ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2020 - 2021 AND 2021-2022

Sustainability study

AUDIT REPORT

Studied for

Pune District Education Association's

Waghire College of Arts, Commerce and Science

Saswad, Taluka Purandar, Pune - 412301

Studied in the capacity of

An accredited & Certified Green Building Professional

Studied by

Greenvio Solutions

Valid till December 2023

Background reference image Janko Ferlic on pexels

Disclaimer

The Audit Team has prepared this report for the **Pune District Education Association's Waghire College of Arts, Commerce and Science** located at *Saswad, Taluka Purandar, Pune - 412301* based on input data submitted by the College 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 Hon'ble Management and College. 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 an Accredited and Certified Green Building Professional-Architect; ISO Certified I.A. (IMS). 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.

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 thanks the **Pune District Education Association's Waghire College of Arts, Commerce and Science, Saswad, Pune** for assigning this important work of Energy Audit. We appreciate the cooperation extended to our team during the entire process.

Our special thanks are due to **Hon. Shri. Ajitdada Pawar,** President, Pune District Education Association, Pune; **Hon. Rajendra Ghadage,** Vice-President, Pune District Education Association, Pune; **Hon. Adv. Sandeep Kadam,** Hon Secretary, Pune District Education Association, Pune and Senate Member SPPU, Pune; **Shri. Adv. Mohanrao Deshmukh,** Treasurer; **Shri L. M. Pawar,** Asst. Secretary; **Shri A. M. Jadhav,** Jt. Secretary (Administration) and everyone from the Management.

Our heartfelt thanks to Chairperson of the entire process **Dr. Shushma Bhosale,** Principal for the valuable inputs.

We are also thankful to **College's Task force the faculty members** who have collected data required **Dr. Sampat Jagdale,** Vice Principal; **Dr. Subhash Whaval,** Vice Principal; **Dr. Sanjay Zagade,** IQAC Co-ordinator and **Dr. Vidya Patankar,** Assistant Professor *(Special mention for the excellent coordination).*

We highly appreciate the assistance of the **entire Teaching, Non-teaching and Admin staff** for their support while collecting the data.

Sustainable Academe
Brand of Greenvio Solutions, Palghar District, Maharashtra- 401208

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1. Introduction

1.1 About the Institution

In a span of four decades the College has made remarkable progress in the field of education. The College has received **DST-FIST-Grants from Department of Science and Technology, Govt. of India**. In order to keep up pace with time, the college has started UGC sponsored B. Voc. Degree Program in Retail Management and Tourism and Hospitality Management. **As on today, more than 5,000 students pursue their education in the College.**

1.2 Statements of the Institution

1.2.1 Mission

The College adheres and focuses *"To provide an open access to learning, irrespective of caste, religion and colour to the community from rural and hilly area. The college aims at providing the higher education to the aspirants at their doorstep."*

1.2.2 Aim

The College has envisioned for the students the aim *"The parent institution keeps the academic atmosphere vibrant by providing adequate infrastructure to be in tune with the vision."*

1.2.3 Objective

The College emphasis on the objectives such as:

- *"To enrich the personality of students of the rural and hilly area*
- *To inculcate confidence, decision making power and better codes of conduct*
- *To cultivate patriotism and love for unity*
- *To develop national spirit and fair attitude among students"*

1.3 About the Institution's Academic arena

The Institution offers the following courses:

- **Graduation**
  - Bachelor of Arts
  - Bachelor of Commerce
  - Bachelor of Science (Computer Science, Botany, Physics, Zoology, Chemistry and Microbiology)
  - Bachelor of Business Administration (Computer Application)
  - B.Voc. - Tourism and Hospitality Management
  - B.Voc. - Food Processing and Technology
- **Certificate Course**
  - Communication skill in English
  - Counselling centre
  - Communication skill
  - Goods and Service tax
  - Basic analytical instrumentation
  - Role of basic mathematics
  - Instrumentation
  - Advance techniques in computer
  - Basic technique in gardening
- **Diploma programs**
  - GST & Tally 1 year Diploma under UGC
  - Diploma in Agro Tourism

The College works towards training young men and women to be competent, committed and compassionate, and lead in all walks of life.

1.4 The surrounding premises around the Institution

The Premises is situated amidst the landscape serene of **Saswad district of Maharashtra** with immense peace and calmness in the surroundings.

1.5 Assessment of the College

1.5.1 Affiliations

The College has all its courses approved and affiliated to the **Savitribai Phule Pune University,** formerly the University of Poona, is a collegiate public state university located in the city of Pune, India.

1.5.2 Certification

AISHE – The College has the AISHE Code *C-41716.*

1.5.3 Accreditation

The following are details of the accreditation of the Institute.

Cycle	First	Second	Third
CGPA	-	2.67	2.83
Grade	B+	B	B++
Year	2004	2014	2019

Table 1: NAAC Accreditation details of the Institute

The college is due to enter its Fourth cycle of NAAC soon.

1.6 Achievements of the College

The College has a tremendous track record of excellence in Built form and educational services provided, below are some of the achievements of the prestigious Institute.

- **STAR DBT College Award**
- **Best NSS Award by SPPU,** 2019-20 & 2020-21.
- **Purandar Magazine Award by SPPU** (2nd Rank for Best Magazine), 2019-20.

2. Institution overview

2.1 Populace analysis for Academic year 2021-2022

2.1.1 Students data

The student data (shared by the College) shows there were a total of **1,595 Boys and 1,779 Girl students,** thus there were **a total of 3,374 students** on the premises.

2.1.2 Staff data

Type	Male	Female	Total
Admin staff	03	02	**05**
Teaching staff	50	45	**95**
Non-Teaching staff	40	8	**48**
Total Staff Members	**93**	**55**	**148**

Table 2: Staff data of the Institution for 2021-2022

The staff data shows the premises had a total of **148** Staff Members.

2.2 Populace analysis for Academic year 2020-2021

2.2.1 Students data

The student data (shared by the College) shows there were a total of **1,600 Boys and 1,936 Girl students,** thus there were **a total of 3,536 students** on the premises.

2.2.2 Staff data

Type	Male	Female	Total
Admin staff	03	02	**05**
Teaching staff	50	29	**79**
Non-Teaching staff	40	8	**48**
Total Staff Members	**93**	**39**	**132**

Table 3: Staff data of the Institution for 2020-2021

The staff data shows the premises had a total of **132** Staff Members.

2.3 Total College Area & College Building Spread Area

The **total site area is 11 acres** and the **total Built-up area of College is 1,71,416 sq. ft.** for **a total of 3,522 footfalls.**

2.4 College Infrastructure

2.4.1 Establishment

The College was established in 1972. The college is located pretty close to nature and hence has very fresh environment which is absolutely pollution free and healthy. The Building is a Reinforced Cement Concrete (RCC) framework building. **Overall the Infrastructure of the Building is excellent in terms of the Architecture Design and Green Building Design. The Premises covers quite a few of the requirements for a Green Habitat.**

2.4.2 Spatial Organisation

The overall ambience of the College is warm and inviting. The classrooms and other spaces have ample natural ventilation in the form of clear glass windows with fresh air ventilation. The architecture of the building is quite well designed. The colour palette not just helps the building to stand out but also provides an Institutional arena. It balances with the local architecture with the natural landscapes of huge trees all around. The design emphasis on providing calmness to the built form and gradually merges with the serene landscape.

The floor to floor height is more than 10 feet. There are provisions for lifts in the premises, whereas there are amenities such as CCTV, Fire extinguishers, Library and first aid box.

2.4.3 Operation and maintenance of the premises

The interview session with the staff regarding the operation and working hours stated that the Institution is open from Monday to Saturday from 08.00 am to 05.00 pm.

3. Green Building Study Audit

3.1 About the Green Building Study Audit

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

3.2 Analysis for the Green Building Study Audit

The procedure included detailed verification for the following:

Energy Audit

- Analysis of the Lights, Fans, Air conditioners, Equipment
- Renewable energy
- Scope for reducing the current energy bills if any
- Improvement in the thermal comfort of the premises

Green Audit

- Green initiatives
- Hygiene audit
- Water Audit - Analysis of the current water consumption of premises; Scope to include Rain water harvesting and Waste water treatment in premises
- Waste Audit - Current waste produced, its segregation and usage; Strategies to be adopted for waste management and awareness

Environmental Audit

- Analysis of the current landscape + hardscape of campus
- Analysis of the flora and fauna of premises
- Strategies adopted at present to enhance vegetation
- Measures that can be adopted for ecological improvement of the premises.

3.3 Strategy adopted for Green Building Study Audit

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

3.4 Timeline of the activities for Green Building Study Audit

- 25 July 2022 – Allotment and Initiation by the College
- 25 July 2022 – Induction meeting
- 30 July 2022 – Survey of the Student and staff submitted
- 17 October 2022 – Submission of the Draft report
- 21 December 2022 – Site visit at the Institute
- 30 December 2022 – Submission of the Main report

Discussion with the Core Team

On-site review with the team for site management, green wall and other features

Group photo with the Team

4. Energy Audit

4.1 Sources of Energy consumption

The premise uses following sources of energy consumption.

4.1.1 Primary sources

- **Electrical (Metered) –** Light, Fans, Equipments, Pumps comprise these sources.
- **Renewable energy –** There are sources of renewable energy available.

4.1.2 Secondary sources

The sources are listed below.

- Gas cylinder - Rs. 3,700/month spent in 2021-22; Rs. 3,250/month in 2020-21.
- UPS - Rs. 13,230/month spent in 2021-22; Rs. 12,150/month in 2020-21.

4.2 Site investigation analysis

The Site investigation observations and interviews with the Maintenance staff, Electrical department in charge are summarised below:

- The **switch-off drills are practised at present,** the maintenance staff and Lab Attendants put off switches of all equipments regularly.
- All the **computers are shut-off after use** and also put on power saving mode.
- There are **display boards encouraging staff and students to save energy are put up in the classrooms and laboratories**.

4.3 Actual Electrical Consumption as per Bills

There was a detailed discussion held about the energy management aspects that are utilised at present and the benefit the College gets in terms of Green Building facilities. We were informed that even though there are certain levels of energy management initiatives such as LED lights, Solar panels (Only in a few places) the College has installed solar panels which has been beneficial to a certain extent.

4.4 Survey Results

An online survey was conducted to analyse the student and staff views about the Energy management practices adopted in College, following is the result received.

4.4.1 Participation

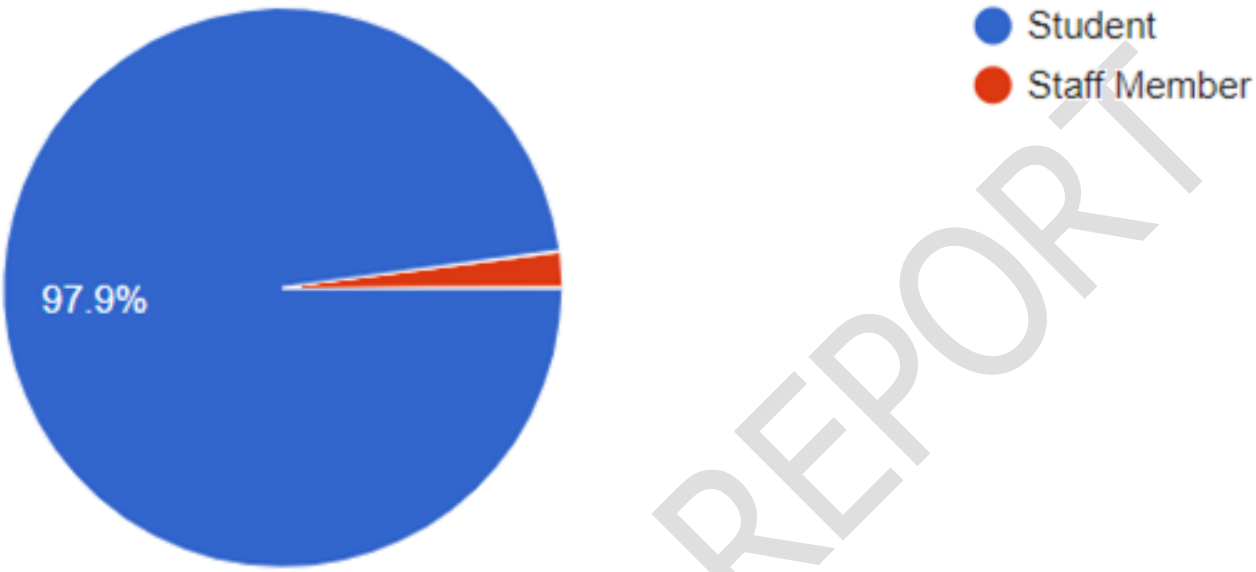


Figure 1: Participation analysis in the survey

A total of **429 responses** were received out of which 98% were students.

4.4.2 Review of the Energy management practices in the premises

Note: The Participants were asked to review the practice on a scale of 1-5 with scale components as follows:

- Scale 1 – Poor
- Scale 2 – Satisfactory
- Scale 3 – Good
- Scale 4 – Very good
- Scale 5 – Excellent

The figures in each of the columns of graph depict the Number of participants responses in numerical (Percentage of the participant response) – For example 101 responses (44.5%)

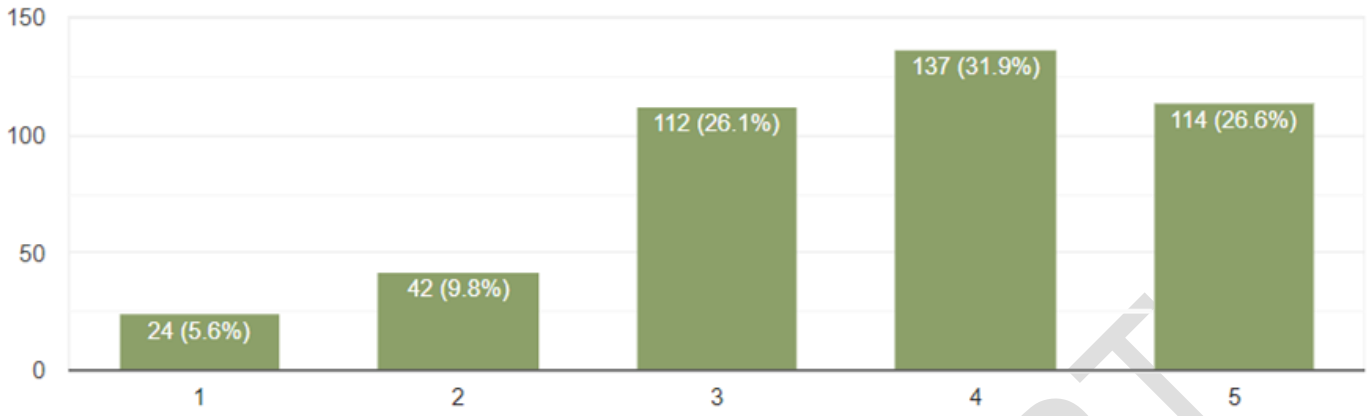


Figure 2: Energy management practices in college

The students, staff **(almost 32%) of the responses found the practices to be very good (rating 4)** and **27% of the responses found practices to be excellent (rating 5).**

4.5 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 in summarised in the following sections. Note: The following analysis is combined for entire premise taking into considerations the duration before pandemic to understand the consumption pattern as post pandemic the premise is used only for a few hours.

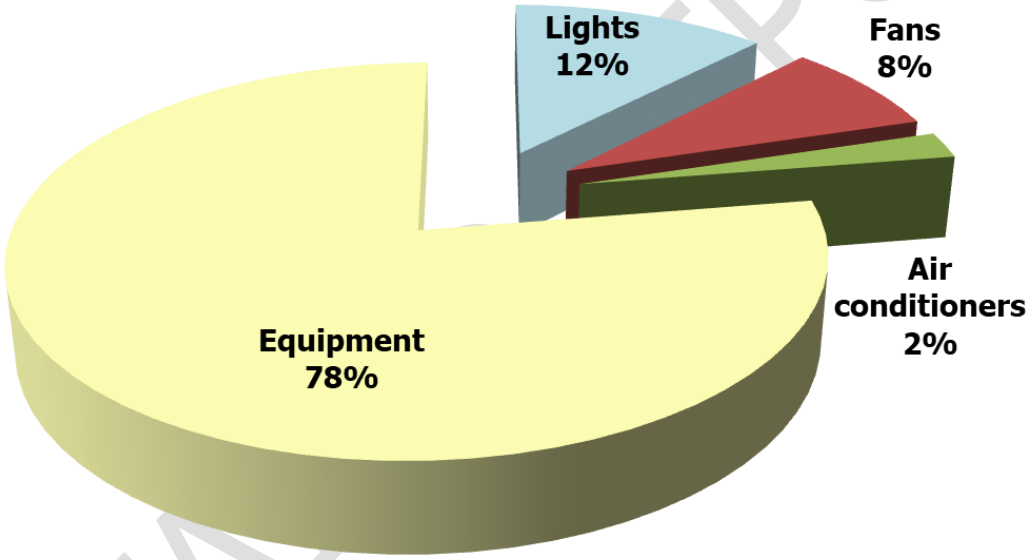


Figure 3: Summary of the calculated electrical consumption as per inventory

The above graph shows that Equipment consumes 78% followed by lights consuming 12% while the fans consume 8% and the air conditioners consume 2% of the total calculated electrical energy.

4.6 Lights

4.6.1 Types of lights based on the numbers

There are a total of **357 lights in the premises;** the following table shows the various types of lights in the premises.

S. No.	Type	Nos.
1	Halogen	11
2	LED	65
3	Non-LED	281

Table 4: Summary of the types of lights in premise

4.6.2 Types of lights based on the power consumption

The energy consumption of Lights is **24,169 kWh** of energy; the following graph shows the type of lights.

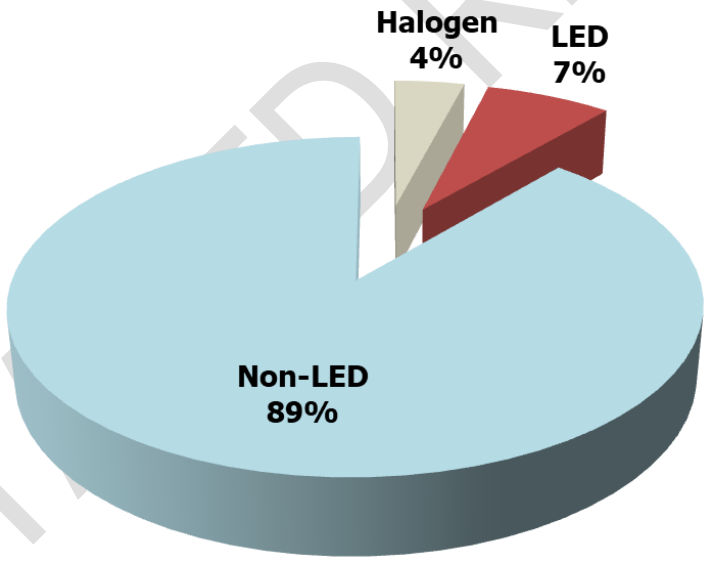


Figure 4: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights in premises shows **Non-LED lights consume 89%** whereas the **LED lights consume 7%** and the **Halogen Lights consume 4%**

4.6.3 Requirement of NAAC

4.6.3.1 Alternative Energy Initiative

Percentage of power requirement met by renewable energy sources – There are solar panels available in the premises. Around 40% of the energy is utilised in premises.

4.6.3.2 Percentage of lighting power requirement met through LED bulbs

The premise has LED Lights contribute to 18% in terms of number and **7% of the power requirement** is met through the same. As per our study we could conclude that both of these numbers should improve.

4.6.4 Floor-wise consumption analysis

The following graph shows the floor-wise consumption.

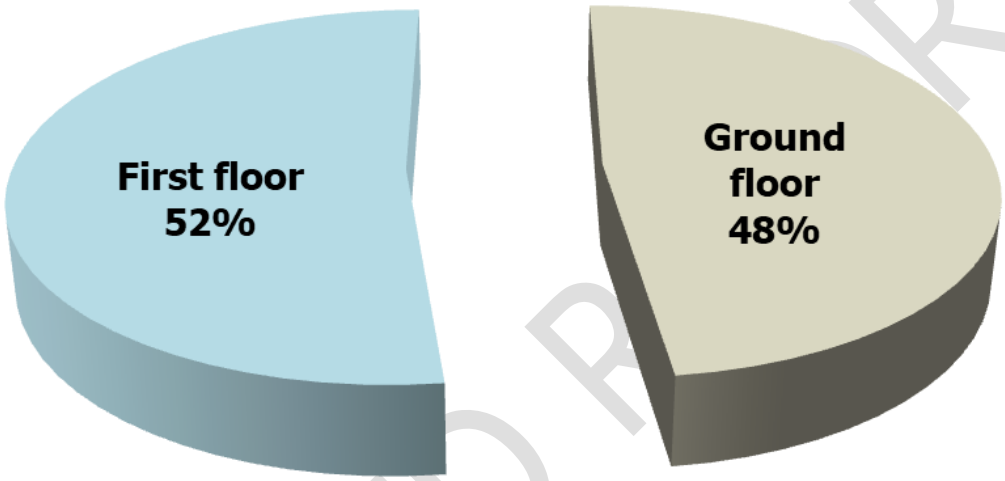


Figure 5: Energy consumed by lights floor-wise

The above analysis shows the fans in the **first floor consumes 52%** whereas the ones in the **ground floor consume 48%** of the total power consumed by lights.

4.6.5 Site investigation observations

Some of the points noticed are as follows:

1. All lights are in working conditions
2. Daily monitoring and check is done by the maintenance staff.
3. There was no fuse defect observed.

4.7 Fans

4.7.1 Types of fans based on the numbers

There are a total of **204 fans** in the premises. The following table shows the various types of fans in the premises.

S. No.	Type	Nos.
1	Small motor exhaust fans	8
2	Ceiling fans	196

Table 5: Summary of the types of fans in premise

4.7.2 Types of fans based on the power consumption

The energy consumption of fans is **15,653 kWh** of energy; the following graph shows the type of fans.

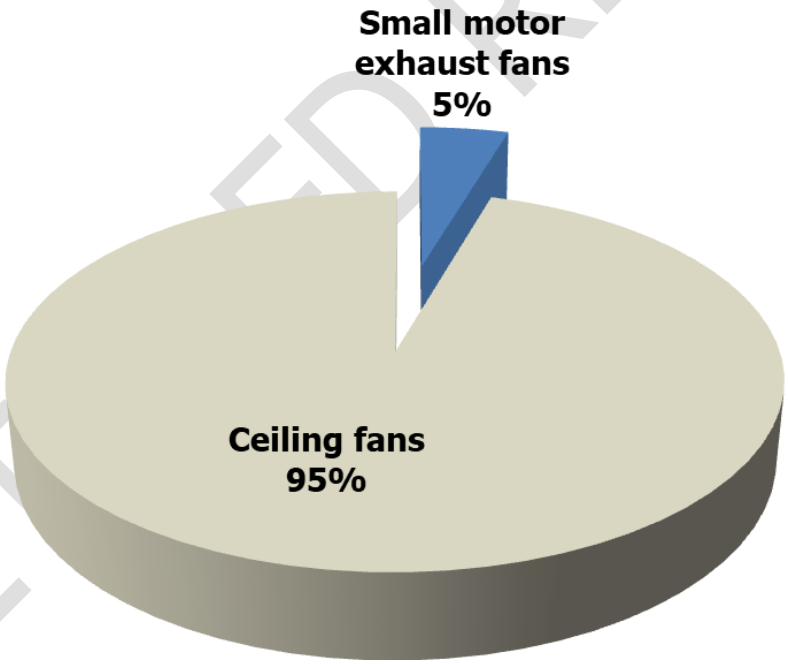


Figure 6: Energy consumed by types of fans in the premise based on the usage study

The analysis of the types of fans in premises shows **Ceiling fans consume 95%** whereas the **Small motor exhaust fans consume 5%** of the total power consumed by fans.

4.7.3 Floor-wise consumption analysis

The following graph shows the floor-wise consumption.

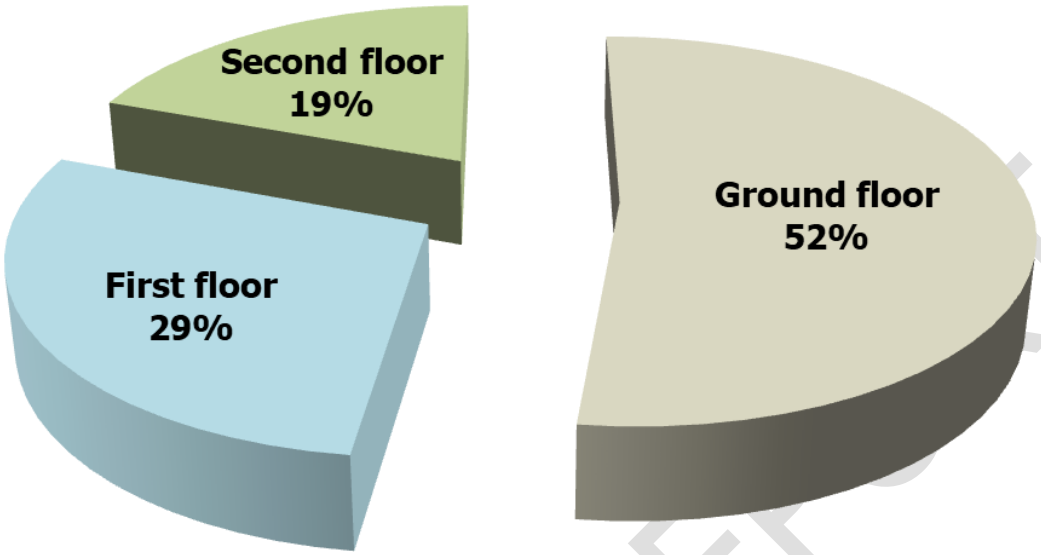


Figure 7: Energy consumed by fans floor-wise

The above analysis shows the fans in the **ground floor consumes 52%** whereas the ones in the **first floor consume 29%** and the ones in the **second floor consume 19%** of the total power consumed by fans.

4.7.4 Site investigation observations

Some of the points noticed are as follows:

1. All fans are in working conditions
2. Daily monitoring and check is done by the maintenance staff and admin staff in an excellent manner.

4.8 Air conditioners

4.8.1 Types of air conditioners based on the numbers

There are **2 air conditioners** on the entire premises**.**

4.8.2 Floor-wise consumption analysis

The energy consumption of air conditioners is **4,422 kWh** of energy; both of the air conditioners are located on the Ground floor and First floor each.

4.8.3 Site investigation observations

Some of the points noticed are as follows:

1. Daily monitoring and check are done by the maintenance staff skilfully.
2. The Outdoor units were not properly cleaned, maintained and had no dust collection problems.

4.8.4 About the replacement of current air conditioners

The current air conditioners are well maintained and energy efficient appliances hence there is no need to change them.

4.8 Equipment

4.8.1 Types of Equipment

There are **14 types of equipment totalling to 269 nos.** in the premises as follows:

S. No.	Name	Nos.
1	Xerox Machine	4
2	Wifi-router	2
3	TV	1
4	R.O. Water Purifier	1
5	Smart board	3
6	Distillation unit	3
7	Refrigerator	5
8	Projector	2
9	Printer	19
10	Desktop computer	163
11	Oven	6
12	Laptop	2
13	CCTV Camera	2
14	Scientific equipment	56

Table 6: Types of equipment in the premise as per the quantity

4.7.2 Types of equipment based on the power consumption

The energy consumption of equipment is **1,52,462 kWh** of energy; the following graph shows the type of equipment.

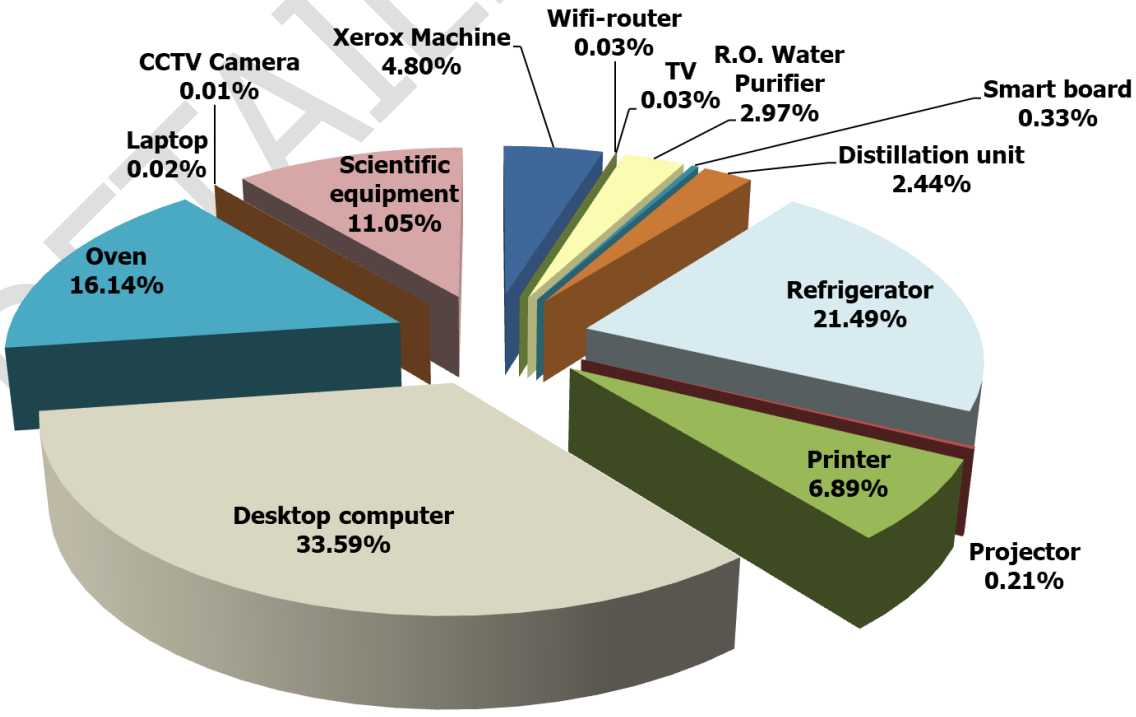


Figure 8: Summary of Energy consumed by equipment in the premises

The above summary shows that **desktop computer consumes more energy at 33.59%** while **refrigerator consumes 21.49%** and the **oven consumes 16.14%** these are maximum consumers as compared to other equipment.

Batteries and Inverter (when used for electrical consumption else it is a battery backup and does not require electricity as an equipment) are also one of the equipment but are excluded in this calculation.

4.8.2 Site investigation observations

Some of the points noticed are as follows:

1. All equipments are in working conditions and daily monitoring and check is done by the maintenance staff and admin staff in an excellent manner.
2. No defect was found in any equipment of electrical consumption.

4.9 Section-wise suggestions related to premises

The following suggestions are to be considered as a ***first priority*** for implementation. These **should be executed within the next 2.5 years from the date of the Report submission or as and when the appliance is not functioning and a replacement is required.** The Institute can execute a plan of action after discussion with Project Head.

Priority 1 – Section 1 – Electromechanical systems

Sub-Section 1 – Lights

The current light analysis shows that there are lights such as Non-LED lights, CFL, Halogen, Mercury lights in the premises. Our technical analysis shows that there would be a reduction of an average of **50% reduction** in energy consumption through lights specifically as a part of the electro -mechanical system if all **Non-LED lights, CFL, Halogen, Mercury lights on all floors** are replaced with an energy efficient appliance whenever the College undergoes renovation.

Sub-Section 2 – Ceiling Fans

The current Fans are in proper working conditions and maintained well. The ceiling fans are in more quantity and consume at least 45W when in use. These should be replaced with energy efficient fans consuming 14W when in use. Our detailed study states that is all the **ceiling fans on all floors** if replaced with star rated appliance results in a reduction of average of **69% reduction** in energy consumption if replaced with energy efficient appliance. It will be suggested to either replace these now if college can have certain plans else the replacement can be done when fans get damaged or are not in working condition.

Sub-Section 2 – Equipment - Desktop computers to laptops

Among all equipment it suggested to replace the desktop computers with laptops as this would be energy efficient. A normal desktop computer consumes on an average 250W and it is to be connected all time when it has to be used. On the contrary a laptop consumes 40W and has a battery backup which lasts up to 4 hours. There is **an average 84% reduction** in energy consumption if replaced with energy efficient appliance which

is a laptop in all the areas of Educational areas. This replacement is however is dependent on a variety of factors as follows.

- Some of the senior staff members may be more convenient with computers, replacement with laptop might result in a change of the working patterns and hours which may affect the productivity.
- Laptops – in case are not handled with care such as if dropped unintentionally might result in data imbalance.
- Students who are not day scholars can use laptop as per their own convenience, whereas in common areas there can a monitoring about the usage hours hence computers may be a preferable option then laptop in certain spaces.
- Similarly depending on the pandemic situation in case it might be possible due to irregular usage the device might have issues while functioning.

Thus the College should analyse the above points and then devise a strategy about the replacement, essentially when the devices get damaged or are not in working condition they can surely be replaced. As well as once they are not in working condition the proposed strategy should be linked towards e-waste management as well.

Priority 2- Section 2 – Building management systems

The College has extreme potential to become 100% energy-efficient premises. In addition to provisions in the electromechanical system, some facilities can be introduced towards building management systems as well. These can be undertaken equally for educational and residential sections.

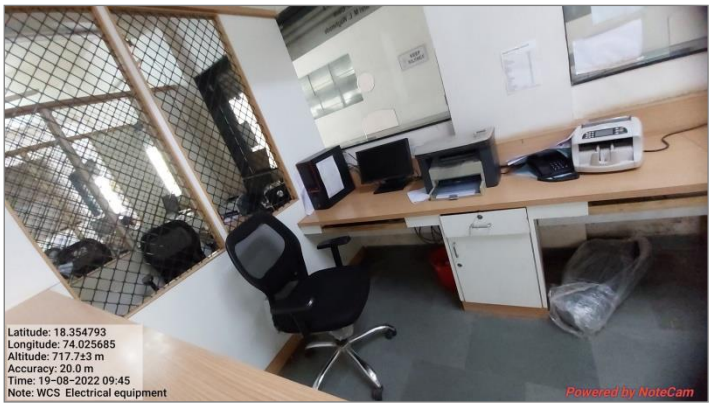
- **Set the BMS time of day schedules** - To suit the minimum occupancy periods of the areas served and implement optimum start-stop incorporating a night purge cycle, session, and holiday schedule.
- **Space temperature Setback -** A temperature setback is a simple strategy to help save utility costs by reducing how often your heating or cooling system operates. *(morrisseyengineering)*
- **Timer control of air conditioners.**
- **Timer control of personal heaters -** Install push button timer control of personal heaters in Residential areas.

5. Towards a Healthy & Sustainable Institution

The following suggestions are to be considered as a ***last priority*** for implementation. These **should be executed within the next 3.5 years** **from the date of the Report submission.** The Institute can execute a plan of action after discussion with Project Head.

- **Cutlery in the Canteen –** The regular plastic and steel plates, and spoons used in Canteen can be replaced with eco-friendly and organic leaves, paper straws, disposable plates, edible spoons, and tables made out of sugarcane waste or bamboo. This will be the first of its kind initiative to be adopted and practiced thus also inculcating healthy practices in students.
- **Terrace farming (Applicable only for the buildings with a flat roof) -** There can be the provision of terrace farming in a designated area of the open space this would enhance the biodiversity and be useful in training students and staff about the healthy practices and food grown which would be used in Canteen.
- **Waste vio –** University can tie-up with our organization and students can be encouraged to collect dry waste and electronic waste such as newspapers, old laptops, and others and hand them over on a weekly or monthly basis thereby making a waste reduction approach in the community. This has benefits such as awareness, and eco-friendly habits in becoming a responsible citizen.
- **Signages –** In addition to the signages being in regular language there can be additional signages in braille language for the specially-abled students.

Energy management initiative at the College



Aspects related to energy usage in the College

6. References

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


WAGHIRE COLLEGE, SASWAD