2



Data Collection:

Occupancy density:

Total area of building-2081.39ft^2(as per the plan provided by building section of college)

Total no. of students-534(480 in UG and 54 in PG)

Occupancy density=3.89m^2/student

Operational hours-6hrs/day

School Days-6 days /week

Holidays-85/year

Area of Different Rooms

S No.	Particular	Area(m)
1	Administration	58.06
2	Library	25.96
3	Corridor Passage	380.5
4	Tea-Club	23.8
5	Labs	874.14
6	Computer Labs	63.87
7	Rest Rooms	102.42
8	Class Rooms	180

TABLE 1

Electricity Consumption

S No.	Particular	Quantity	Watt/unit	Total Unit
1	Tube Light	98	40	3920
2	Fan	64	60	3840
3	Projectors	3	300	900
4	Water Cooler	1	120	120
5	Computer System	50	250	12500

TABLE 2

Total Electricity Consumption=35750 KWh/year

Water Consumption

Consumption per capita=45li/day (as per 1172:1983)

Total Water Consumption per day-(45*534) =24030lit/day

Annual Water Consumption-(24030*280)=6728400lit i.e. 6728.4m^3/year

Building Orientation:

S No.	Direction	Length(meter)
1	North-West	178
2	South-West	146
3	South-East	178
4	North-East	146

TABLE 3

Result:

Suggestion by EDGE software for Energy

- ED 02: Reflective Paint/Tiles for Roof - Solar Reflectivity of 0.7
- ED 03: Reflective Paint/Tiles for Walls - Solar Reflectivity of 0.7
- ED 05: Insulation of Roof: U-value of 0.442
- ED 06: Insulation of External Walls: U-value of 0.435
- ED 09: Natural Ventilation for Classrooms
- ED 10: Energy-Efficient Ceiling Fans
- ED 23: Energy-Saving Light Bulbs - Internal Space
- ED 24: Energy-Saving Light Bulbs - External Spaces
- ED 25: Occupancy Sensors in Bathrooms
- ED 26: Occupancy Sensors in Classrooms
- ED 27: Occupancy Sensors in Corridors
- ED 28: Photoelectric Sensors to Harvest Daylight
- ED 30: Solar Photovoltaics - 25% of Total Energy Demand
- ED 31: Other Renewable Energy for Electricity Generation

Suggestions by EDGE software for Water Consumption

- ED 02: Low-Flow Faucets in All Other Bathrooms - 2 L/min
- ED 03: Dual Flush for Water Closets in All Bathrooms - 6 L/first flush and 3 L/second flush
- ED 04: Water-Efficient Urinals in All Other Bathrooms - 2 L/flush
- ED 07: Rainwater Harvesting System - 50% of Roof Area Used for Collection
- ED 10: Grey Water Treatment and Recycling System

Suggestions by EDGE software for Materials

- EDM 01: Floor Slab With Concrete Filler Slab
- EDM 06:Flooring With Ceramic Tiles

Conclusion:

Saving in Energy

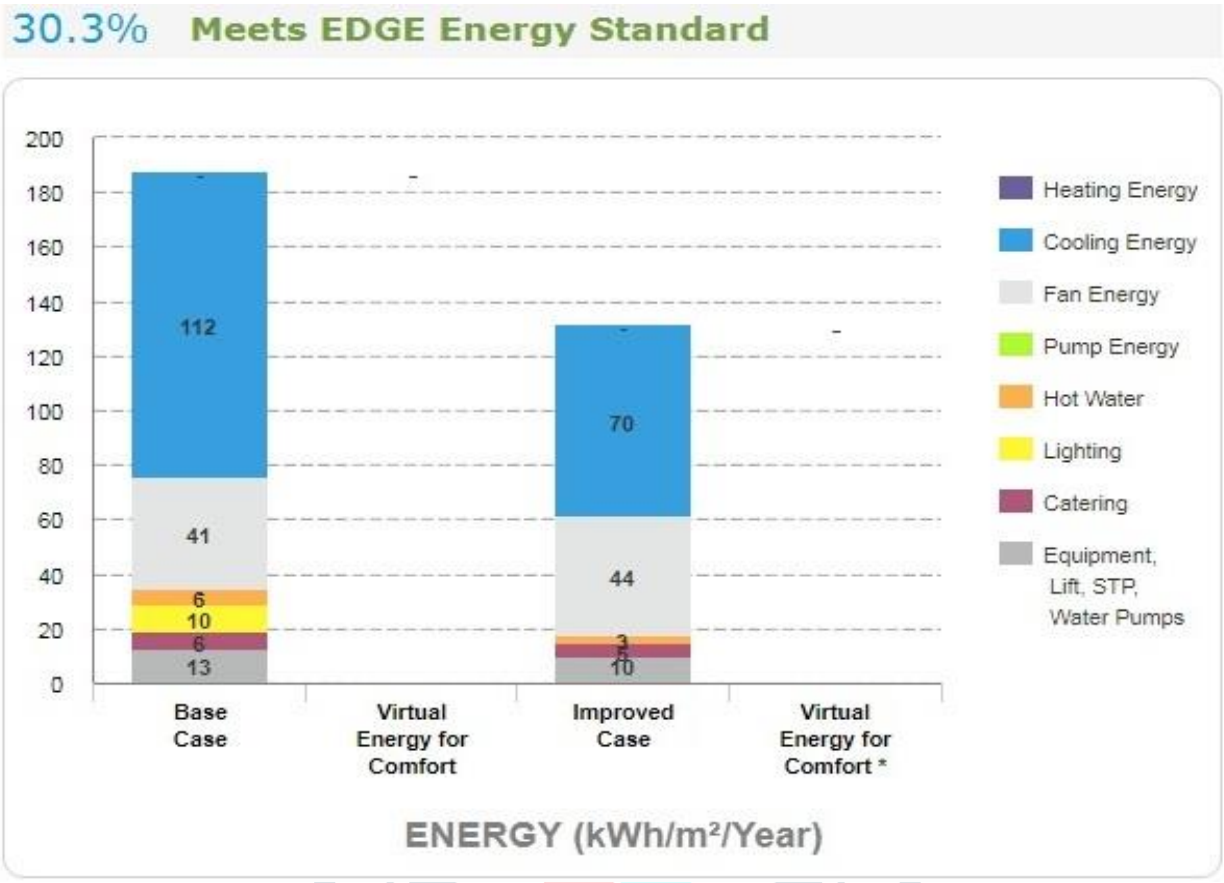


FIG 1

The total savings in energy is estimated to be 30.3% less as compare to the base case.This saving is in different categories as described in fig 1

Saving in Water Consumption

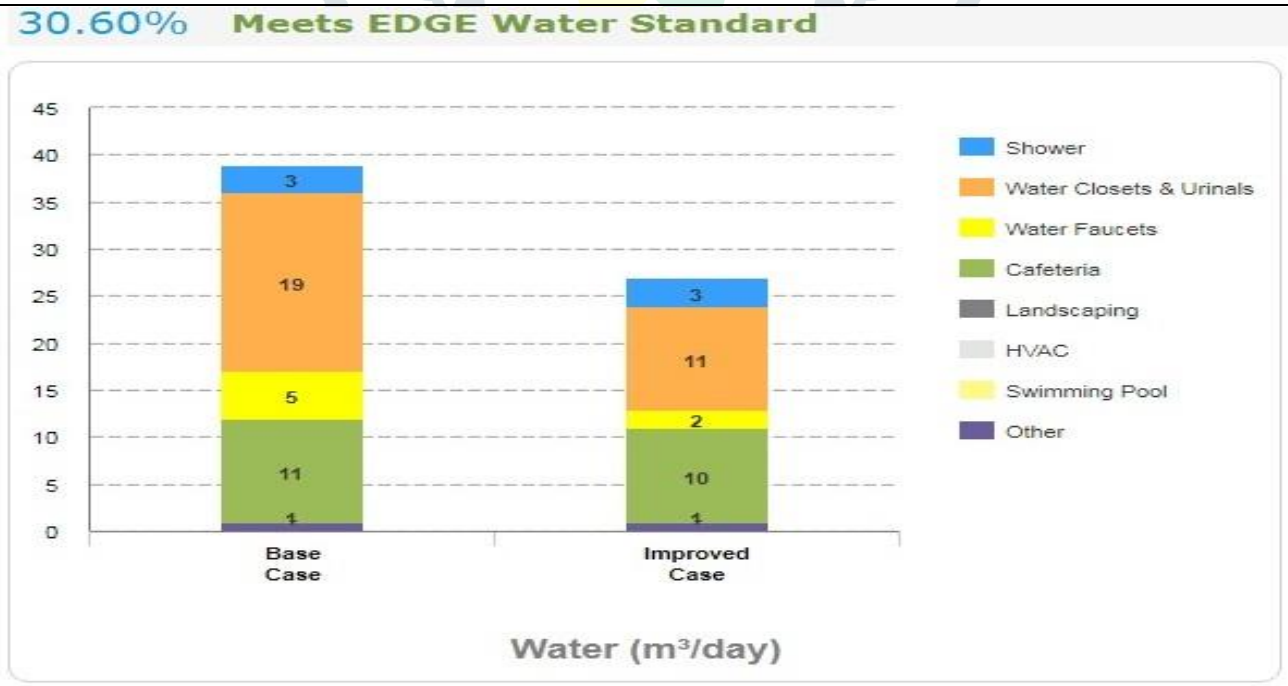


FIG 2

The total savings in consumption of water is reduced by 30.6% as compsre to the base case.The savings in different categories is shown in fig

Saving in Emboided Energy

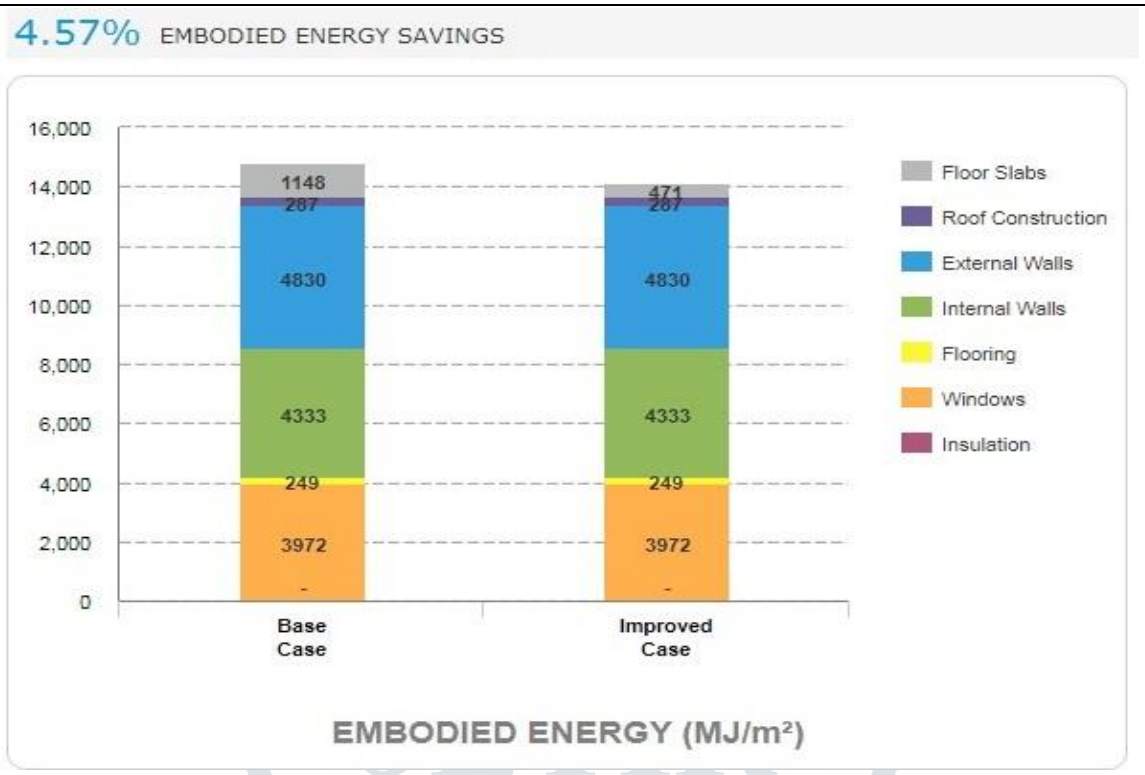


FIG 3

The total Embodied energy savings is estimated to be 4.57% as compare to the base case. The total Embodied Energy savings is shown in fig 3.

Cost Analysis

• **Base case utility cost** -This is the cost on which our project is going .In our case it is estimated to be **185671.42 Rs /month**

• **Utility cost reduction** -This is the reduction in cost per month which is 56789.08 Rs/month in our case.

• **Incremental Cost** – This is the increase in cost or total amount required for the execution of the results provided by the EDGE software **1720174.10 rs**

• **Payback in years** – The total cost which will be spend on the execution of the results provided by software will be recovered in 2.5 **years.**

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