# ENERGY AUDIT

STUDY PERIOD (TWO YEARS) 2020 – 2021 & 2021 – 2022

**Sustainability study**

# AUDIT REPORT

**Studied for**

Women's Education Society's

**Lady Amritbai Daga College for Women of Arts, Commerce and Science & Smt. Ratnidevi Purohit College of Home Science and Home Science Technology**

Shankar Nagar, Nagpur – 440010, Maharashtra, India

**Studied in the capacity of**

**Accredited with IGBC** and **Certified with ASSOCHAM GEM**

Registered Architect & Green Building Professional

**Studied by**

Greenvio Solutions

Website https://thegreenviosolutions.co.in/

Issued on **28 January 2023** and Valid till **January 2024**

*Background reference image Janko Ferlic on pexels*

# Inferences of the Site visit

Audit conducted by : Nahida Shaikh, IGBC AP, GEM CP, Architect
Accredited and Certified Green Building Professional
ASSOCHAM GEM Certified Professional Registration number 22/718
*Link for the Verification website* https://www.green-assocham.com/manage_gem_cp.php?pageno=12

Institute: L.A.D. & Smt. R.P. College for Women, Nagpur Date: 10-1-2023
Audits covered: Green, Energy, Environment Day: Tuesday

| Observations | Inferences |
|---|---|
| - Immense eco initiatives related to environment<br>- plastic ban, compost,<br>- bio toilet,<br>- xeriscaping,<br>- NO Vehicle zone/ Botanical | - Include smart lighting/landscape<br>- Increase awareness posters/ signages<br>- solar - parking<br>- awareness on compound wall. |

Evidence of the site visit



Signature of Ar. Nahida Shaikh,
ASSOCHAM GEM CP 22/718

L.A.D. & SMT. R.P. COLLEGE FOR WOMEN NAGPUR-10

College Name: L.A.D. & Smt. R.P. College for Women, Nagpur
Signature:
Name: Dr. ARCHANA MASRAM
Designation: Coordinator-IRAC
Date: 10-1-2023

For Greenvio Solutions
Signature:
Name: Mrs F. A. Shaikh
Designation: Manager
Date: 10/01/2023

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# Disclaimer

The Audit Team has prepared this report for the **Women's Education Society's Lady Amritbai Daga College for Women of Arts, Commerce and Science & Smt. Ratnidevi Purohit College of Home Science and Home Science Technology** located at *Shankar Nagar, Nagpur – 440010, Maharashtra, India* 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 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.

**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 thanks the **Women's Education Society's Lady Amritbai Daga College for Women of Arts, Commerce and Science & Smt. Ratnidevi Purohit College of Home Science and Home Science Technology, 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 due to **Adv. Sunil V. Manohar,** President; **Dr. Avinash Deshmukh,** Vice President; **Mr. Kishore Dewani,** Vice President; **Mr. Murali M. Pantula,** Treasurer; **Dr. Shyamala Nair,** Secretary; **Dr. Nanda Rathi,** Jt. Secretary and everyone from the Management.

Our heartfelt thanks to Chairperson of the entire process **Dr. Pooja Pathak,** Officiating Principal for the valuable inputs.

We are also thankful to **College's Task force the faculty members** who have collected data required

**Mrs. Maya Jadhao**, Asso. Prof. Dept. Botany; **Ms. Madhavi Gaikwad**, Asso. Prof. Dept. Botany; **Dr. Ashwini Balki**, Asst. Prof. Dept. Biotechnology; **Dr. Lata Katre**, Asst. Prof. Dept. Botany; **Ms. Mrunali Malkhede**, Asst. Prof. Dept. Biotechnology and **Ms. Mugdha Ranganath**, Asst. Prof. Dept. Biotechnology.

We highly appreciate the assistance of Non-teaching staff members - **Mrs. Lalita Renke, Mrs. Anita Sontakke** and 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

# Contents

# 1. Introduction

## 1.1 About the Institution

The Lady Amritbai Daga College for Women of Arts, Commerce & Science and Smt. Ratnidevi Purohit College of Home Science and Home Science Technology is a premier Women's College in Central India in existence for the last 82 years with its goal centered around women's progress in educational, social and cultural fields. **It was established at a time when a women's College was considered a path breaking venture. The beginnings were humble.**

**The College known as "College of Arts for Women" from 1932 to 1935 and as "Central College for Women" from 1935, moved to its own building in 1942 on a sprawling campus of 26 acres of land donated by the Governor Central Provinces and Berar in 1940 at Seminary Hills.**

Today the versatility of the range of its programmes is its strength. **The original strength was of 23 students and presently the College has more than 4,000 students on roll in the Junior and Senior College.** The handful of staff, is now approximately 300 involved in the faculties of Arts, Science, Home Science, (B.Sc.,H.Sc. and B.Tech) and Commerce.

**The institution has completed 82 years of sustained progress in the field of empowering women through access to higher education.** Poised for further growth and expansion since its platinum year, the College has introduced non-conventional, innovative courses. These courses are designed to support self-help initiatives and will go beyond the traditional core degree requirements which also continue to take up community imperatives to fulfil academic social responsibilities through training initiatives in the four villages adopted by the college.

**The College started initially with only the Arts faculty, today offers multiple courses in different faculties at Under Graduate, Post Graduate and Junior College level.**

## 1.2 Statements of the Institution

### 1.2.1 Vision

The College proposes *"To develop the institute into a reputed brand name for excellence in academics and empower women with higher learning and research capabilities through dynamic and value based education for global competency and strength of character."*

### 1.2.2 Mission

The College adheres and focuses "*To foster higher education In women and thereby enlighten and empower them."*

### 1.2.3 Aim

The College is working towards aim of being *"Centered around women's progress in educational, social and cultural fields."*

### 1.2.4 Motto

The College channelizes its efforts towards the motto of *"Women Empowerment."*

### 1.2.5 Objective

It is the objective of the College is:

- *To introduce new courses and reinforce existing ones within the framework of the University norms.*
- *To honour academic scholarship and outstanding achievements in sports and extracurricular activities.*
- *To develop amongst its students, an academic as well as all round competency.*
- *To foster value-based, creative and critical learning.*
- *To hone skills for living in a technologically globalized and ecologically aware, environment.*
- *To ensure awareness of gender rights and gender justice in the institution.*
- *To develop amongst its students a commitment to Society.*
- *To promote life-long learning through proactive teaching and learning process.*
- *To develop in its culture a commitment to excellence.*

## 1.3 Assessment of the Institute

### 1.3.1 Affiliations

The Institute is affiliated to **Rashtrasant Tukadoji Maharaj Nagpur University (R.T.M.U.N.),** formerly Nagpur University, is a public state university located in Nagpur, Maharashtra. It is one of India's oldest universities, as well as the second oldest in Maharashtra.

### 1.3.2 Accreditation

The following are details of the accreditation awarded by the National Assessment & Accreditation Council (NAAC) to the College.

| Cycle | First | Second | Third |
|---|---|---|---|
| **CGPA** | 84.25 | 3.11 | 3.1 |
| **Grade** | A | A | A |
| **Year** | 2003 | 2011 | 2016 |

*Table 1: NAAC Accreditation details of the Institute*

The College is due to enter its Fourth cycle of NAAC.

### 1.3.3 Certification

The College has received the following Certifications

- NIRF – Participated in the National Institutional Ranking Framework.
- AISHE – The All India Survey of Higher Education code is C-18237.

## 1.4 Infrastructure of the Institute

The college has two Campuses one is situated at Shankar Nagar and another at Seminary Hills. There following infrastructure facilities are available at present:

- *Around 7 Smart (Digitally enabled) classrooms.*
- *Seminar Halls for conducting seminars, association meetings, paper presentations, and various teaching-learning activities.*
- *Library with OPAC, Audio Visual Section for visually impaired students to listen audio books; Abrar the audio book reader is also available for these students. Library is partially*

*automated with SOUL 2.0 software at both the campuses.*

- *The Shankar Nagar campus has around 14 laboratories for the Faculty of Science like Microbiology, Biochemistry, Biotechnology, Zoology , Applied Electronics, HMCT, Interior Design , Cosmetic Technology provide advanced experiential learning.*
- *The Seminary Hills Campus has around 20 Laboratories with one Research lab which has all modern facilities required for the Research as Brookfield Viscometer, Single Pan, pH Meter, Penetrometer, Spectrophotometer, and Laptop. Department Of HMCT has modern equipment like under counter Refrigerator, Ice machine, bottle cooler rack and display counter with adjustable temperature.*
- *Shankar Nagar campus has one Big Auditorium Justice BhavanishankarNiyogi Hall having accommodation capacity of 1000 students as well an additional Conference Hall (closed auditorium) having capacity of 200 students. Similarly Seminary Hills Campus has D. J. Deshmukh Hall having capacity of 300 students.*
- *Department of Botany has maintained a Botanical Herbal Garden. Department of Zoology & Applied Electronics have started Manure Production unit and managing the garbage generated at both the campuses.*
- *Sports facilities - include – Indoor sports include 1- Gymnasium Hall , 1-Table tennis Table, 3-Carrom, Karate, 1 Electronic Tread Mills, 1 Rowing Machine, 1 Electronic Bicycle , 1 Cross Trainer, Functional Trainer. While the Outdoor sports include - Basketball Court -1, Volleyball Court-1 , Kho-Kho, Court- 1, Kabaddi Ground, Cricket Pitches -2 Half Pitches ( 1 Cement -1 Mud Wickets)*
- *The Department of History has collection of rare coins.*
- *The Department of Geography has Tracing table, A-View Open access software for virtual meetings and Nagpur district atlas contains nine major maps, two satellite images of Nagpur city of 2005, World Clock, Survey instruments.*
- *The Department of Psychology performs Intelligence testing, Personality testing for students and Aptitude testing for junior college students and on the basis of aptitude guidance is provided for selection of further studies also personality testing is also carried out Clinical testing like anxiety, stress, and depression .The testing tools are approved by American Psychological Association.*
- *The college cafeteria at both the campuses caters hygienic food to staff and students. The canteen works under supervision of Canteen Committee and Health Committee. The food menu and the rate are decided by the Canteen Committee.*
- *There are Hostel facilities for outside girl students in the premises of both campuses.*

# 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 **2,896 female students** on the premises.

### 2.1.2 Staff data

| Type | Male | Female | Total |
|---|---|---|---|
| **Teaching staff** | 1 | 54 | **55** |
| **Non-Teaching staff** | 28 | 35 | **63** |
| **Total Staff Members** | **29** | **89** | **118** |

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

The staff data shows the premises had a total of **118** 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 **3,123 female students** on the premises.

### 2.2.2 Staff data

| Type | Male | Female | Total |
|---|---|---|---|
| **Teaching staff** | 01 | 64 | **65** |
| **Non-Teaching staff** | 33 | 38 | **71** |
| **Total Staff Members** | **34** | **102** | **136** |

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

The staff data shows the premises had a total of **136** Staff Members.

## 2.3 Total College Area & College Building Spread Area

The **total site area is 30.10 acres** & **total Built-up area of College is 4,83,232 sq. ft. for around 3,014 populace footfalls.**

## 2.4 College Infrastructure

### 2.4.1 Establishment

**The College was established in 1932.**

### 2.4.2 Spatial Organisation

The College has ample and wide open classes with facilities appropriate for an educational space. There are open spaces with a beautiful entrance approach. The balance of hardscape and softscape provides a landscape serene ambience. **Overall the Infrastructure of the Building is excellent in terms of the Architecture Design.**

### 2.4.3 Operation and maintenance of the premises

The data collection session was held with the staff regarding the operation and working hours. The schedule is mentions that the College is working Monday to Saturday with timings being 07:00 hours to 16:00 hours.

# 3. Green Building Study as a Research based technical audit

## 3.1 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.

## 3.2 Analysis of the Green Building Study Audit

The procedure included detailed verification for the following:

**Energy Audit**

- Analysis of the Lights, Fans, AC, 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 campus; Rainwater harvesting and Wastewater treatment on the 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 the premises
- Analysis of the flora and fauna of the 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 the admin department, actual inventory, investigation to check the operation and maintenance, analysis of the data collection, and preparation of the Report.

## 3.4 Activities undertaken for the Green Building Study Audit

- Allotment and Initiation by the Institute
- Survey of students and staff completed
- Site visit at the Institute
- Submission of the Certificate

## Induction Meeting

Institute: L.A.D. & Smt. R.P. College for Women, Nagpur Date: 10-1-2023

Audits covered: Green, Energy, Environment Day: Tuesday

| S. No | Name | Designation | Signature |
|---|---|---|---|
| 1. | Mrs. Farida Shaikh | Project Manager | |
| 2. | Ar. Nalida Abdulla | IGBC CoFM CP | |
| 3. | Dr. Pooja Pathak | Principal | Pooja Pathak |
| 4. | Dr. Archana Masram | IQAC-coordinator | |
| 5. | Mrs. Maya Jadhao | Incharg-Green Audit | |
| 6. | Ms. Madhavi Gaikwad | member | |
| 5. | Ms. Kanchan Bade | IQAC Cocoordinator | |
| 6. | Dr. Surashmie Kaalmegh | Criteria-7-Head | |
| 7. | Dr. Chasita Patil | Criteria-7 Head | |
| 8. | Dr. Ashwini Balkhi | member | |
| 9. | Mrs. Mrunali Malkhede | member | |
| 10. | Lalita Renke | member | Mrs. L.P. Renke |
| 11. | Anita Sontakke | member | |

L.A.D. & Smt. R.P. College for Women, Nagpur
College Name:
Signature:
Name: Dr. ARCHANA MASRAM
Designation: Coordinator, IQAC
Date: 10-1-2023

For Greenvio Solutions
Signature:
Name: Mrs F. A. Shaikh
Designation: Manager
Date: 10/01/2023

## Exit Meeting

Institute: L.A.D.& Smt. R.P. College for Women, Nagpur Date: 10-1-2023

Audits covered: Green, Energy & Environment Day: Tuesday

| S. No | Name | Designation | Signature |
|---|---|---|---|
| 1. | Mrs. Farida. A Shaikh | Project Manager | |
| 2. | Ar. Nalida Abdulla | IGBC; GIMEP | |
| 3. | Dr. Pooja Pathak | Principal | Prof. Pathak |
| 4. | Dr. Archana Masram | IQAC-Coordinator | |
| 5. | Mrs. Maya Jadhao | Incharge-Green Audit | |
| 6. | Ms. Madhavi Gaikwad | Member | |
| 7. | Ms. Kanchan Bade | IQAC-Coordinator | |
| 6. | Dr. Sushmie Kaalmegh | Criterion 7- Head | |
| 7. | Dr. Chaitra Patil | Criterion 7- Head | |
| 8. | Dr. Ashwini Balki | member | |
| 9. | Ms. Mrunali Malkhede | Member | mrunali |
| 10. | Lalita Renke | Member | M&L P. Renke |
| 11. | Anita Sontakke | member | |

L.A.D.& Smt. R.P. College for Women,
College Name: Nagpur
Signature:
Name: Dr. ARCHANA MASRAM
Designation: Coordinator, IQAC
Date: 10-1-2023

For Greenvio Solutions
Signature:
Name: Mrs F. A. Shaikh
Designation: Manager
Date: 10/01/2023

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# 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 solar panels in the premises.

### 4.1.2 Secondary sources

These are available in the form of Gas cylinders, Inverters, Diesel generator for general and backup purposes. The details are documented below:

| S.no. | Premises | Nos. of gas cylinders required | Amount spent | Inverter at campus-1 |
|---|---|---|---|---|
| 1 | Chemistry Dept.at Campus-1 | 8 cylinders per year | 8,960/- per year | |
| 2 | Biotechnology Dept. at Campus-1 | 3 cylinders per year | 3,360/-per year | |
| 3 | Microbiology Dept. at Campus-1 | 2 cylinders per year | 2,240/-per year | |
| 4 | Canteen at Campus-1 | 6-8 cylinders per month | 6,720/- to 8,960/- per month | |
| 5 | Home Economics Dept. At Campus-1 | 6-7 cylinders per year | 6,720/- to 7,840/- per year | 01 |
| 6 | Textile Dept. at Campus-2 | 2 cylinders per year | 2,240/- per year | |
| 7 | Chemistry Dept. at Campus-2 | 3 cylinders per year | 3,360/- per year | |
| 8 | HMCT Dept. at Campus-2 | 36 cylinders per year | 40,320/- per year | |
| 9 | Cosmetic Dept. at Campus-2 | 20 cylinders per year | 22,400/-per year | |
| 10 | Home Science Dept. at Campus-2 | 6 cylinders per year | 6,720/- per year | |

*Table 4: Details of the gas cylinders in the premises*

## 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.

## 4.3 Actual Electrical Consumption as per Bills

### 4.3.1 Consumption study

The admin department had shared the bills for Meter which is connected to the Building and is the main source of energy supply. The details are documented below.

| Sr.no | Month | Year | Units consumed | Amount |
|---|---|---|---|---|
| **Consumer No.419990008991 at campus 1** | | | | |
| **1** | January | 2020 | 6,360 | 86,756.49 |
| **2** | February | 2020 | 6,021 | 83,461.10 |
| **3** | March | 2020 | 6,021 | 81,494.04 |
| **4** | April | 2020 | 6,140 | 90,745.87 |
| **5** | May | 2020 | 6,149 | 90,745.87 |
| **6** | June | 2020 | 15,431 | 31,292.00 |
| **7** | July | 2020 | 3,661 | 52,867.39 |
| **8** | August | 2020 | 3,647 | 53,166.75 |
| **9** | September | 2020 | 4,306 | 61,295.71 |
| **10** | October | 2020 | 4,325 | 59,932.15 |
| **11** | November | 2020 | 3,343 | 49,587.24 |
| **12** | December | 2020 | 3,140 | 47,501.28 |
| **13** | January | 2021 | 2,653 | 41,982.94 |
| **14** | February | 2021 | 2,881 | 44,921.89 |
| **15** | March | 2021 | 2,885 | 44,235.93 |
| **16** | April | 2021 | 2,216 | 35,869.72 |
| **17** | May | 2021 | 2,249 | 35,869.46 |
| **18** | June | 2021 | 2,536 | 39,146.81 |
| **19** | July | 2021 | 2,856 | 42,992.59 |

| | | | | |
|---|---|---|---|---|
| **20** | August | 2021 | 3,606 | 51,792.04 |
| **21** | September | 2021 | 3,887 | 55,007.36 |
| **22** | October | 2021 | 3,560 | 51,088.76 |
| **23** | November | 2021 | 3,111 | 45,896.73 |
| **24** | December | 2021 | 3,140 | 47,501.28 |
| **25** | January | 2022 | 2,971 | 44,176.88 |
| **26** | February | 2022 | 2,970 | 44,552.21 |
| **27** | March | 2022 | 4,869 | 66,461.25 |
| **28** | April | 2022 | 7,058 | 92,998.73 |
| **29** | May | 2022 | 5,704 | 77,375.63 |
| **30** | June | 2022 | 5,940 | 90,139.29 |
| **31** | July | 2022 | 6,563 | 99,374.00 |
| **32** | August | 2022 | 6,539 | 98,877.38 |
| **Consumer No.419990158372 at campus 1** | | | | |
| **1** | January | 2020 | 1,917 | 27,344.41 |
| **2** | February | 2020 | 1,922 | 27,393.24 |
| **3** | March | 2020 | 1,467 | 21,173.73 |
| **4** | April | 2020 | 642 | 11,205.12 |
| **5** | May | 2020 | 717 | 12,023.66 |
| **6** | June | 2020 | 952 | 14,536.13 |
| **7** | July | 2020 | 1,235 | 17,788.15 |
| **8** | August | 2020 | 1,081 | 16,130.30 |
| **9** | September | 2020 | 1,452 | 20,354.17 |
| **10** | October | 2020 | 1,521 | 21,107.86 |
| **11** | November | 2020 | 1,064 | 16,177.70 |
| **12** | December | 2020 | 1,203 | 17,845.19 |
| **13** | January | 2021 | 1,183 | 17,551.48 |
| **14** | February | 2021 | 1,336 | 19,700.21 |
| **15** | March | 2021 | 1,088 | 20,711.10 |
| **16** | April | 2021 | 923 | 14,282.06 |
| **17** | May | 2021 | 1,116 | 16,763.09 |
| **18** | June | 2021 | 1,166 | 16,956.51 |
| **19** | July | 2021 | 1,527 | 22,723.80 |
| **20** | August | 2021 | 1,732 | 23,804.79 |

| | | | | |
|---|---|---|---|---|
| **21** | September | 2021 | 1,629 | 21,816.61 |
| **22** | October | 2021 | 1,538 | 21,582.85 |
| **23** | November | 2021 | 1,452 | 20,351.23 |
| **24** | December | 2021 | 1,203 | 17,845.19 |
| **25** | January | 2022 | 1,237 | 18,105.57 |
| **26** | February | 2022 | 1,220 | 17,945.11 |
| **27** | March | 2022 | 2,570 | 39,306.64 |
| **28** | April | 2022 | 3,752 | 50,093.01 |
| **29** | May | 2022 | 3,462 | 52,644.83 |
| **30** | June | 2022 | 3,138 | 40,824.20 |
| **31** | July | 2022 | 2,302 | 37,552.58 |
| **32** | August | 2022 | 2,284 | 40,415.47 |
| **33** | September | 2022 | 2,885 | 43,892.65 |
| **34** | October | 2022 | 2,161 | 34,390.17 |
| **Consumer No.4199901587001 at campus 2** | | | | |
| **1** | January | 2020 | 3,558 | 39,895.86 |
| **2** | February | 2020 | 3,948 | 44,057.94 |
| **3** | March | 2020 | 3,948 | 43,566.29 |
| **4** | April | 2020 | 3,673 | 29,410.32 |
| **5** | May | 2020 | 4,767 | 31,371.02 |
| **6** | June | 2020 | 544 | 4,695.09 |
| **7** | July | 2020 | 590 | 5,055.07 |
| **8** | August | 2020 | 457 | 4,014.27 |
| **9** | September | 2020 | 550 | 3,959.50 |
| **10** | October | 2020 | 409 | 3,638.65 |
| **11** | November | 2020 | 370 | 3,333.46 |
| **12** | December | 2020 | 326 | 2,989.13 |
| **13** | January | 2021 | 308 | 2,848.27 |
| **14** | February | 2021 | 266 | 2,519.61 |
| **15** | March | 2021 | 289 | 7,404.16 |
| **16** | April | 2021 | 283 | 2,580.34 |
| **17** | May | 2021 | 304 | 2,738.32 |
| **18** | June | 2021 | 269 | 2,475.02 |
| **19** | July | 2021 | 268 | 2,467.50 |

| | | | | |
|---|---|---|---|---|
| **20** | August | 2021 | 262 | 2,422.35 |
| **21** | September | 2021 | 288 | 2,617.96 |
| **22** | October | 2021 | 316 | 2,828.60 |
| **23** | November | 2021 | 209 | 2,023.63 |
| **24** | December | 2021 | 270 | 2,008.59 |
| **25** | January | 2022 | 147 | 1,557.21 |
| **26** | February | 2022 | 174 | 1,760.33 |
| **27** | March | 2022 | 169 | 1,753.39 |
| **28** | April | 2022 | 201 | 1,979.19 |
| **29** | May | 2022 | 183 | 1,843.56 |
| **30** | June | 2022 | 240 | 2,490.87 |
| **31** | July | 2022 | 363 | 5,217.83 |
| **32** | August | 2022 | 371 | 3,596.85 |
| **33** | September | 2022 | 363 | 3,529.31 |
| **Consumer No.419990018341 at campus 2** | | | | |
| **1** | January | 2020 | 3,240 | 44,244.84 |
| **2** | February | 2020 | 3,032 | 41,888.92 |
| **3** | March | 2020 | 3,032 | 41,480.35 |
| **4** | April | 2020 | 2,923 | 44,955.78 |
| **5** | May | 2020 | 6,347 | 9,502.37 |
| **6** | June | 2020 | 1,265 | 21,520.15 |
| **7** | July | 2020 | 1,544 | 24,586.33 |
| **8** | August | 2020 | 1,349 | 22,500.78 |
| **9** | September | 2020 | 1,360 | 22,522.21 |
| **10** | October | 2020 | 1,842 | 27,857.26 |
| **11** | November | 2020 | 1,441 | 23,355.47 |
| **12** | December | 2020 | 1,249 | 21,347.72 |
| **13** | January | 2021 | 1,283 | 21,721.99 |
| **14** | February | 2021 | 1,367 | 22,732.80 |
| **15** | March | 2021 | 1,355 | 22,461.91 |
| **16** | April | 2021 | 1,147 | 20,257.09 |
| **17** | May | 2021 | 1,149 | 20,271.71 |
| **18** | June | 2021 | 995 | 18,476.30 |
| **19** | July | 2021 | - | 6,714.00 |

| | | | | |
|---|---|---|---|---|
| **20** | August | 2021 | 2,653 | 36,006.63 |
| **21** | September | 2021 | 1,264 | 21,425.04 |
| **22** | October | 2021 | 1,317 | 21,962.18 |
| **23** | November | 2021 | 1,312 | 21,970.90 |
| **24** | December | 2021 | 1,350 | 22,539.74 |
| **25** | January | 2022 | 1,061 | 19,291.16 |
| **26** | February | 2022 | 1,484 | 23,872.27 |
| **27** | March | 2022 | 2,667 | 37,256.61 |
| **28** | April | 2022 | 3,199 | 43,058.09 |
| **29** | May | 2022 | 2,835 | 39,788.09 |
| **30** | June | 2022 | 1,991 | 33,527.51 |
| **31** | July | 2022 | 1,802 | 30,797.43 |
| **32** | August | 2022 | 2,653 | 36,006.63 |
| **33** | September | 2022 | 1,264 | 21,425.04 |
| **34** | October | 2022 | 1,317 | 21,962.18 |
| **35** | November | 2022 | 1,312 | 21,970.90 |
| **36** | December | 2022 | 1,350 | 22,539.34 |
| **Consumer No.419990586978 at campus 2** | | | | |
| **1** | January | 2020 | 2,006 | 22,431.72 |
| **2** | February | 2020 | 2,369 | 26,311.52 |
| **3** | March | 2020 | 2,369 | 26,032.13 |
| **4** | April | 2020 | 2,270 | 18,201.91 |
| **5** | May | 2020 | 4,474 | 5,481.81 |
| **6** | June | 2020 | 714 | 6,025.43 |
| **7** | July | 2020 | 599 | 5,128.49 |
| **8** | August | 2020 | 538 | 4,648.14 |
| **9** | September | 2020 | 621 | 5,297.66 |
| **10** | October | 2020 | 779 | 6,534.08 |
| **11** | November | 2020 | 661 | 5,610.67 |
| **12** | December | 2020 | 727 | 6,127.16 |
| **13** | January | 2021 | 768 | 6,448.94 |
| **14** | February | 2021 | 722 | 6,088.03 |
| **15** | March | 2021 | 682 | 5,761.42 |
| **16** | April | 2021 | 804 | 6,499.82 |

| | | | | |
|---|---|---|---|---|
| **17** | May | 2021 | 675 | 5,529.36 |
| **18** | June | 2021 | 508 | 4,273.01 |
| **19** | July | 2021 | 609 | 4,032.83 |
| **20** | August | 2021 | 441 | 3,768.98 |
| **21** | September | 2021 | 464 | 3,942.01 |
| **22** | October | 2021 | 596 | 4,935.04 |
| **23** | November | 2021 | 645 | 5,303.67 |
| **24** | December | 2021 | 713 | 5,815.23 |
| **25** | January | 2022 | 431 | 3,693.74 |
| **26** | February | 2022 | 741 | 6,025.88 |
| **27** | March | 2022 | 1,192 | 9,621.97 |
| **28** | April | 2022 | 1,420 | 33,364.48 |
| **29** | May | 2022 | 1,102 | 8,768.32 |
| **30** | June | 2022 | 1,004 | 8,941.01 |
| **31** | July | 2022 | 814 | 7,336.92 |
| **32** | August | 2022 | 441 | 3,768.98 |
| **33** | September | 2022 | 464 | 3,942.01 |
| **34** | October | 2022 | 596 | 4,935.04 |
| **35** | November | 2022 | 645 | 5,303.67 |
| **36** | December | 2022 | 713 | 5,815.23 |

*Table 5: Details of the electrical consumption*

The summary of the above study shows the average consumption varies for each month.

### 4.3.2 Solar study

The summary of the study shows there has been a positive impact by the installation of solar panels. Although the effect is very minimal but the process will be gradually improvised in future.

## 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

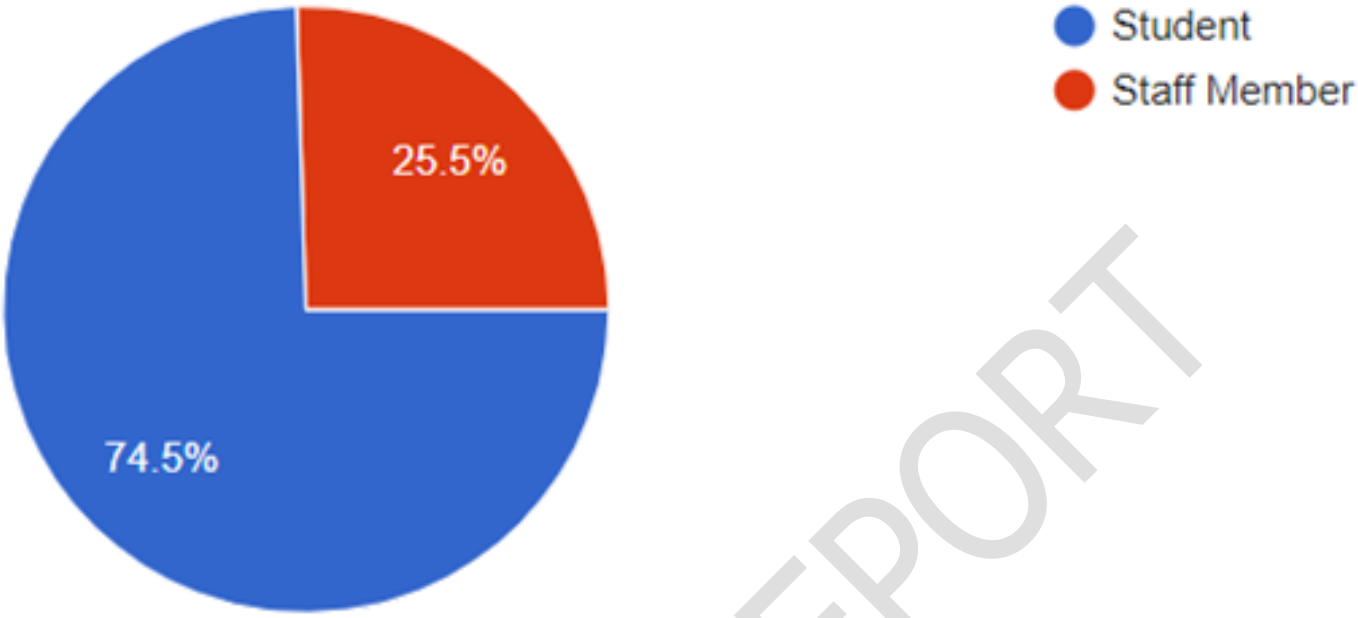



*Figure 1: Participation analysis in the survey*

A total of **102 responses** were received out of which 75% 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%)

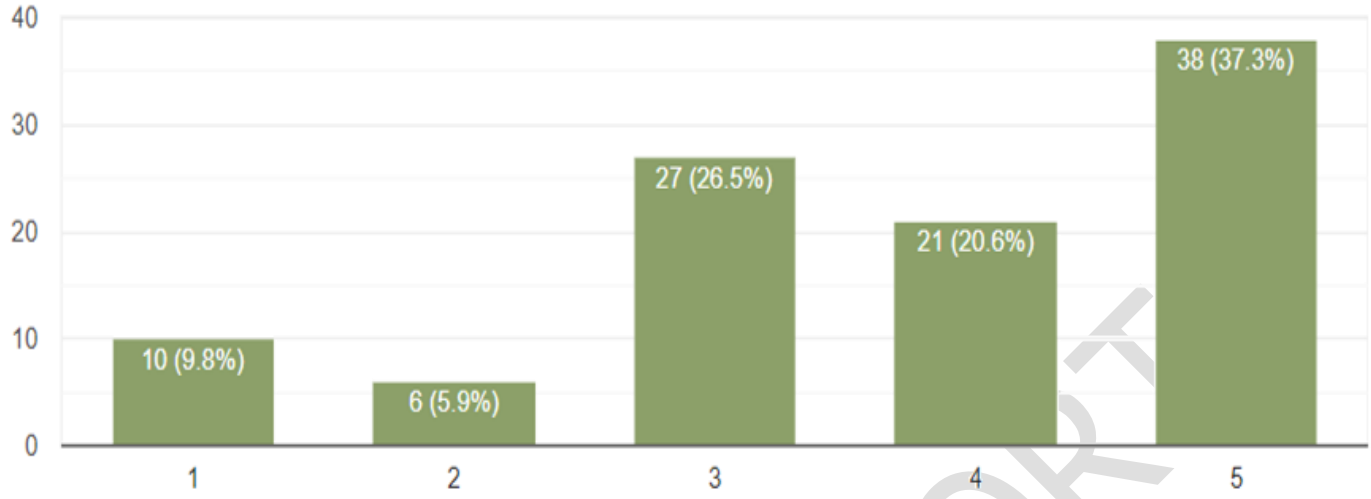



*Figure 2: Energy management practices in college*

The students, staff **(almost 37%) of the responses found the practices to be excellent (rating 5)** and **21% of the responses found practices to be very good (rating 4).**

## 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.

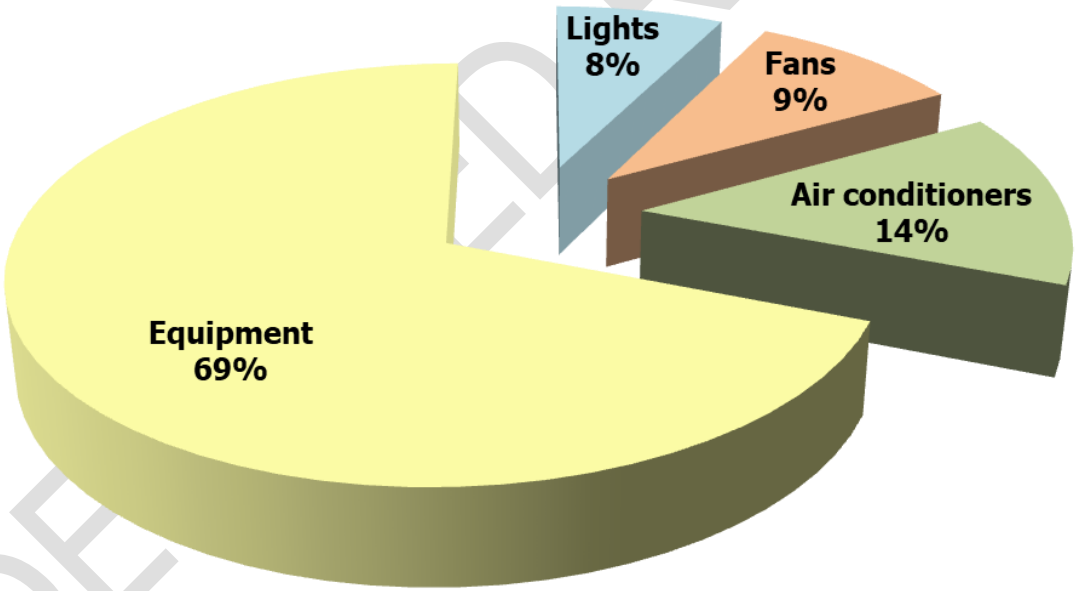



*Figure 3: Summary of the calculated electrical consumption as per inventory*

The above graph shows that equipment consumes 69% whereas the air conditioners consume 14% while the fans consume 9% and the lights consume 8% of the total calculated electrical energy.

## 4.6 Lights

### 4.6.1 Types of lights based on the numbers

There are a total of **910 lights on the premises;** the following table shows the various types of lights on the premises.

| S. No. | Type | Nos. |
|---|---|---|
| **1** | CFL | 25 |
| **2** | Halogen | 1 |
| **3** | LED | 840 |
| **4** | Non-LED | 44 |

*Table 6: Summary of the types of lights on-premise*

### 4.6.2 Types of lights based on the power consumption

The energy consumption of lights is **23,734 kWh** of energy.

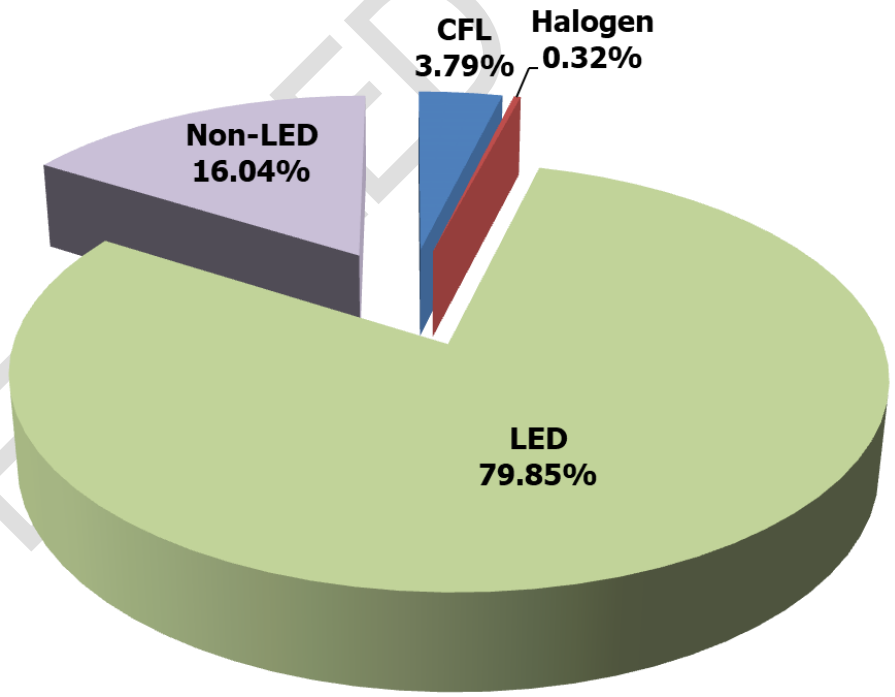



*Figure 4: Energy consumed by types of lights in the premise based on the usage study*

The analysis of the types of Lights on the premises shows that the **LED lights consume 79.85% (approx. 80%)** while the **Non-LED lights consume 16.04%** whereas the **CFL lights consume 3.79%** and the **Halogen lights consume 0.32%**

### 4.6.3 Energy efficiency analysis

#### 4.6.3.1 Alternative energy initiatives practiced

The solar panel system was installed as an experimental basis at both campuses.

- The Shankar Nagar campus installation is above the Principals office with a grid of a few lights and fans at second floor level.
- The Seminary Hills Campus has a digital clock working due to it.

#### 4.6.3.2 Percentage of lighting power requirement met through LED lights

The premise has LED Lights to contribute to 92% in terms of number and **80% of the power requirement** is met through the same. As per our study, we could conclude that both of these are the highest contributions among all the types of lights.

### 4.6.4 Site investigation observations

- All lights are in working conditions.
- There was no fuse defect observed.

### 4.6.5 About the replacement of the lights (Campus-wise)

The Non-LED lights are present in the Shankar Nagar Campus only; the Seminary Hills campus has 100% LED lights consumption. Whenever there is a possibility of replacement the first preference should be given to Non-LED lights and then CFL, Halogen lights as the Non-LED lights are maximum in numbers.

## 4.7 Fans

### 4.7.1 Types of fans based on the numbers

There are a total of **586 fans** on the premises as follows:

| S. No. | Type | Nos. |
|---|---|---|
| **1** | Ceiling fans | 567 |
| **2** | Large motor exhaust fans | 8 |
| **3** | Small motor exhaust fans | 4 |
| **4** | Wall mounted fans | 7 |

*Table 7: Summary of the types of fans in the premises*

### 4.7.2 Types of fans based on the power consumption

The energy consumption of fans is **29,994 kWh** of the energy.

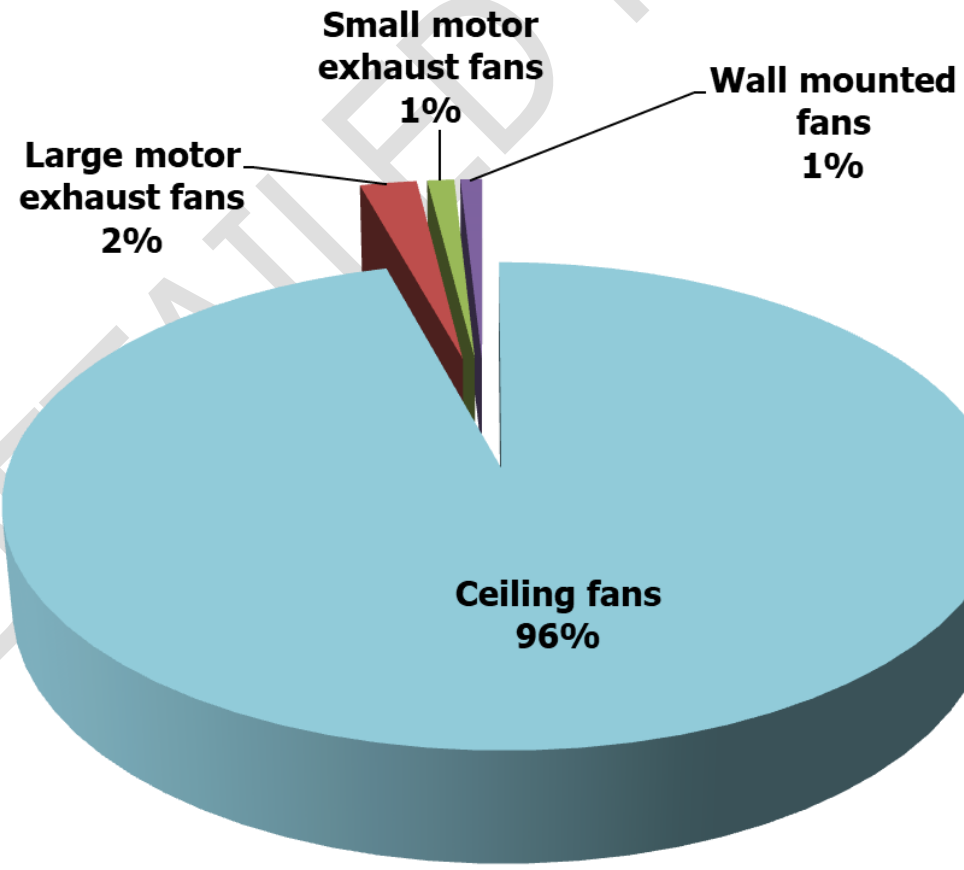



*Figure 5: Types of fans based on power consumption*

### 4.7.3 Energy efficiency-wise consumption analysis

There are no energy efficient fans in the premises.

### 4.7.4 Campus-wise consumption analysis

The following graph shows the Campus-wise consumption of only Ceiling fans since they form a majority.

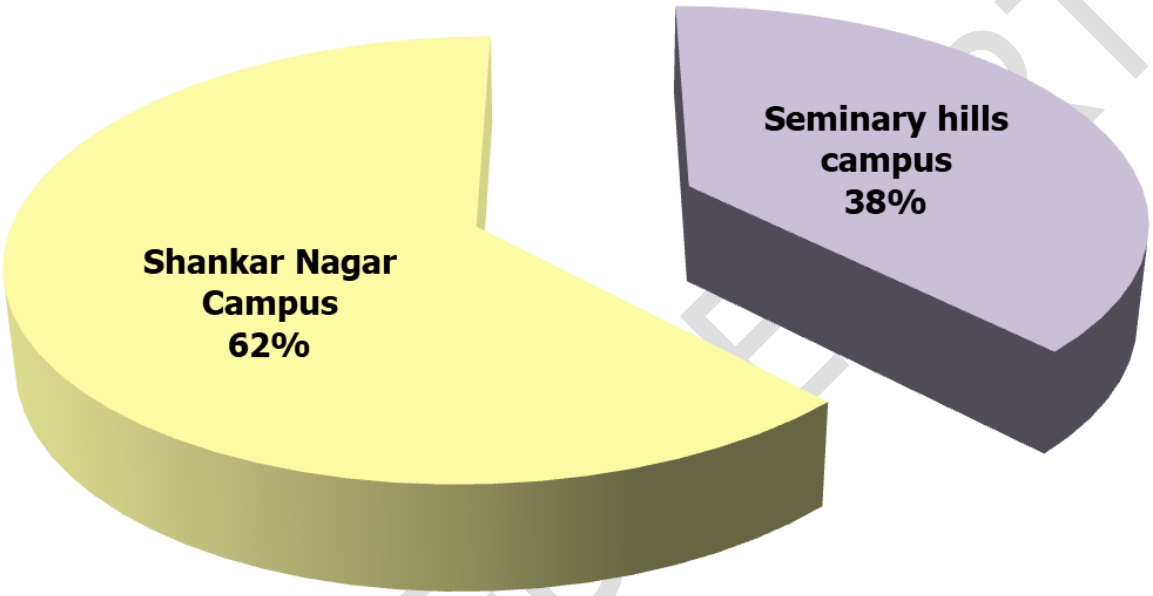



*Figure 6: Energy consumed by fans campus wise*

The above analysis shows the fans in the **Shankar Nagar campus consumes 62%** and the ones in the **Seminary hills campus consumes 38%** of the total power consumed by fans.

### 4.7.5 Site investigation observations

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 **18 air conditioners** on the entire premises**.**

### 4.8.2 Building-wise consumption analysis

The energy consumption of air conditioners is **43,980 kWh** of energy.

### 4.8.3 Energy efficiency-wise consumption analysis

The following graph is documented on the basis of the data collected.

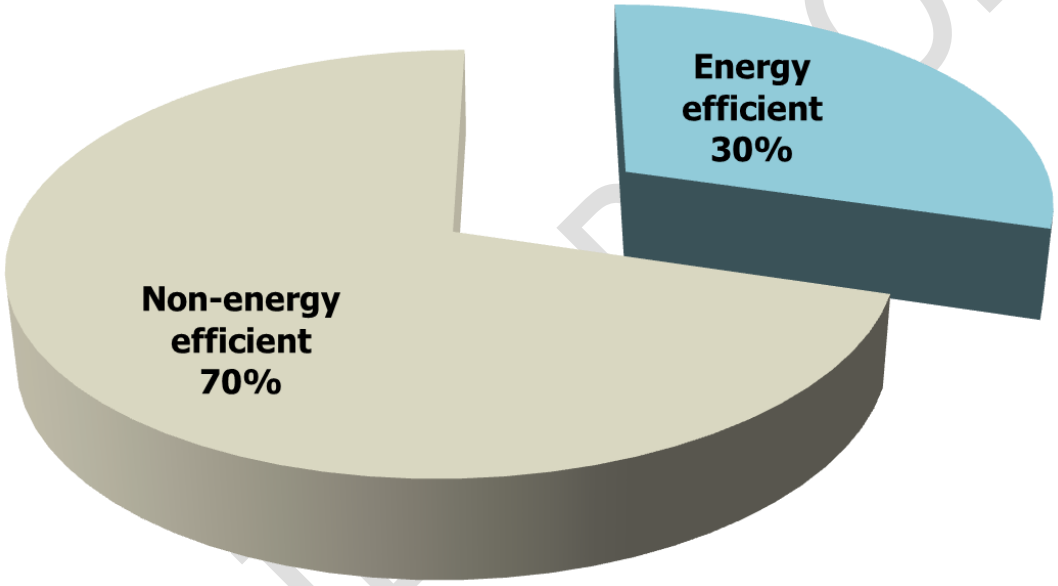



*Figure 7: Analysis based on the energy efficiency*

The documented data shows that around 30% of the air conditioners are energy efficient appliances.

### 4.8.4 Site investigation observations

The Outdoor units are properly cleaned, maintained and had no dust collection problems.

### 4.8.5 About the replacement of current air conditioners

The current air conditioners are well maintained, though there is not an immediate requirement for replacement however, whenever the College undergoes redevelopment there can be provisions for replacement with energy-efficient appliances or new air conditioners that require less power consumption.

## 4.9 Equipment

### 4.9.1 Types of Equipment

There are **232 nos. of key equipment** in the premises as follows

Disclaimer - The College is a regular faculty and a technical premise hence there are certain scientific equipment which are subjective for their usage, thus these have been excluded and the research is based only the genera usage pattern.

| S. No. | Name | Nos. |
|---|---|---|
| 1 | Desktop Computers | 25 |
| 2 | Barcode scanner | 152 |
| 3 | Lift motor | 1 |
| 4 | Oven | 1 |
| 5 | Printer | 4 |
| 6 | Projector | 12 |
| 7 | Refrigerator | 14 |
| 8 | Sanitary incinerator machine | 14 |
| 9 | Water Filter | 2 |
| 10 | Water cooler | 1 |
| 11 | Xerox machine | 2 |
| 12 | Water motor starter | 2 |
| 13 | Key Scientific equipment | 2 |

*Table 8: Types of equipment in the premise as per the quantity*

### 4.9.2 Types of equipment as per their energy contribution

The energy consumption of equipment is **2,19,219 kWh** of energy.

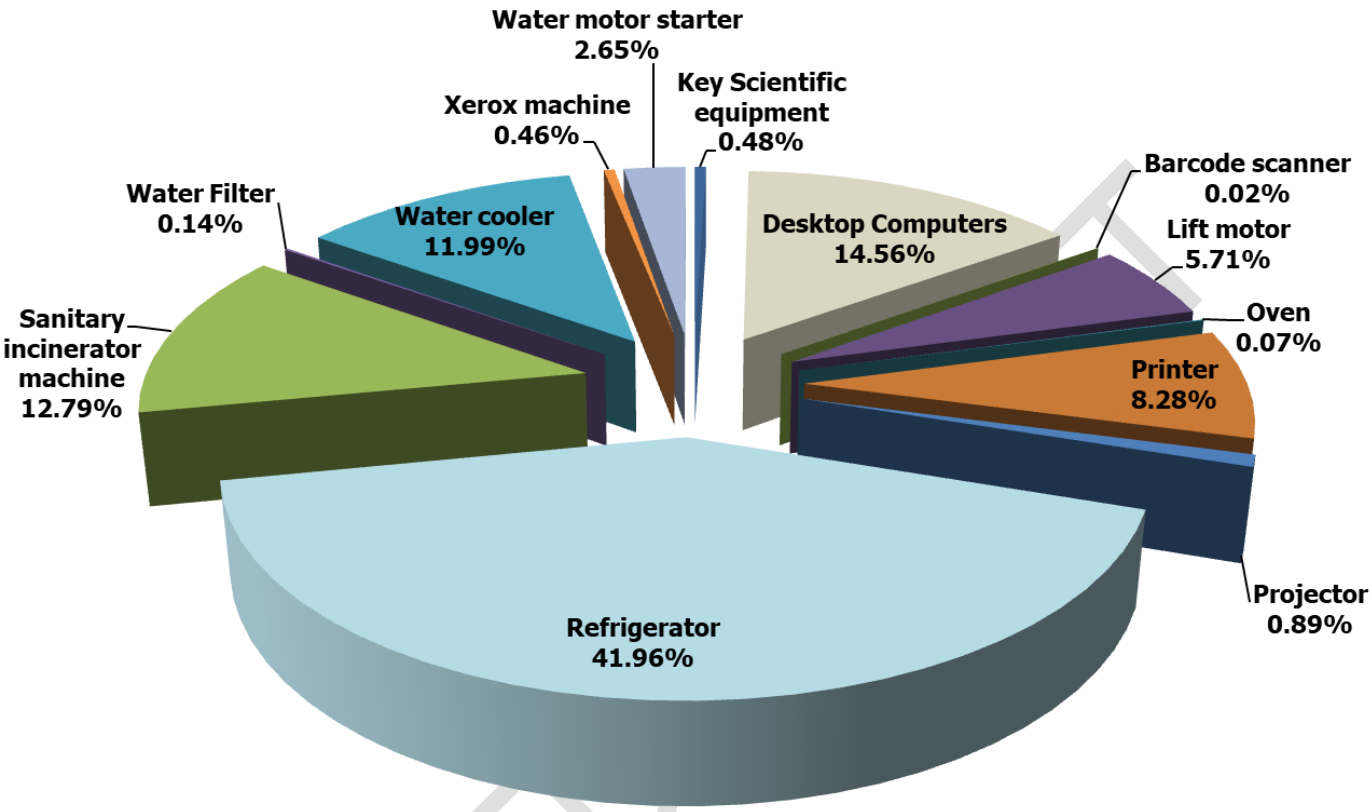



*Figure 8: Summary of Energy consumed by equipment in the premises*

The above summary shows that **refrigerator consumes more energy at 41.96%** while **desktop computer consumes 14.56%** and the **sanitary incinerator machine consumes 12.76%** these are maximum consumers as compared to other equipment.

Inverters and Diesel generator (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.

### 4.9.3 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.

## 4.10 Recommendations for a Sustainable Habitat

Over the time energy efficient appliances have been a boon not only to the energy saving parameters they adhere to but also the eco-friendly habits it helps to inculcate. The Institution such as Schools and Colleges are the best way to implement these initiatives. It creates awareness among the students at a young age. The Institutions also act as a symbol and representative of being an energy efficient premise. Following the analysis we found are some of the suggestions which can be implemented for an energy efficient Institution. This would help in reduction of the current electrical consumption by a major percentage.

The following suggestions are to be considered as a ***first priority*** for implementation. These **should be executed within the next 1.5 to 2.5 years** **from the date of the Report submission.** The Institute can execute a plan after discussion with Project Head.

### Electromechanical systems – Electrical and Lighting

#### Section 1 – Non-LED lights

The current light analysis shows that Non-LED lights consume anywhere between 50W to 54W and even more when in use; these should be replaced with LED lights which consume on an average 12-16W when in use.

Our technical analysis shows that there would be a reduction of an average of **67% reduction** in energy consumption through lights specifically as a part of the electro - mechanical system if all **Non-LED lights on all floors** are replaced with an energy efficient appliance whenever the College undergoes renovation.

#### 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.

## Section 3 – 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.

# 5. Inferences as consolidated study

The following details are consolidated study recommendations related to 'entire Institute' and should be considered as ***second priority*** for implementation, once the section wise recommendations are implemented. The following recommendations should be ***implemented within 2.5 to 3.5 years from the date of the Report submission.*** The Institute can execute a plan of action after discussion with Project Head.

## 5.1 Alternatives to increase renewable energy

### 5.1.1 Solar farms (Applicable to the seminary hills campus)

This option can be explored with due discussion with the surrounding and adjacent farmland owners. This will serve as a noble project and will provide dual benefits to farm land and University w.r.t to electricity bill power reduction.

***Plate 1: Solar farm concept for the Institute (For reference purpose only)***

*Source: Image by Zsuzsa Bóka from Pixabay*

### 5.1.2 Solar parking (Applicable to both the campuses)

The University can turn its existing parking areas into solar panel powered parking areas. This will provide shade and renewable energy benefit to the University.

***Plate 2: Solar parking concept for the Institute (For reference purpose only)***

*Source: Image by https://solarpowerproject.in/solar-panels-for-parking-lots.php*

## 5.2 Alternatives towards Smart premises mechanisms

### 5.2.1 Facility management systems, controls

(Includes electromechanical systems – Electrical, Water)

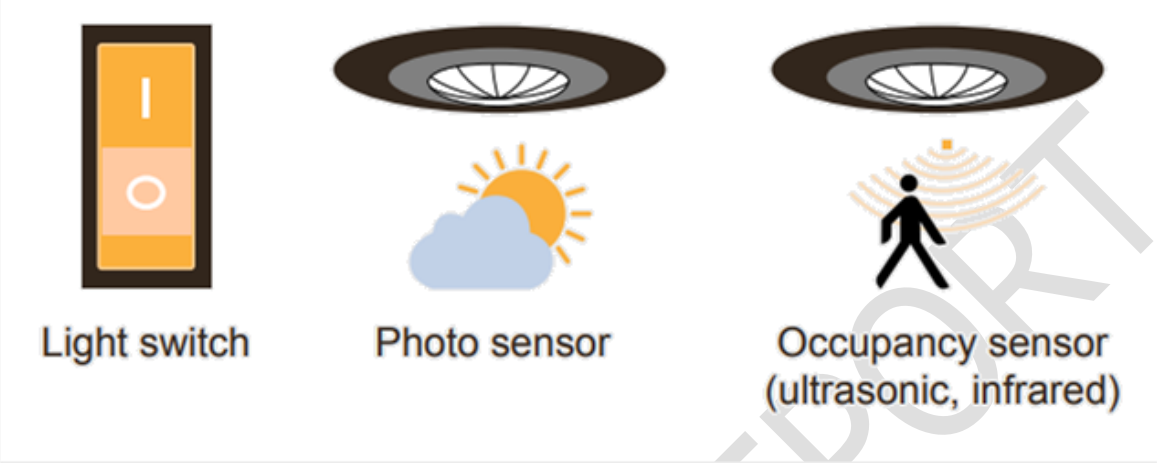
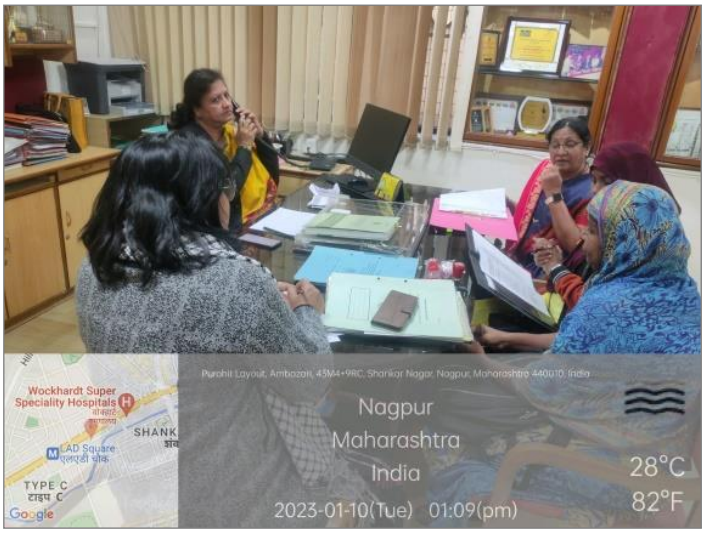



***Plate 3: Understanding the lighting concepts***

Source: https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=NG125PFE4WHMWSYAK8TCAKIHMWX0F4QD

The above diagram provides a detailed study of how the system controls should be incorporated in the premises as fare as lighting systems are considered. The suggestions for this sub-section are listed below.

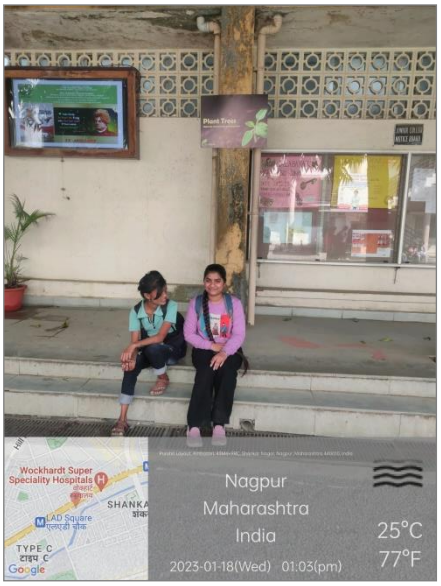
- Install PIR control of the lighting in the toilet areas.
- Install low flow taps with automatic shut off in the toilets.
- Install push button timer control in all rooms lighting and ceiling fans.
- Install Power Electronics control of the Foyer notice board lighting.
- Installation of intelligent lighting controller will help in controlling the lighting energy.
- Use of photo sensor switch for street light controlling helps in conserving the lighting energy.



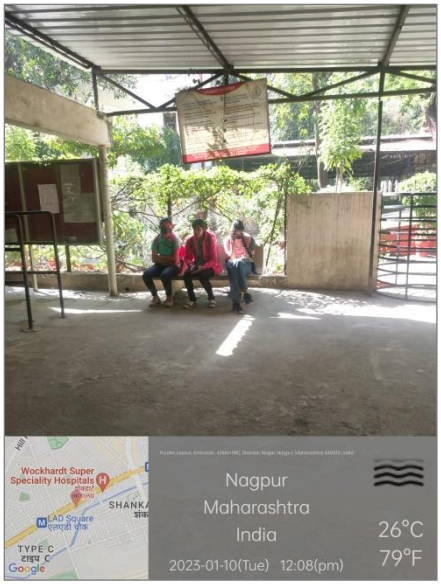


Discussion with the Core Team








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

# 6. References

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