ENERGY AUDIT

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

Sustainability study

AUDIT REPORT

Studied for

Marwadi Sammelan's

B. M. Ruia Girls' College

11 Krishna Kunj, Vachcha Gandhi Road,
Gamdevi, Mumbai, Maharashtra. 400007

Studied in the capacity of

Accredited and Certified GBP

Studied by

Website: https://thegreenviosolutions.co.in/
Email: greenviosolutions@gmail.com

Background reference image Janko Ferlic on pexels

Disclaimer

The Audit Team has prepared this report for **Marwadi Sammelan's B.M.Ruia Girls' College, Mumbai** located at *11 Krishna Kunj, Vachcha Gandhi Road, Gamdevi, Mumbai, Maharashtra. 400007* 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

Palghar District, Maharashtra- 401208

sustainableacademe@gmail.com

Acknowledgement

The Audit Assessment Team extends its appreciation to **Marwadi Sammelan's B.M.Ruia Girls' College, Mumbai, Maharashtra** 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. Santosh Kaul Kak** (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. Usha Kiran Tiwari, Associate Professor and Head***
- Admin staff member – ***Mrs. Sharmila Sharma, Ms. Poonam Shukla***
- Non-teaching staff member – ***Mr. Marathe***

Contents

1. Introduction

1.1 About the Institution

1.1.1 Vision

The Institute envisions *"Empowerment and Enlightenment of women by envisaging their aspirations in the light of wisdom"*

1.1.2 Mission

The Institute aspires *"Empowerment of women through academic excellence, promotion of the national language Hindi, cultural awareness and contribution towards nation building."*

2. Overview

2.1 Summarised Populace analysis

2.1.1 Students data

The data (shared by Institute) shows there were:

- 386 students in 2023-24
- 464 students in 2022-23

2.1.2 Staff data

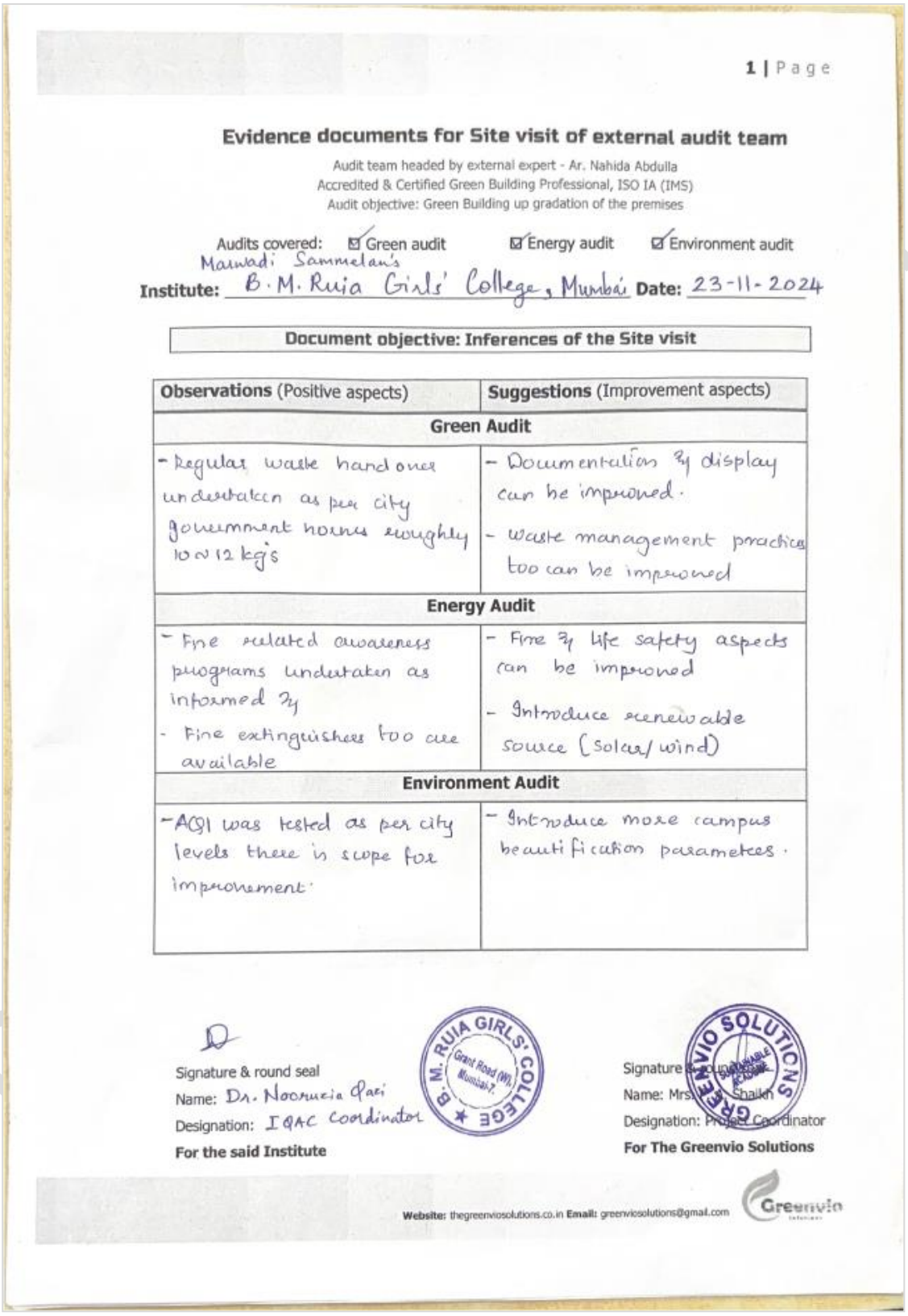
The data (shared by Institute) shows there were:

- 30 staff members (Admin + Teaching + Non-teaching) in 2023-24
- 29 staff members (Admin + Teaching + Non-teaching) in 2022-23

For analytical purposes the populace of academic year 2023-24 shall be taken into consideration, which is 386 students + 30 staff members;

Thus, total populace stands at 416 nos.

3. Observation



1 | Page

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: Marwadi Sammelan's B.M. Ruia Girls' College, Mumbai Date: 23-11-2024

Document objective: Inferences of the Site visit

Observations (Positive aspects)	**Suggestions** (Improvement aspects)
Green Audit	
- Regular waste hand over undertaken as per city government norms roughly 10 to 12 kg's	- Documentation & display can be improved. - Waste management practices too can be improved
Energy Audit	
- Fire related awareness programs undertaken as informed by - Fire extinguishers too are available	- Fire & life safety aspects can be improved - Introduce renewable source (Solar/wind)
Environment Audit	
- AQI was tested as per city levels there is scope for improvement.	- Introduce more campus beautification parameters.

Signature & round seal
Name: Dr. Noorunia Qazi
Designation: IQAC Coordinator
For the said Institute

B. M. RUIA GIRLS' COLLEGE Grant Road (W) Mumbai-7

GREENVIO SOLUTIONS SUSTAINABLE SOLUTIONS

Signature & round seal
Name: Mrs. Shaikh
Designation: Project Coordinator
For The Greenvio Solutions

Website: thegreenviosolutions.co.in Email: greenviosolutions@gmail.com

Greenvio

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: Marwadi Samaj Sanchalit B.M. Ruia Girls' College Mumbai **Date:** 23-11-2024

Document objective: Proof of the Site visit

Meeting with the core team

Investigation of the systems

Signature & round seal
Name: Dr. Noorjia Qazi
Designation: IQAC Coordinator
For the said Institute

B.M. RUIA GIRLS' COLLEGE Grant Road (W) Mumbai-7.

Signature & round seal
Name: Mrs. [illegible] Shaikh
Designation: Project Coordinator
For The Greenvio Solutions

GREENVIO SOLUTIONS

Plate 2: Evidence files related to proof of the site visit

4. Investigation

The micro-climate temperatures of the site depends upon various factor including through evapotranspiration, trees and other vegetation cool the air around them. *(Reference and further edited with details from dnr.louisiana.gov)* The base temperature for thermal comfort in India is 24°C (75°F) – Reference study

https://www.researchgate.net/post/What_is_the_base_temperature_for_thermal_comfort_in_India#:~:text=The%20base%20temperature%20for%20thermal%20comfort%20in%20India%20is,C%20(75%C2%B0F).

The following results were carried out during visit on ***23 November 2024.***

S. No.	Space	Result (^{0}C)	Required (^{0}C)	Improvement required
1.	Library (2nd floor) @ 08:47	23	24	No
2.	Auditorium (4th floor) @ 10:46	24	24	No

Table 1: Results for the micro-climate temperature study

The above study was conducted using the HuaFeng Accuweather software.

As the above study shows the sampling carried in all areas following are major observations:

- As the floor rises the temperature rises.
- Almost all spaces have temperatures within limit

The reason for such good results can be:

- ***Shaded site with residential buildings on almost all sides***
- ***Shaded providing trees on periphery keeping the site protected from direct sunlight and allowing filtered sunlight***

5. Documentation

Section 1 – Fire and Life safety

5.1 Facilities study

As part as provisions are concerned only 'fire extinguishers' are available.

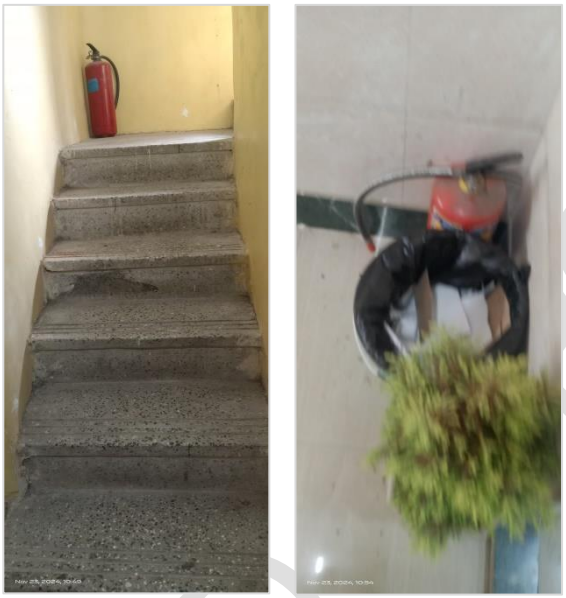


Plate 3: Evidence of the fire and life safety measures undertaken

Most of the extinguishers are refilled and in function.

Section 2 – Energy generation & expense incurred

5.2 Load distribution study

5.2.1 Categorization

Since the campus is an Educational Institute WITH residential (Tenants) within site; thus the type of load can be stated as 'Commercial + Residential' as 'Mixed use'

5.2.2 Primary sources of energy consumption

- **Electrical (Metered) –** Light, Fans, Equipments, Pumps comprise these sources.
- **Alternate sources of energy consumption –** The facilities are 'NOT' available.

5.2.3 Secondary sources of energy consumption

Only gas cylinders were observed as secondary source in canteen area.

5.3 Technical payload study

The data related to electricity bills is documented below.

Sr. No.	Month	Year	Amount	(A) Total units consumed	(B) Solar units generated	(C = A-B) Gross units consumed after deduction
Academic year between 2023-2024						
1	June	2023	29,540	2,690	0	2,690
2	July	2023	28,400	2,446	0	2,446
3	August	2023	56,460	2,542	0	2,542
4	September	2023	34,337	2,989	0	2,989
5	October	2023	31,941	2,504	0	2,504
6	November	2023	36,160	3,171	0	3,171
7	December	2023	22,610	1,861	0	1,861
8	January	2024	24,520	2,039	0	2,039
9	February	2024	25,980	2,166	0	2,166
10	March	2024	24,720	2,313	0	2,313
11	April	2024	28,220	3,155	0	3,155
12	May	2024	35,600	2,768	0	2,768
Academic year between 2022-2023						
13	June	2022	17,750	1,911	0	1,911
14	July	2022	23,730	2,682	0	2,682
15	August	2022	28,320	2,628	0	2,628
16	September	2022	28,400	2,848	0	2,848
17	October	2022	28,710	2,899	0	2,899
18	November	2022	22,250	2,449	0	2,449
19	December	2022	18,550	2,103	0	2,103
20	January	2023	17,000	1,922	0	1,922
21	February	2023	16,520	1,845	0	1,845
22	March	2023	18,190	2,235	0	2,235
23	April	2023	24,730	2,756	0	2,756
24	May	2023	25,980	2,990	0	2,990

Table 2: Details of the electrical consumption

The observation related to above information states:

- **Alternate source of energy is 'NOT' available**
- **Percentage of energy met by alternate source (Renewable – Solar or wind) is ZERO.**

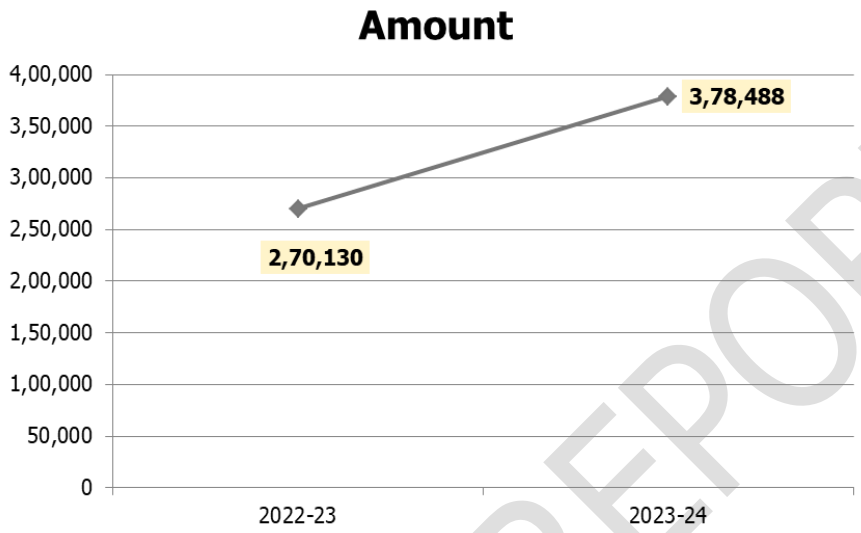


Plate 4: Amount study

- There has been an increase of Rs. 1,08,358 towards electrical expenses.
- Total **amount** spent is **Rs. 6,48,618/-**
- Average amount spent for every unit consumed in 2022-23 is Rs.9/-
- Average amount spent for every unit consumed in 2023-24 is Rs. 12/-

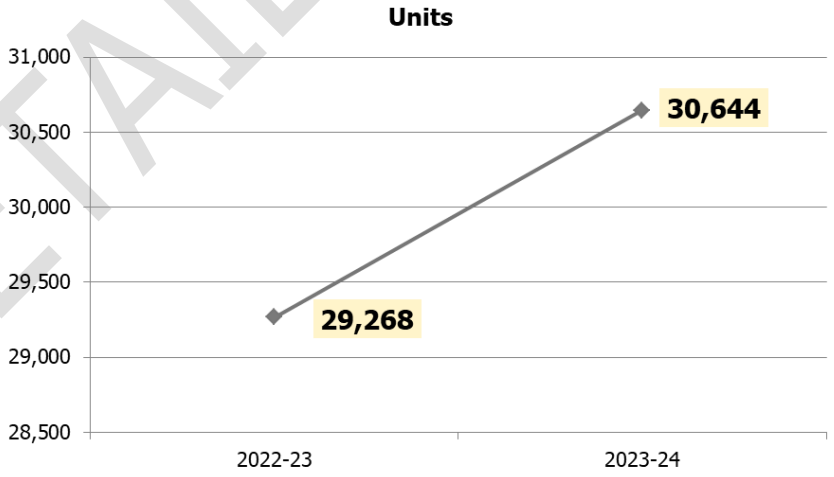


Plate 5: Electrical study

- **There has been an increase of 1,376 units in consumption.**
- **Total units** consumed **~ 59,912 units (Electrical)**

Section 3 – Energy consumption

5.4 Calculated electrical consumption study

(Energy consumption by the electrical appliances study)

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

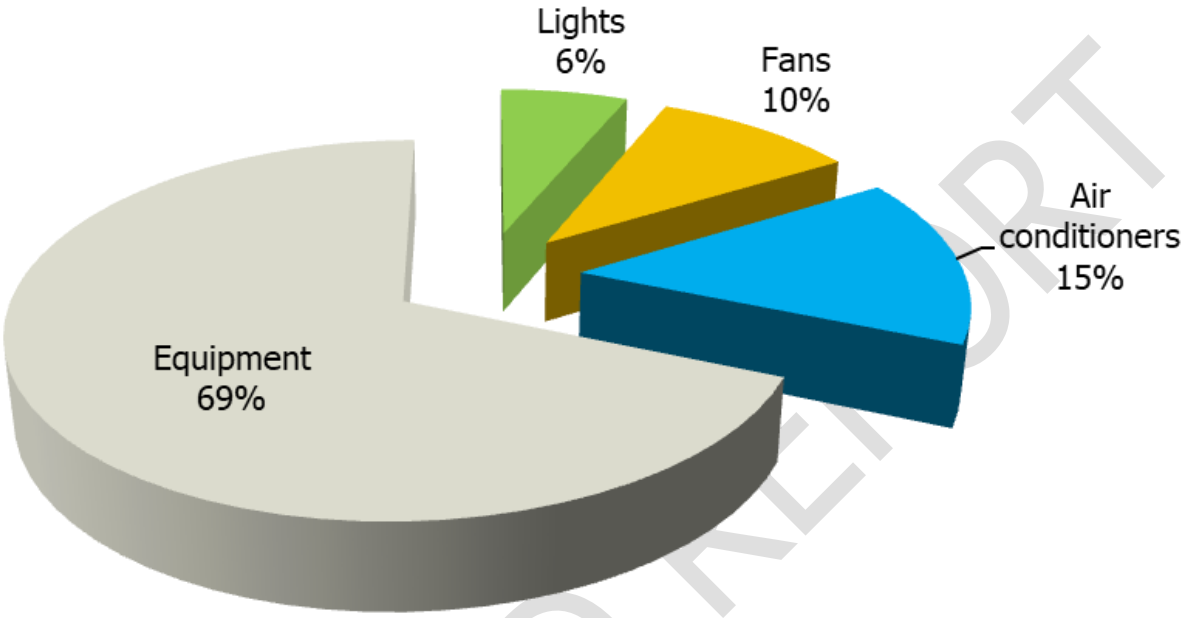


Figure 1: Summary of the calculated electrical consumption as per inventory

The above graph shows that equipment consume 69% whereas air conditioners consume 15% while fans consume 10% and the lights consume 6% of total calculated electrical energy.

5.5 Lights

5.5.1 Types of lights based on the numbers

There are **134 lights on the premises;** the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	**LED lights** *(Energy efficient appliance)*	128
2	**Non-LED lights** *(Non-Energy efficient appliance)*	6

Table 3: 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 **7,104 kWh** of energy.

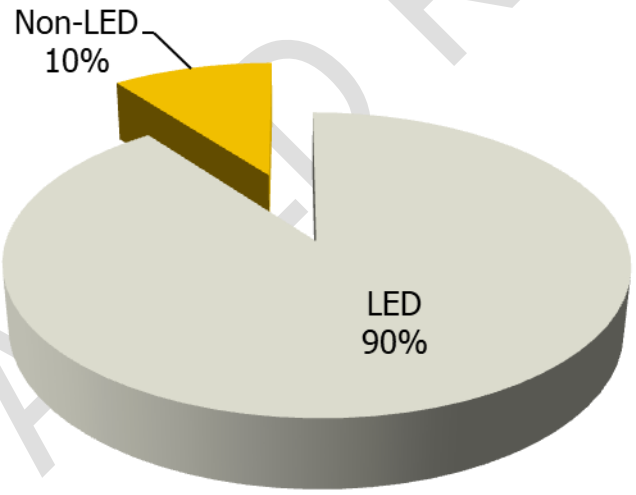


Figure 2: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **LED lights consume 90%** whereas the **Non-LED lights consume 10%** of the total power consumed by lights.

Note: The above study is based on the data provided by the Institute; however it was observed there were many Non-LED and non-working lights (In few nos.) within the premises.

5.6 Fans

5.6.1 Types of fans based on the numbers

There are **95 fans** on the premises as follows:

S. No.	Type	Nos.
1	Ceiling fans	89
2	Small motor exhaust fans	4
3	Medium motor exhaust fan	1
4	Wall mounted fan	1

Table 4: Summary of the types of fans in the premises

5.6.2 Types of fans based on the power consumption

The energy consumption of fans is **11,273 kWh** of the energy.

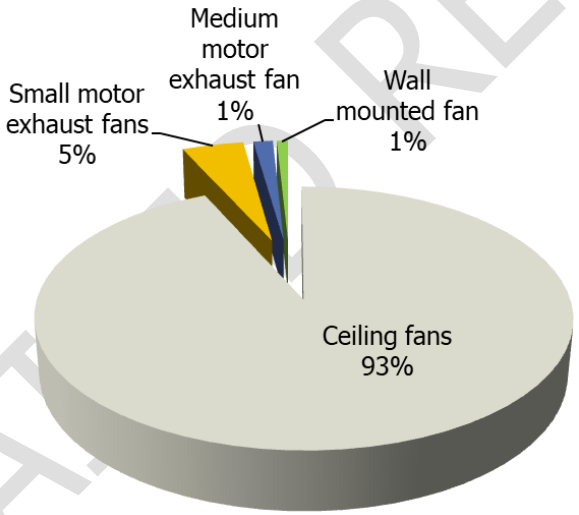


Figure 3: Types of fans based on power consumption

The above analysis shows Ceiling fans (Regular) consume 93% whereas the small motor exhaust fans consume 5% while the medium motor exhaust fans and wall mounted fans consume 1% each of total power consumed by fans.

5.7 Air conditioners

5.7.1 Types of air conditioners based on the numbers

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

5.7.2 Building-wise consumption analysis

The energy consumption of air conditioners is **16,861 kWh** of energy.

5.8 Equipment

Only the major appliances information was shared.

5.8.1 Types of Equipment

There are **73 nos. of equipment** in the premises.

5.8.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **77,398 kWh** of energy.

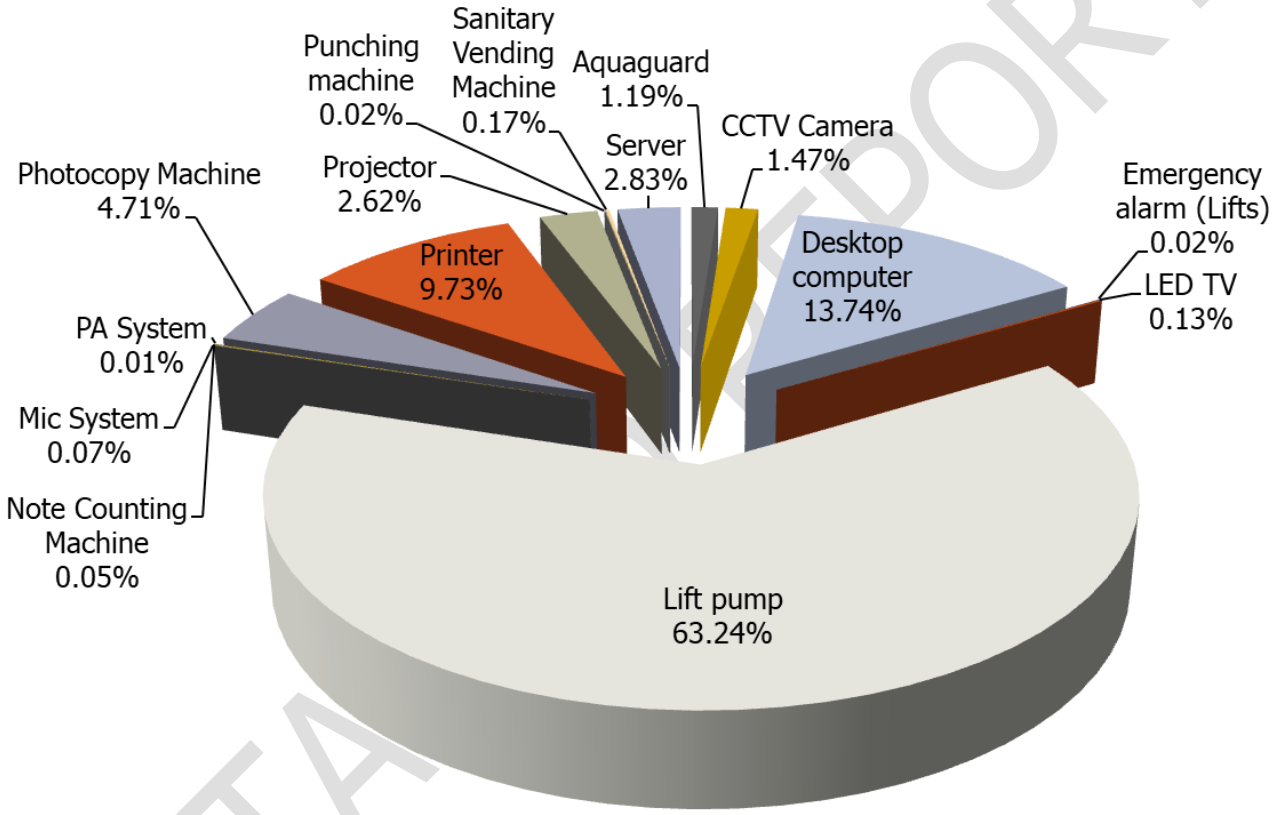


Figure 4: Energy consumed by types of equipment in the educational sector based on the usage study

The above summary shows that **lift pump consumes more energy at 63.24%** while the **desktop computer consumes 13.74%** whereas **printer consumes 9.73%** and **photocopy machine consumes 4.71%** these are major consumers as compared to other equipment.

Section 4 – Building safety

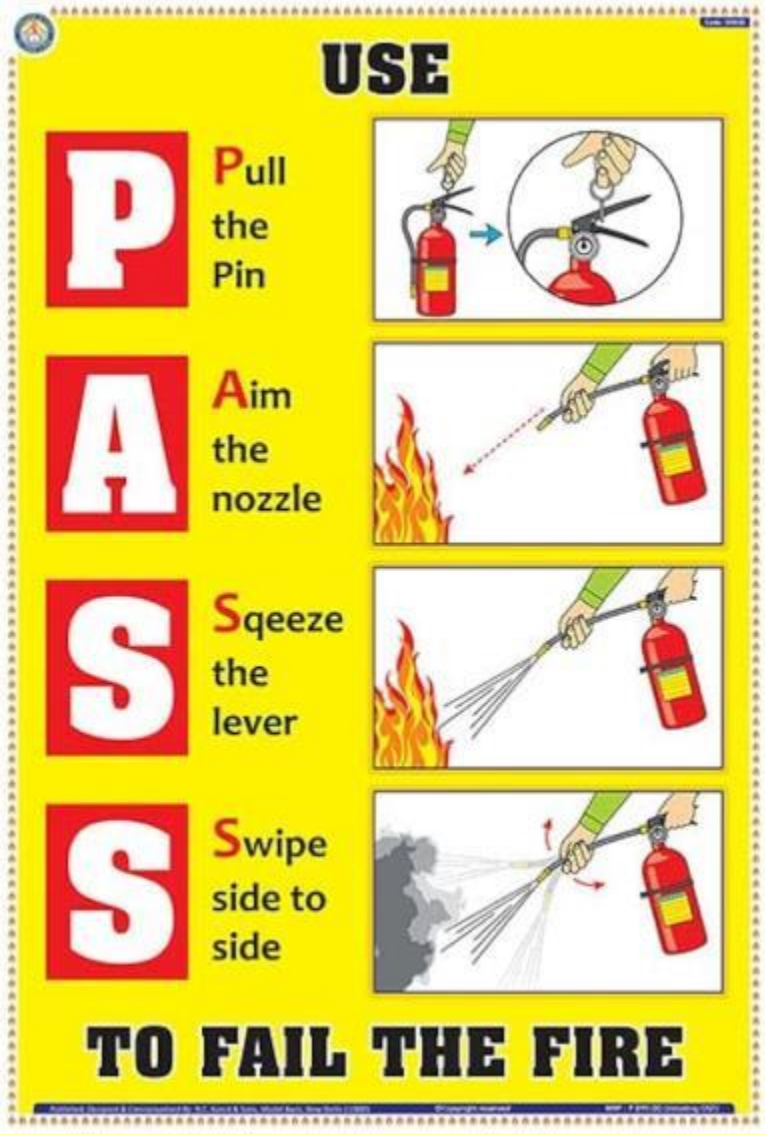
The building is too old, certain hands on observation state

- A mix of wooden + RCC structure
- Structural audit undertaken in 2023
- Building proposed for redevelopment and talks are under process
- It shall take a while for the building to be redeveloped

6. Suggestion

The suggestion (inference) would act as a 'PLAN OF ACTION' to implement all the suggestions in a detailed manner.

- Conduct the 'Before' and 'After' study with photos
- Document the same in 'Action taken report'

S. No.	Aspect with evidence if any	Suggestion
1.	Fire and Life safety aspect **Aspect area:** **Signages and display for awareness**	Wherever there is a fire extinguisher display the PASS board in English and local language  Source: Amazon

2.	Fire and Life safety aspect **Aspect area:** **Fire balls**	Replace fire extinguishers with fire balls on all staircase landing and kitchen areas  Image source: https://www.variex.in/fire-ball-capacity/  Image source: Flipkart and Indiamart
3.	Fire and Life safety aspect **Aspect area:** **Warning signages**	Introduce signages on all beams of staircase landings for safety     

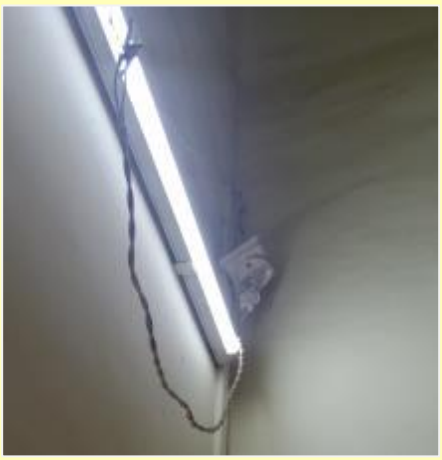
4.	Fire and Life safety aspect **Aspect area:** **Exposed electrical wiring**	      ***Exposed wirings in entire campus*** Certain areas were observed to have exposed and double load on electrical wiring; Appropriate concealing and fabrication should be undertaken for these areas using cable concealers

		 Image reference: Amazon
5.	Fire and Life safety aspect **Aspect area:** **Safety signages**	Introduce fire and life safety signages in appropriate locations in A/3 size poster on every floor near entrance  Image reference: Amazon
6.	Energy generation aspect **Aspect area:** **Windmill**	Efforts can be made to undertkae feasibility study to check whether windmills in small size can be installed on rooftop or solar panels to reduce electrical loads.

7.	Energy consumption aspect **Aspect area:** **Old appliances added to electrical load**	Removed unwanted/ non-functioning appliances and wirings 
8.	Energy consumption aspect **Aspect area:** **Document switches**	The switches should be indicated as follows:  Image source: Amazon
9.	Structural safety aspect **Aspect area: Study**	External structural audit through a structural engineer should be conducted every year and report should be made public on website. Additionally, mandatory visit and review by local fire dept. should be undertaken with proper report displayed on website and near entrance of premises.

10.	Structural safety aspect **Aspect area:** **Civil work**	Certain areas were observed for water leakages, broken ceiling, cracks in structural elements, moss acculumation, these possess safety and health risk; civil work should be undertaken immediately or redevlopment measures should be fastened. 
11.	Structural safety aspect **Aspect area:** **Unwanted storage**	Unwanted storage should be removed from terrace & other areas 
12.	Structural safety aspect **Aspect area:** **Unwanted storage**	Till the redevelopment/ structural measure are put into action; the thread of riser of staircases can be repaired immediately.

		 
13.	Structural safety aspect **Aspect area:** **Emergency exit**	The staircase from library was infromed us 'Emergency exit' however it is not feasble to access the same; similar the breakout areas are covered with storage materials – It is uggested to clear the storage and demarate these areas as 'Danger zones' 

Table 5: Observation based suggestion study of the campus

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.energuide.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
- Inference study reference images
    - https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD
    - https://housing.com/news/smart-gardening/
    - https://solarpowerproject.in/solar-panels-for-parking-lots.php