

ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2022 - 2023 & 2023 - 2024

Sustainability study

AUDIT REPORT

Studied for

**A. J. Institute
of Engineering & Technology**

NH-66, Kottara Chowki,
Mangaluru-575006

Studied in the capacity of

Accredited and Certified GBP



Studied by

**Greenvio
Solutions**

Website: <https://thegreenviosolutions.co.in/>

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Disclaimer

The Audit Team has prepared this report for the **A. J. Institute of Engineering & Technology** located NH-66, Kottara Chowki, Mangaluru-575006 based on input data submitted by the Institute analysed by the team to the best of their abilities.

The details have been consolidated and thoroughly studied as per the various guidelines for Green Buildings available in National and International Standards; the report has been generated based on comparative analysis of the existing facilities and the prerequisites formulated by various standards. The inputs derived are a result of the inspection and research. These will further enhance and develop a Healthy and Sustainable Institution.

These can be implemented phase wise or as a whole depending on the decision taken by the internal team. The warranty or undertaking, expressed or implied is made and no responsibility is accepted by Audit Team in this report or for any direct or consequential loss arising from any use of the information, statements or forecasts in the report.

The audit is a thorough study based on the inspection and investigation of data collected over a period of time and should not be used for any legal action. This is the property of Greenvio Solutions and should not be copied or regenerated in any form.

The Report is prepared by the Team of Greenvio Solutions under their brand and department – Sustainable Academe as Consultancy firm with the Project Head - Ar. Nahida Shaikh who is as an Accredited and Certified Green Building Professional-Architect. Green Building consultancy is her forte and she is one of the most sought after names when it comes to providing excellent quality services within the stipulated time frame.

The Study is conducted in capacity of Accredited & Certified Green Building Professional with extensive experience.

Ar. Nahida Abdulla

Greenvio Solutions

Developing Healthy and Sustainable Environments

We are an Environmental and Architectural Design Consultancy firm

Sustainable Academe is our department for conducting audits

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Acknowledgement

The Audit Assessment Team extends its appreciation to the **A. J. Institute of Engineering & Technology** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are extended are due to everyone from the Management.

Our heartfelt thanks are extended to the Chairperson of the entire process **Dr. Shantharama Rai C**, (Principal) for the valuable inputs.

We are also thankful to Institute's Task force who have played a major role in data collection.

- Teaching staff member – **Dr. John Prakash Veigas**, Assoc. Prof & HOD-AIDS
- Non-teaching staff member – **Mr. Abhishek Shetty**, Maintenance Engineer
- Admin staff member - **Mrs. Smitha Shetty**, Office Superintendent

Sustainable Academe

Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

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1. Introduction

1.1 About statements of the Institute

1.1.1 Vision

The Institute proposes "To produce top-quality engineers who are groomed for attaining excellence in their profession and competitive enough to help in the growth of nation and global society."

1.1.2 Mission

The Institute adheres:

- To offer affordable high-quality graduate program in engineering with value education and make the students socially responsible
- To support and enhance the institutional environment to attain research excellence in both faculty and students and to inspire them to push the boundaries of knowledge base
- To identify the common areas of interest amongst the individuals for the effective industry- institute partnership in a sustainable way by systematically working together
- To promote the entrepreneurial attitude and inculcate innovative ideas among the engineering professionals

1.2 Assessment of the Institute

The Institute was established in 2016.

1.2.1 Affiliations

The courses provided by Institute have received affiliation through the **Visvesvaraya Technological University (VTU), Belagavi, Karnataka.**

1.2.2 Certification

AISHE – The All India Survey of Higher Education code is C-56446

1.2.3 Approval

The courses by the Institute have received approval through **All India Council for Technical Education (AICTE), New Delhi.**

DETAILED REPORT

2. Overview

2.1 Summarised Populace analysis for 2023-2024

2.1.1 Students data

The data (shared by the Institute) shows there were **1,251 students**.

2.1.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	14	20	34
2	Teaching staff	41	48	89
3	Non-Teaching staff	11	16	27
Total Staff Members		66	84	150

Table 1: Staff data of the Institution for 2023-2024

The staff data shows the Institute premises had **150 Staff Members**.

2.2 Summarised Populace analysis for 2022-2023

2.2.1 Students data

The data (shared by the Institute) shows there were **1,039 students**.

2.2.2 Staff data

S. No.	Type	Male	Female	Total
1	Admin staff	10	21	31
2	Teaching staff	46	34	80
3	Non-Teaching staff	12	23	35
Total Staff Members		68	78	146

Table 2: Staff data of the Institution for 2022-2023

The staff data shows the Institute premises had **146 Staff Members**.

3. Research

3.1 Campus area

The **site spread over 0.5 acres of land.**

3.2 About the Green Building Study Audit

It is a systematic study of the aspects which make the Institution sustainable and healthy premises for its inhabitants.

3.3 Analysis of the Green Building Study Audit

The procedure included detailed verification as follows:

- Investigation
- Technical
- Observations
- Inferences

3.4 Strategy adopted for Green Building Study Audit

The strategies included data collection from the admin department, actual inventory, investigation to check the operation and maintenance, analysis of the data collection, and preparation of the Report.

4. Investigation

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Evidence documents for Site visit of external audit team


Audit team headed by external expert - Ar. Nahida Abdulla
Accredited & Certified Green Building Professional, ISO IA (IMS)
Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit


Institute: AJ Institute of Engineering & Technology Date: 08.05.2024


Document objective: Inferences of the Site visit

Observations (Positive aspects)	Suggestions (Improvement aspects)
Green Audit	
- Water management, harvesting, recycling all practices are well maintained	- Waste management practices can be improved
Energy Audit	
- Solar panel is one of the blocks. - Fine 3 life safety measures are good.	- Scope to improve energy production due with solar panels, hot-water heater, sensor based facilities
Environment Audit	
- Good green cover 3 plantations - Overall good ambience	- Documentation 3 reflectance can be improved




Signature & round seal
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Plate 1: Evidence files related to inferences of the site visit

Evidence documents for Site visit of external audit team

Audit team headed by external expert - Ar. Nahida Abdulla
Accredited & Certified Green Building Professional, ISO IA (IMS)
Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit

Institute: *AJ Institute of Engineering and Technology* Date: *08.05.2024*

Document objective: Proof of the Site visit



Meeting with the core team



Investigation of the systems


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Plate 2: Evidence files related to the site visit

Evidence documents for Site visit of external audit team

Audit team headed by external expert - Ar. Nahida Abdulla
 Accredited & Certified Green Building Professional, ISO IA (IMS)
 Audit objective: Green Building up gradation of the premises

Audits covered: Green audit Energy audit Environment audit

Institute: AJ Institute of Engineering & Technology Date: 08.05.2024

Document objective: Induction Meeting attendance sheet

S. No.	Name	Committee	Designation	Signature
1.	Mrs. F. A. Shaikh	External	Project Coordinator	
2.	Ar. Nahida Abdulla	External	Project Head	
3.	DR. Shivakumar Rai	Internal	Principal	
4.	Dr. P. Mahabaleswaram	Internal	Dean Academics	
5.	Dr. Antony P J	Internal	Vice Principal	
6.	Dr. John P. Velgas	Internal	HOD - AI & DS	
7.	Dr. Amarnath	Internal	Prof. (Civil)	
8.	N. ARUL	"	N. ARUL	
9.	Jithendra N.K	"	Asst. Prof (ECE)	
10.	Nitesh	"	Asst Prof (CV)	
11.	Renuka K. Kothari	"	Asst. Prof (Chemistry)	
12.	Rachana Kunder	"	Asst. Prof (Chemistry)	
13.	Dr. Laxmi Guleppagol	"	Associate Prof & HOD ICB	
14.	Amogh Shetty	"	Asst. Prof (Physics)	
15.	Dr. Prabhakara B.K	"	Associate Profess (ISE)	
16.	Dr. Chanchal Antony	"	Associate Prof & Head (Army)	

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Plate 3: Evidence file related to induction meeting attendance record

Evidence documents for Site visit of external audit team

Audit team headed by external expert - Ar. Nahida Abdulla
 Accredited & Certified Green Building Professional, ISO IA (IMS)
 Audit objective: Green Building up gradation of the premises

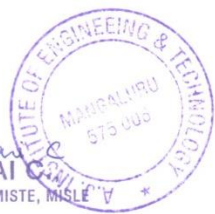
Audits covered: Green audit Energy audit Environment audit

Institute: AJ Institute of Engineering & Technology Date: 08.05.2024

Document objective: Exit Meeting attendance sheet

S. No.	Name	Committee	Designation	Signature
1.	Mrs. F. A. Shaikh	External	Project Coordinator	
2.	Ar. Nahida Abdulla	External	Project Head	
3.	Dr. Shantharam Ravi	Internal	PRINCIPAL	
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5.	Dr. Anthony P S	Internal	Vice Principal	
6.	Dr. John P. Veigas	Internal	HOD - AI & DS	
7.	Dr. Amarnath	Internal	Prof (civil)	
8.	Dr. Sadananda K	Internal	HOD - PHYSICS	
9.	Jithendra. N. K	"	Asst. Prof. (CECE)	
10.	Nitesh	Internal	Asst Prof (CV)	
11.	Mrs. Nidhi. T. N	Internal	Asst. Professor (Physics)	
12.	Mrs. Divya. M. Kothari	Internal	Asst. Prof (Chemistry)	
13.	Mrs. Radhika K	Internal	Asst. Prof (Chemistry)	
14.	Dr. Laxmi Guleppalli	Internal	Associate Prof & HOD IIS	
15.	Dr. Chanchal Antony	Internal	Assoc. Prof & HOD AIME	
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Plate 4: Evidence file related to exit meeting attendance record

5. Documentation

Section 1 – Energy management

5.1 Primary sources of energy consumption

- **Electrical (Metered)** – Light, Fans, Equipments, Pumps comprise these sources.
- **Alternate sources of energy consumption**– No sources available.

5.2 Secondary sources of energy consumption

The information was not provided.

5.3 Actual electrical consumption as per bills

The information shared for the meter available in the premises.

S. No.	Month	Year	Amount
Academic year 1 (June 2022 to May 2023)			
1	June	2022	5,20,574.00
2	July	2022	3,47,135.00
3	August	2022	4,33,152.00
4	September	2022	4,39,214.00
5	October	2022	4,38,007.00
6	November	2022	4,92,666.44
7	December	2022	4,94,841.00
8	January	2023	4,81,439.00
9	February	2023	4,81,885.00
10	March	2023	5,63,641.97
11	April	2023	5,06,358.00

12	May	2023	5,43,804.00
Academic year 2 (June 2023 to May 2024)			
13	June	2023	4,69,185.00
14	July	2023	4,81,486.93
15	August	2023	5,12,338.00
16	September	2023	5,12,340.00
17	October	2023	4,12,721.00
18	November	2023	5,67,664.00
19	December	2023	4,99,918.00
20	January	2024	4,95,360.00
21	February	2024	5,17,625.00
22	March	2024	6,20,131.00

Table 3: Details of the electrical consumption

Note: Two years refers to data submitted for past twenty-two months

The observation related to above information states:

- ⇒ The **total amount** spent in past two years is **Rs. 1,08,31,486.34/-**
- ⇒ The **average amount** spent every month are **Rs. 4,92,340.29/-**
- ⇒ **Alternate source of energy is not available.**
- ⇒ **Percentage of energy met by alternate (solar (renewable)) source is zero.**

5.4 Calculated Electrical Consumption as per inventory

The electricity bills provide actual consumption data. The following is the calculated consumption. It is done to understand the percentage of energy usage in the premises by various applications. It is based on the inventory collected and interviews with the staff.

The additional data such as wattage is taken from market research. In terms of electrical consumption, the main sources are lights, fans, air conditioner, and equipment. The inventory and data collection for sources of energy consumed in the premise is summarised in the following sections.

The following documentation is based on the consumption practice of the premises on a regular working day.

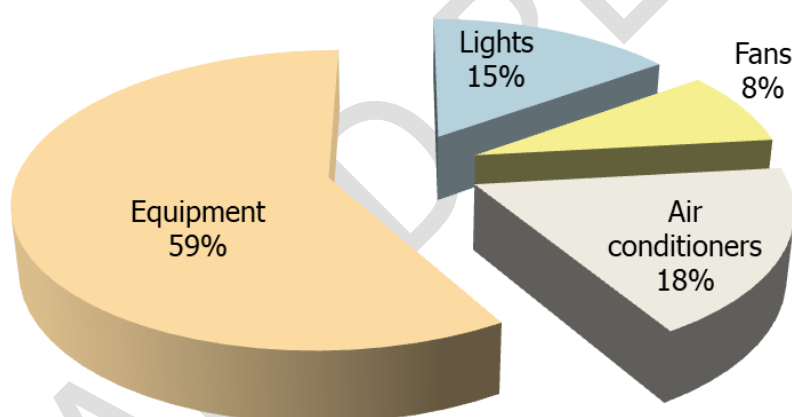


Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipment consume 59% whereas the air conditioners consume 18% while the lights consume 15% and the fans consume 8% of the total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **2,324 lights on the premises**; the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	LED lights (<i>Energy efficient appliance</i>)	1,929
2	Non-LED lights (<i>Non-Energy efficient appliance</i>)	395

Table 4: Summary of the types of lights on-premise

5.5.2 Types of lights based on the power consumption

The energy consumption of lights is **1,43,723 kWh** of energy.

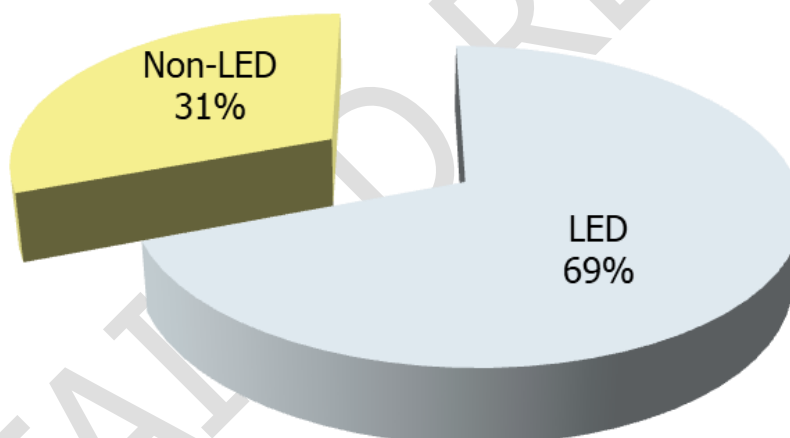


Figure 2: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **LED lights consume 69%** whereas the **Non-LED lights consume 31%** of the total power consumed by lights.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **930 fans** on the premises as follows:

S. No.	Type	Nos.
1	Ceiling fans	911
2	Pedestal fans	2
3	Wall mounted fans	17

Table 5: Summary of the types of fans in the premises

5.6 Types of fans based on the power consumption

The energy consumption of fans is **77,776 kWh** of the energy.

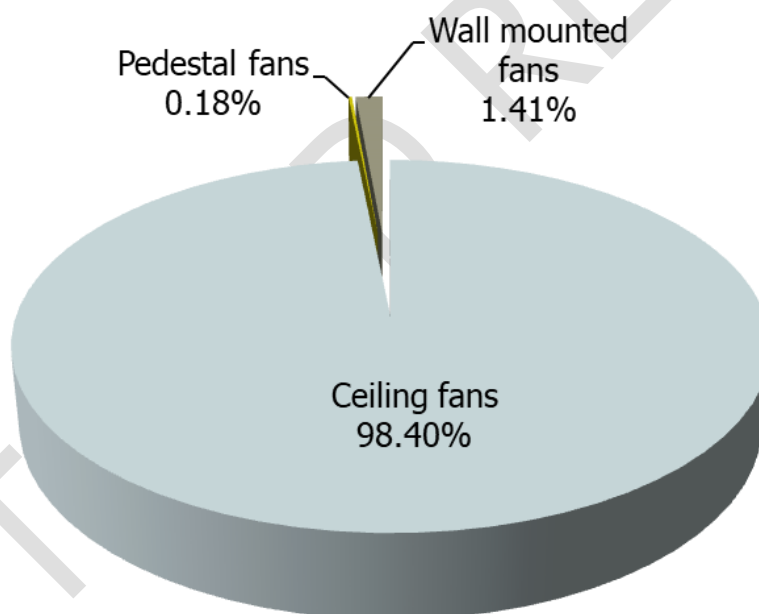


Figure 3: Types of fans based on power consumption

The above analysis shows that the **ceiling fans consume 98.40%** whereas the **wall mounted fans consume 1.41%** while the **pedestal fans consume 0.18%** of total power consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

There are **39 air conditioners** on the entire premises.

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **1,73,802 kWh** of energy.

5.8 Equipment

5.8.1 Types of Equipment

There are **1,086 nos. of equipment** in the Educational sector.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **5,58,874 kWh** of energy.

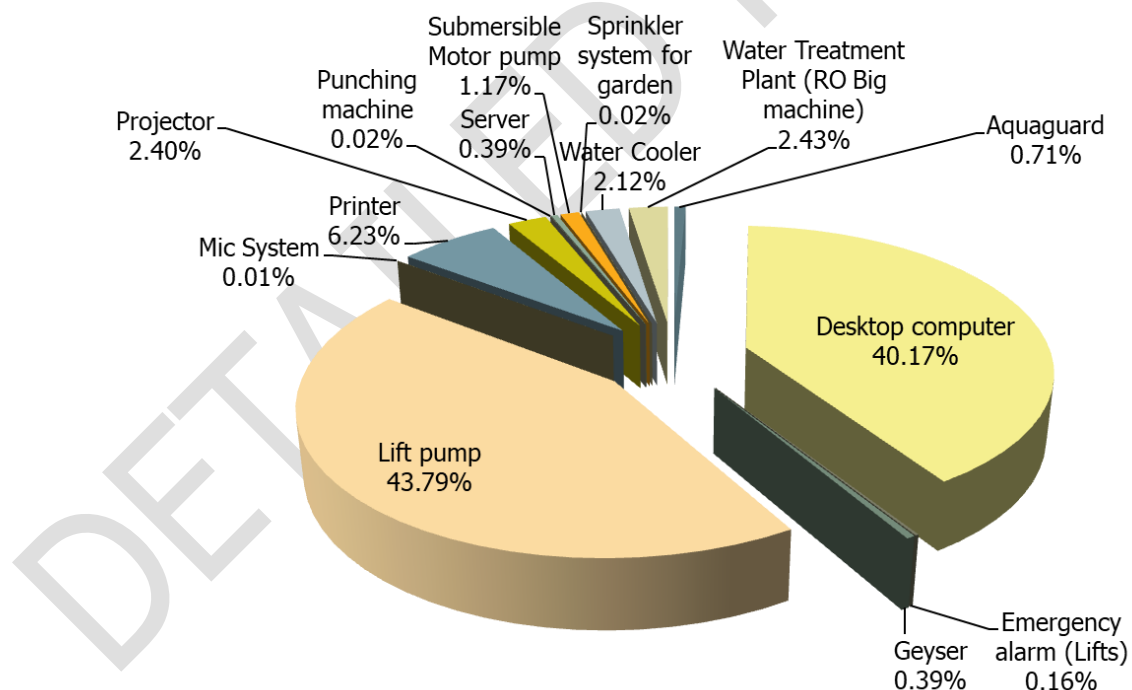


Figure 4: Energy consumed by types of equipment in the educational sector based on the usage study

Above summary shows **lift pump consumes more energy at 43.79%** while **desktop computer consumes 40.17%** whereas **printer consumes 6.23%** and **water treatment plant (RO big machine) consumes 2.43%** these are maximum consumers as compared to other equipment.

Section 2 – Life safety management

Fire and life safety are an important consideration of the National Building Code 2016. This aspect is touched upon as part of this study in the capacity of an Architect registered with the Council of Architecture. As part of the research, fire safety audit was considered from the 'Building systems' perspective. ***The study suggests that there is scope for certain improvements such as***

- ➔ ***There should be documentations of the switchboards and main boards such as SB1, MB1 further the switches should be documented appropriately.***
- ➔ ***The study suggests that the floor should have a 'FIRE ESCAPE ROUTE LAYOUT' that highlights the position of stakeholders and nearest passage as well as staircase.***



Plate 5: Fire fighting system in the premises

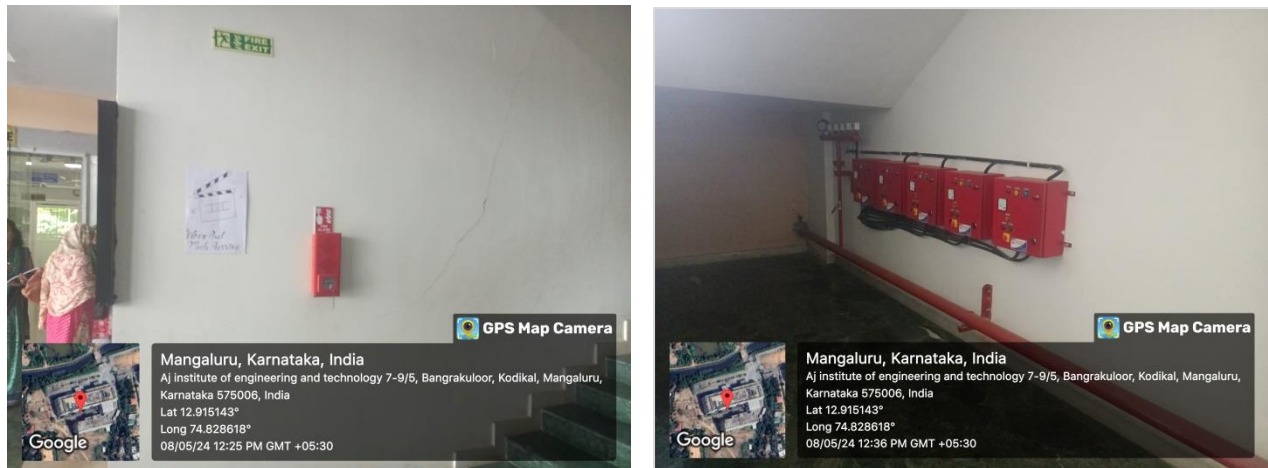


Plate 6: Fire alarm and hydrant pipe

The study suggests there should be additionally precautions near the storage under staircase.

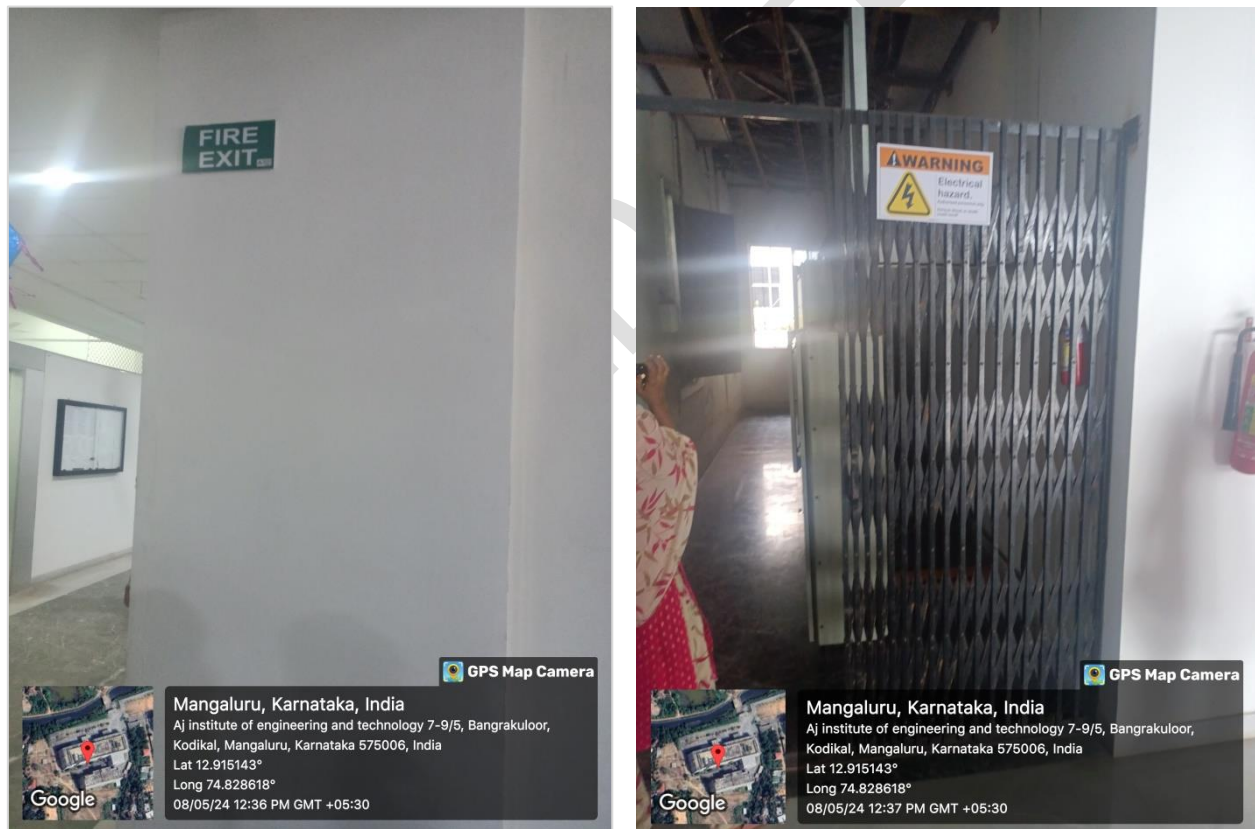


Plate 7: Signages for safety precautions in the premises

The study suggests that the nos. and size of Fire and life safety signages should be increased.

6. Inferences

The suggestion (inference) would act as a 'PLAN OF ACTION' to implement all the suggestions in a detailed manner. The same has been identified in two phases for a total duration of three years.

➔ Phase 1

- Duration: One year from the date of Report submission – Shared currently
- These are first hand suggestions
- They are easy and quick to implement
- They involve close very less or almost no expenses
- They can serve as a foundation for the entire plan of action

Section 1 – Energy management

➔ General practice

- The stakeholders should be educated to
 - i. Keep the lights on in the class room only when needed and unplug electrical devices when not in use.
 - ii. Electrical appliances consume energy even when you are not using them hence plugging something in only when needed can save electrical energy usage.
 - iii. At the time of locking the departments all fans, lights should be switched off.
 - iv. The students should be trained to switch off fans and lights when there is no need of them.
 - v. Staff should be trained to switch of lights and fans in their rooms when they leave the room.

➔ Awareness and vigilance

- Strict instructions for avoiding wastage of energy including rules such as if anyone is found putting on the switch unnecessary may be a punishable offence

or fine

- Seminars/ Webinars/ Workshops o stakeholders on energy preservation, use of e-vehicles
- Conduct visits and monitoring by authority for check of appliances/ their working conditions/ energy usage etc. every fifteen to twenty days

➔ Facilities intervention to reduce electrical load

- Use white colored interiors and exterior façade to reflect light and
- Avoid dark colored interior and exterior façade, especially exterior façade
- Cover the inverters/ solar meters on the rooftop areas
- Demarcate the areas as 'DANGER' and do not allow any other stakeholder except the skilled or expertise staff member
- Cover the rooftop of outdoor air conditioner units to avoid any direct sun exposure on the top area as this may lead to increased electrical consumption and reduce the duration of quick cooling

➔ Display information about the technical facilities

- Any space that has any source of renewable energy in the block certain information as follows should be displayed on a board near the entrance or foyer area of the block for sensitization
 - i. 'DANGER ZONE' and 'NO SMOKING ZONE' boards
 - ii. Do and Don't for the specific type of plant
 - iii. Plant name
 - iv. Capacity
 - v. Location
 - vi. Type of renewable energy system
 - vii. Nos. of units
 - viii. Installation date, month and year
 - ix. Energy generated per day and annually
 - x. Energy consumption actual requirement per day and annually
 - xi. Energy saved per day and annually
 - xii. Last maintenance date and vendor
 - xiii. Revenue generation (if any) per day and annually
 - xiv. Institute name and logo

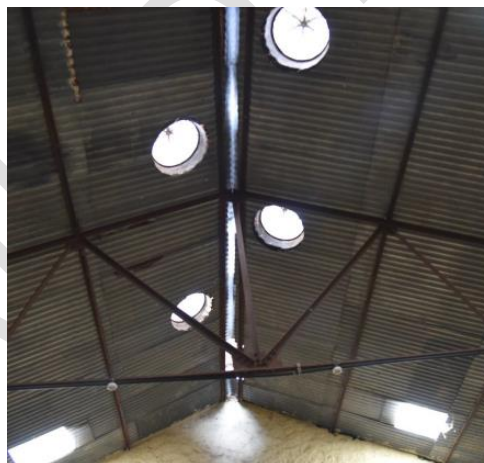
Section 2 – Energy generation

➔ Design interventions - Natural energy catchers through solar light wells for Direct/ indirect solar heat gain

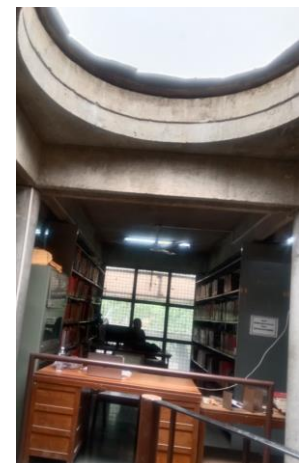
- The natural light can be harnessed and utilised during day time to reduce the artificial electrical loads and provide fresh ventilation
 - i. Plastic bottles filled with 3/4th water and washing soda 1/2 bottle; partially nailed outside the roof can invite up to 100W of energy
 - ii. Turbo ventilators act as a natural source of light and air with areas that have good wind source and sunlight
 - iii. Any geometrical shaped skylight either open to sky or covered with transparent sheets invites direct or filtered natural light inside the building; when equipped with plantations such as climbers it invites further fresh ventilation
 - iv. Caution: All of these have to be installed keeping the monsoon condition of the site and surrounding in mind



i.



ii.



iii.

Plate 8: Demonstration of solar lamp, turbo ventilator and asbestos sheet

(Photo left side <https://www.instructables.com/How-to-build-a-SOLAR-BOTTLE-BULB/> and Photo right side ABDHC Ashti)

Section 3 – Life safety management

➔ Display boards for awareness

- All fire and life safety exit signages as per NBC norms should be displayed at every nook and corner including assembly point, exit points
- A RACE Board at the location of extreme populace/ footfalls.
- There should be a PASS Board alongside every fire extinguisher



Reference suggestions 1: PASS Board display

➔ Fire and life safety measures

- Every space that has a gas cylinder/ air conditioner/ combustible appliance/ more than ten electrical or electronic appliance and Server rooms there should be EITHER sand bucket/ fire ball/ fire extinguisher

➔ Laboratory safety measures

- *There should be additional provisions in the LABORATORIES including:*
 - i. *Eye washers*
 - ii. *First aid box*
 - iii. *Concealing of exposed wiring*
 - iv. *Display chart about the 'dos and don'ts, a workshop for stakeholders about fire and life safety*
 - v. *Rubber flooring as an electrical safety measure*

Laboratory Safety

LABORATORY SAFETY

LABORATORY DRESS

Splash Goggles

Gloves

Face Shield

Laboratory coat
Also wear shoes that are closed from all sides

HOUSEKEEPING

Keep the laboratory clean and organized.

A place for everything and everything in its place.

CHEMICAL SPILLS

- Wear shoes covered from all sides while cleaning chemical spills.
- Do not just sweep spilled chemicals with a broom.
- Spray agents that solidify chemical spills or neutralize them.
- Do not dump the cloth soaked in spilled chemical in a waste bin. That cloth then becomes hazardous.
- Ventilate the room.

TRANSFERRING LIQUIDS

Pour the liquid down a stirring rod to avoid splattering

Never pipette by mouth

Always add acid to water

Use funnel while pouring from a wide mouth container to a small mouth container

LABELING CHEMICALS

CAUTION
CHEMICAL STORAGE ONLY
NO FOOD OR DRINK IN THIS UNIT

Always store chemicals in a rack and place a caution sign.

Do not use chemicals from unlabeled containers

HEATING CHEMICALS

Wear safety glasses while heating in a laboratory

Keep the direction of the mouth of the test tube away from yourself and others.

Heat gently to avoid splattering

While boiling, leave the stirring rod in the beaker

EYE WASH

Let water go directly into the eyes. Keep your hands free to hold your eyes open. Rinse eyeballs and interior of the eye gently for about 15 minutes.

WATER REACTIVE METALS

- Water reactive metals react violently with water.
- Handle them with extreme caution. Direct contact with them causes burns.
- Store Sodium, Lithium and Potassium under dry mineral oil or dry kerosene.
- Store metals in tight containers.
- Do not store Potassium for very long periods.

Metal cans provide durable storage, are fire resistant and break resistant for several hazardous chemical.

FIRE EXTINGUISHERS

CAUSE OF FIRE	TYPE OF FIRE EXTINGUISHER				
	HALON	DRY CHEMICAL	CARBON DIOXIDE	POWDER CLASS	SAND BUCKET
A. easily combustibles like paper, wood and trash	YES	YES	NO offers very little protection	NO	NO
B. flammable liquids like alcohol	YES	YES	YES	NO	NO
C. electrical equipments	YES	YES	YES	NO	NO
D. water reactive chemicals	NO	NO	NO	YES	YES

HARMFUL VAPOURS

Ventilate the room. Open all doors and windows.

Use respirator

Use fume hood

Switch on the exhaust fan and open all windows to let the vapours out.

WASTE CONTAINERS

- Sort your laboratory waste.
- Dispose hazardous and non-hazardous waste in separate bins and bags.
- Maintain separate bins for chemicals, broken glasses, and general waste.
- Identify all bins by marking them or by different colours.

SAFETY RULES

- Do not perform unauthorized experiments.
- Never work alone in the laboratory.
- Report all accidents immediately to the teacher or the laboratory in-charge.
- If toxic vapours are generated, use fume hood.
- Wear a chemical splash goggles and resistant gloves.
- Wear a chemical resistant apron or coat.
- Tie back long hair.
- Do not wear loose sleeves.
- Do not wear shorts.
- Do not wear sandals.
- No food or beverage inside the laboratory.
- Do not leave experiments unattended.
- Keep knowledge of the exits, safety showers, eye wash, fire blankets and extinguishers.
- Do not run around in the laboratory.
- Keep the working shelf and the laboratory clean.
- Extinguish burners when away from desk.

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Plate 9: Lab safety manual in the premises

➔ Earth pit zones

- Add signboard about 'Outdoor Electrical area'
- Code the earthing pits in the courtyard.

➔ DG and Transformer area

- Add safety signages such as 'Danger-do not touch' etc.
- Add signboards about the usage such as 'Transformer areas' and 'Diesel Generator area' etc.
- Every user in this space should compulsorily jacket, helmet, gloves, boots while working and being a part of this space.
- Code the earthing pits in the courtyard.
- Add additional fire extinguishers

DETAILED R/R

7. Compilation

The study is based on the data collected, analyzed, rechecked, and confirmed through multiple modes. For the quality study, some standards/ notes have been referred to. These are listed and noted below. However, no direct references have been used anywhere. These are used as a base to analyze and study the data collected.

Specific references for study related to energy

- ➔ <https://www.energy.gov/eere/buildings/zero-energy-buildings>
- ➔ <https://www.dsaarch.com/zero-net-positive-energy>
- ➔ U.S. Energy Information Administration
- ➔ <https://www.happysprout.com/inspiration/what-is-smart-gardening/>
- ➔ <https://ieeexplore.ieee.org/document/6779316>
- ➔ <https://www.murata.com/en-global/apps/industry/security/entranceandexitsystem>
- ➔ <https://www.energiguide.be/en/questions-answers/what-are-the-alternatives-to-air-conditioning/2121/>
- ➔ IGBC Green Campus rating system Abridged Reference Guide
- ➔ GEM Sustainability Certification Rating Program

