

ENERGY AUDIT REPORT

of
DR. D. Y. PATIL SCHOOL OF ENGINEERING,
Charholi Budruk, Pune 412 105



Year: 2018-19

Prepared by

Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Muktangan English School, Parvati, Pune 411009
Phone: 09890444795, Email: enrichcons@gmail.com



MAHARASHTRA ENERGY DEVELOPMENT AGENCY



Maharashtra Energy Development Agency
(A Government of Maharashtra undertaking)
2nd Floor, MHADA Commercial Complex, Opp. Tridat Nagar, Yerwada, Pune 411 006,
Ph No: 020-26614393/266144403
Email: eee@mahaurja.com, Web: www.mahaurja.com

ECN/2018-19/CR-05/4174

19th September, 2018

**CERTIFICATE OF REGISTRATION
FOR CLASS 'A'**

We hereby certify that, the firm having following particulars is registered with **MAHARASHTRA ENERGY DEVELOPMENT AGENCY (MEDA)** under given category as "Energy Planner & Energy Auditor" in Maharashtra for Energy Conservation Programme of MEDA.

Name and Address of the firm : **Enrich Consultants**
Yashashree, Plot No. 26, Nirmal Bag Society,
Near Mukangan English School,
Parvati, Pune - 411009.

Registration Category : Empanelled Consultant for Energy Conservation Programme

Registration Number : **MEDA/ECN/CR-05/2018-19/EA-03**

- Energy Conservation Programme intends to identify areas where wasteful use of energy occurs and to evaluate the scope for Energy Conservation and take concrete steps to achieve the evaluated energy savings.
- MEDA reserves the right to visit the firm at any time without giving any prior information and canceling the registration, if the information is found incorrect.
- This empanelment is valid till **31st March 2021** from the date of registration, to carry out energy audits under the Energy Conservation Programme
- The Director General, MEDA reserves the right to cancel the registration at any time without assigning any reasons thereof.


(Smita Kudarikar)
General Manager (EC)



Enrich Consultants

Yashashree, 26, Nirmal Bag Society,
Near Mukhtangan English School, Parvati, Pune 411 009
Tel: 09890444795 Email: enrichcons@gmail.com

Ref: EC/DYPSOE/18-19/01

Date: 25/8/2019

CERTIFICATE

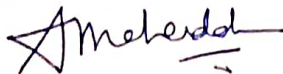
This is to certify that we have conducted Energy Audit at Dr. D. Y. Patil School of Engineering, Charholi Budruk, Pune 412 105, in the Academic year 2018-19

The Institute has adopted following Energy Efficient practices:

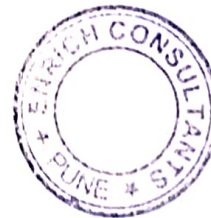
- Usage of Energy Efficient LED Fittings
- Maximum usage of Day Lighting

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Energy Efficient.

For Enrich Consultants,



A Y Mehendale,
Certified Energy Auditor
EA-8192



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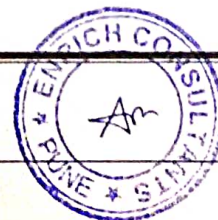
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ACKNOWLEDGEMENT

We at Enrich Consultants, Pune, express our sincere gratitude to the management of Dr. D. Y. Patil School of Engineering, Charholi Budruk Pune 412 105 for awarding us the assignment of Energy Audit of their Charholi campus for the Academic Year: 2018-19.

We are thankful to all Faculty members & staff members for helping us during the field study.



EXECUTIVE SUMMARY

1. Dr. D. Y. Patil School of Engineering, Charholi Budruk, Pune 412 105 consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

2. Present Level of Energy Consumption & CO₂ Emission:

No	Parameter	Energy consumed, kWh	CO ₂ Emissions, MT
1	Total	318515	254.81
2	Maximum	34094	27.28
3	Minimum	16488	13.19
4	Average	26542.9	21.23

3. Various Majors Adopted for Energy Conservation:

- Usage of Energy Efficient LED fittings

4. Usage of Alternate Energy Source:

The College is in a process of installation of 80 kWp Roof Top Solar PV Plant. Therefore as on Date the percentage of usage of Alternate Energy to Annual Energy requirement stands to be zero percent.

5. Percentage of Lighting Power Requirements met by LED bulbs:

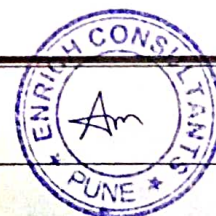
- The total Lighting Load is 24.675 kW.
- The LED Lighting Load is 0.675 kW.
- The percentage of LED to the total annual lighting power requirement is 2.74 %

6. Notes & Assumptions:

1. 1 kWh of Electrical Energy releases 0.8 Kg of CO₂ into atmosphere

ABBREVIATIONS

AC	: Air conditioner
MSEDCL	: Maharashtra Energy Distribution Company Limited
LED	: Light Emitting Diode
kWh	: kilo-Watt Hour
Qty	: Quantity
W	: Watt
kW	: Kilo Watt
PC	: Personal Computer
MT	: Metric Ton



CHAPTER-I

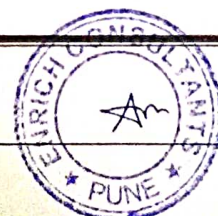
INTRODUCTION

1.1 Objectives:

1. To study Connected Load
2. To study the present Energy Consumption
3. To compute the CO₂ emissions
4. To study usage of Renewable Energy
5. To study usage of LED Lighting

1.2 Table No-1: General Details of Institute:

No	Head	Particulars
1	Name	Dr. D. Y. Patil School of Engineering
2	Address	Charholi Budruk Pune 412 105



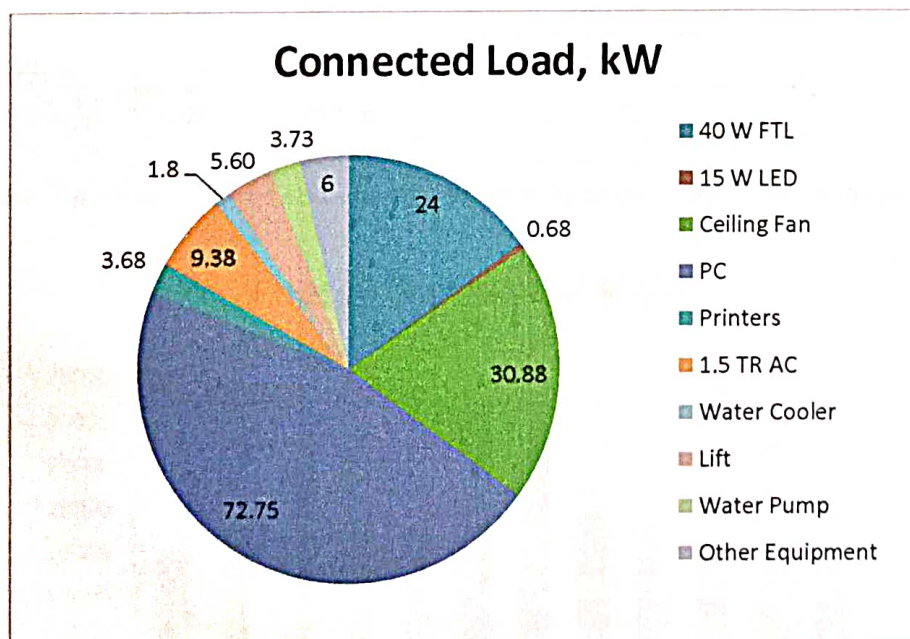
CHAPTER-II STUDY OF CONNECTED LOAD

In this chapter, we present the details of various Electrical loads as under

Table No 2: Details of Overall Connected Load:

No	Equipment	Qty	Load, W/Unit	Load, kW
1	40 W FTL	600	40	24
2	15 W LED	45	15	0.68
3	Ceiling Fan	475	65	30.88
4	PC	485	150	72.75
5	Printers	21	175	3.68
6	1.5 TR AC	5	1875	9.38
7	Water Cooler	4	450	1.8
8	Lift	1	5595	5.60
9	Water Pump	1	3730	3.73
10	Other Equipment	40	150	6
11	Total			158

Chart No 1: Total Connected Load:



CHAPTER-III

STUDY OF ELECTRICAL ENERGY CONSUMPTION

In this chapter, we present the analysis of last year Electricity Bills

Table No 3: Electrical Bill Analysis- 2018-19:

No	Month	Energy Consumed, kWh
1	Apr-18	14119
2	May-18	30109
3	Jun-18	23816
4	Jul-18	27625
5	Aug-18	16488
6	Sep-18	29459
7	Oct-18	34094
8	Nov-18	18086
9	Dec-18	16940
10	Jan-19	32666
11	Feb-19	29734
12	Mar-19	30084
13	Total	318515
14	Maximum	34094
15	Minimum	16488
16	Average	26543

Chart No 2: To study the variation of Month wise Energy Consumption, kWh:

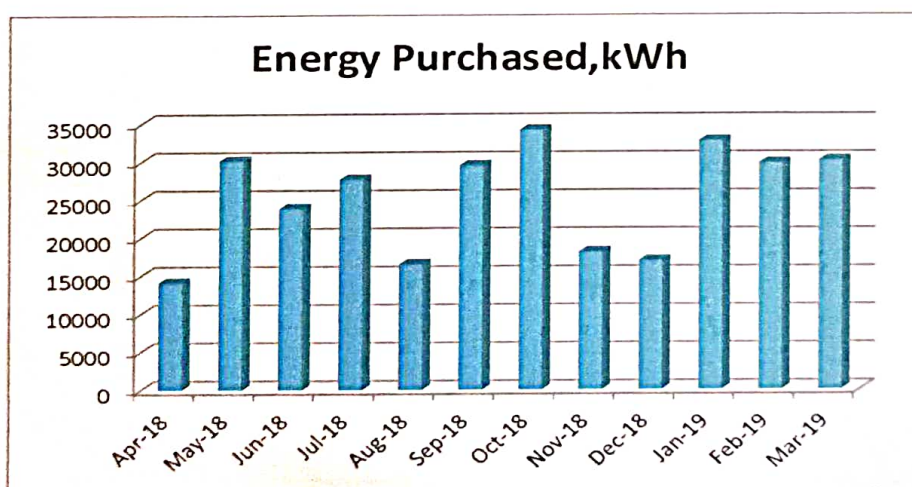
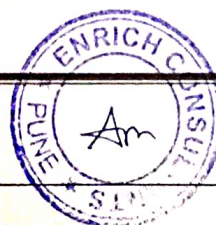


Table No 4: Key observations:

No	Parameter	Energy consumed, kWh
1	Total	318515
2	Maximum	34094
3	Minimum	16488
4	Average	26542.9



CHAPTER-IV

CARBON FOOTPRINTING

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities.

In this we compute the emissions of Carbon-Di-Oxide, by usage of the various forms of Energy used by the Institute for performing its day to day activities

The Institute uses Electrical Energy for various Electrical gadgets.

Basis for computation of CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is:

- 1 kWh of Electrical Energy releases 0.8 Kg of CO₂ into atmosphere

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the Institute due to its Day to Day operations

Table No 5: Month wise CO₂ Emissions:

No	Month	Energy Consumed, kWh	CO ₂ Emissions, MT
1	Apr-18	14119	11.29
2	May-18	30109	24.09
3	Jun-18	23816	19.05
4	Jul-18	27625	22.10
5	Aug-18	16488	13.19
6	Sep-18	29459	23.57
7	Oct-18	34094	27.28
8	Nov-18	18086	14.47
9	Dec-18	16940	13.55
10	Jan-19	32666	26.13
11	Feb-19	29734	23.79
12	Mar-19	30084	24.07
13	Total	318515	254.81
14	Maximum	34094	27.28
15	Minimum	16488	13.19
16	Average	26542.9	21.23

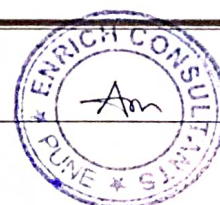


Chart No 3: Representation of Month wise CO₂ emissions:

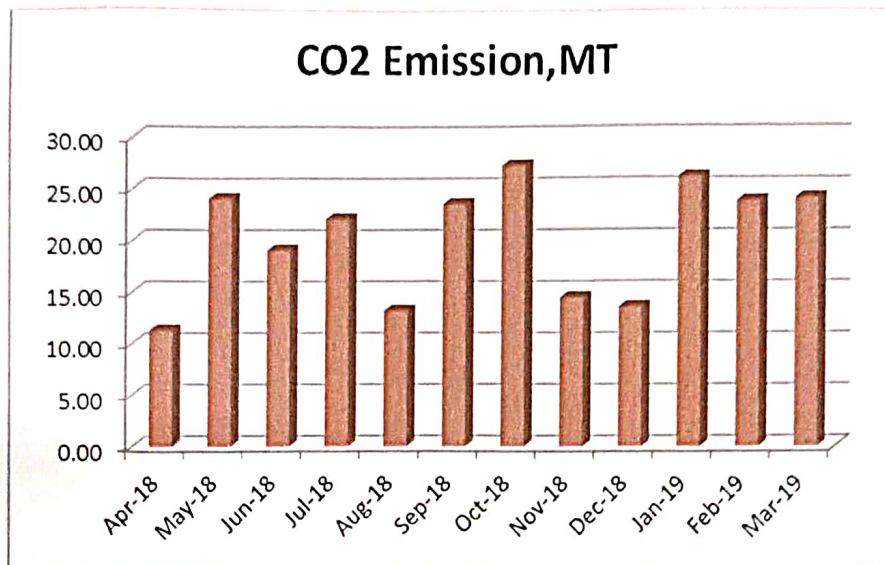


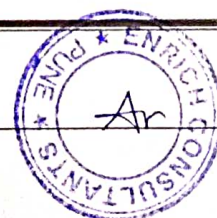
Table No 6: Key observations:

No	Value	Energy Consumed, kWh	CO2 emissions, MT
1	Total	318515	254.81
2	Maximum	34094	27.28
3	Minimum	16488	13.19
4	Average	26542.9	21.23

CHAPTER-V

STUDY OF USAGE OF ALTERNATE ENERGY

The College is in a process of installation of 80 kWp Roof Top Solar PV Plant. Therefore as on Date the percentage of usage of Alternate Energy to Annual Energy requirement stands to be zero percent.



CHAPTER-VI

STUDY OF USAGE OF LED LIGHTS

In this Chapter, we present the annual Lighting requirements and usage of LEDs.

Table No 7: Computation of Annual Lighting Power requirement met by LED Lights:

No	Particulars	Value	Unit
1	No of 40 W FTL Fittings	600	Nos
2	No of 15 W LED Fittings	45	Nos
3	Load/Unit of 40 W FTL Fitting	40	W/Unit
4	Load/Unit of 15 W LED Fitting	15	W/Unit
5	Total Load of 40 W FTL Fittings=1*3	24	kW
6	Total Load of 15 W LED Fittings=2*4	0.675	kW
7	Total Lighting Load= 5 + 6	24.675	kW
8	LED Lighting Load = 4	0.675	kW
9	% of Usage of LED Lighting=(8)*100/(7)	2.74	%

Energy Audit Certificate

The study is conducted as per Indian and International Green Building Standards initiated in the capacity of an Accredited & Certified Green Building Professional

It is awarded for 2020-2021 and 2021-2022 (Analysed for 2 years) to the Esteemed Institution


Dr. D. Y. Patil Educational Enterprises Charitable Trust's

Ajeenkya D. Y. Patil School of Engineering

Dr. D. Y. Patil Knowledge City, Charholi (Bk.) via Lohegaon, Pune – 411047

As part of the Institution's initiatives for a Healthy & Sustainable College the audit was conducted.
We appreciate the immense efforts taken by Staff and students towards the Energy Management and Conservation.

Valid till December 2023


Ar. Nandini Shaikh

Architect, IGBC Accredited Professional, ISO Certified I. A. (IMS)
Assocham GEM Certified Professional (Regn. No. 22/718)

Project Head and Green Building Professional-Consultant

Sustainable Academe

Sustainability Department of Greenvio Solutions, Naigaon
An environment Design and Consultancy developing Healthy and Sustainable Environment
sustainableacademe@gmail.com | greenviosolutions@gmail.com



ENERGY AUDIT

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

Sustainability study **AUDIT REPORT**

Studied for
Dr. D. Y. Patil Educational Enterprises Charitable Trust's
**Ajeenkya D. Y. Patil
School of Engineering**

Dr. D. Y. Patil Knowledge City,
Chandoli (Bk.) via Lohegaon, Pune – 411047

Studied in the capacity of
An accredited & Certified Green Building Professional



Valid till December 2023

Disclaimer

The Audit Team has prepared this report for the **Dr. D. Y. Patil Educational Enterprises Charitable Trust's Ajeenkya D. Y. Patil School of Engineering** located at Dr. D. Y. Patil Knowledge City, Charholi (Bk.) via Lohegaon, Pune – 411047 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 **Dr. D. Y. Patil Educational Enterprises Charitable Trust's Ajeenkya D. Y. Patil School of Engineering, 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 **Dr. Ajeenkya D.Y. Patil**, President Ajeenkya DY Patil Group & Chairman Ajeenkya DY Patil School of Engineering; **Dr. E.B. Khedkar**, Vice President Ajeenkya DY Patil Group; **Dr. Sushant Patil**, Trustee & Advisor; **Dr. Kamaljeet Kaur**, Director - Technical Campus and everyone from the Management.

Our heartfelt thanks to Chairperson of the entire process **Dr. Farook B. Sayyad**, Principal for the valuable inputs.

We are also thankful to **College's Task force the faculty members** who have collected data required **Prof. Riyaj Kazi**, Assistant Professor & IQAC Coordinator and **Prof. Lt. Col. Sanjay Karodpati** (Retd.), Head, Civil Engineering Department; Phase-I and III: Teaching Staff - **Dr. Pallavi Kharat**, Assistant Professor, Civil Department; Phase-II: Teaching Staff - **Prof. Kunal Marathe**, Assistant Professor, Mechanical Department; **Prof. Tejpal Pardeshi**, Assistant Professor, ENTC Department and the Phase-IV: Teaching Staff: **Prof. Uday Kakade**, Assistant Professor, Civil Department.

We highly appreciate the assistance of **Mr. Amol Patil**, Admin Department; **Mr. Nitin Kakade**, Lab Technician Assistant to Internal Audit Team; **Mr. Amol Sawant**, Lab Assistant & Electrical coordination 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

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1. Introduction

1.1 About the Institution

Ajeenkya D. Y. Patil School of Engineering (DYPSOE) is one of the most prestigious academic groups in the Pune City and state of Maharashtra which is Approved by AICTE and Affiliated to SP Pune University.

DYPSOE was established by the Chairman of Ajeenkya D.Y.Patil Group. The institute offers five UG Programs (B.E), three PG Programs (M.E) and three Diploma programs.

1.2 Statements of the Institution

1.2.1 Vision

The College proposes "Empowerment through quality technical education."

1.2.2 Mission

The College adheres and focuses

- To excel as a center of excellence in technical education
- To impart skill based education to meet the needs of industry and society
- To achieve excellence in teaching, learning and research
- To inculcate social and ethical values among the students

1.2.2 Aim

The College has formulated the following aim to achieve its mission which is "To produce technocrats, leaders and entrepreneurs."

1.2.4 Objective

It is the objective of the College is "To provide best of the facilities to satisfy the need and expectations of all the stakeholders."

1.2.5 Motto

The College channelizes its efforts towards the motto of "Striving to impart the quality technical education through academic excellence."

1.3 Assessment of the Institute

1.3.1 Affiliations

The Institute is affiliated to **Savitribai Phule Pune University**, formerly the University of Poona, is a collegiate public state university located in the city of Pune, India.

1.3.2 Accreditation

The College has received '**B+**' Grade with a **CGPA of 2.61** in its First cycle of Accreditation in 2018 awarded by the National Assessment & Accreditation Council (NAAC). The College is due to enter its second cycle of NAAC.

1.3.3 Certification

The College has received the following Certifications

- ISO 9001:2015 – Quality Management Systems
- ISO 21001:2018 – Management systems for Educational Organizations
- NIRF – Participated in the National Institutional Ranking Framework and has secured position in rank band 251-300 for the year 2022.
- AISHE – The All India Survey of Higher Education code is C-46648-2020.

1.3.4 Approval

The technical courses provided by the College are approved by **All India Council for Technical Education (AICTE)**, New Delhi.

1.4 Achievements of the Institute

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

- **Sustainable Institutions of India**, Green Institutional Ranking 2022
- **Cyclothon 2022**, Longest Line of Moving Cycle- India of Book of Rewards, 2022
- **Best Institute for Campus Life**, 2022
- **Dataquest T-School Award**, 2021
- **Clean & Green Campus**, 2021

- Clean and Pollution free campus, 2021
- Outstanding Industry-Academic Contributor, 2020
- Best Industry Academia Interface Award, 2019
- Maximum Female Candidate recruitment in a single day, 2019
- Global Education Excellence Award, 2017

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 **1,656 Boys and 448 Girl students**, thus there were **a total of 2,104 students** on the premises.

2.1.2 Staff data

Type	Male	Female	Total
Admin staff	12	1	13
Teaching staff	38	45	83
Non-Teaching staff	37	29	66
Total Staff Members	87	75	162

Table 1: Staff data of the Institution for 2021 - 2022

The staff data shows the premises had a total of **162 Staff Members**.

2.2 Populace analysis for Academic year 2020 - 2021

2.2.1 Students data

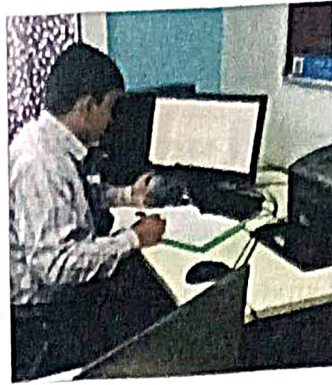
The student data (shared by the College) shows there were a total of **1,658 Boys and 419 Girl students**, thus there were **a total of 2,077 students** on the premises.

2.2.2 Staff data

Type	Male	Female	Total
Admin staff	12	1	13
Teaching staff	44	35	79
Non-Teaching staff	36	40	76
Total Staff Members	92	76	168

Table 2: Staff data of the Institution for 2020 - 2021

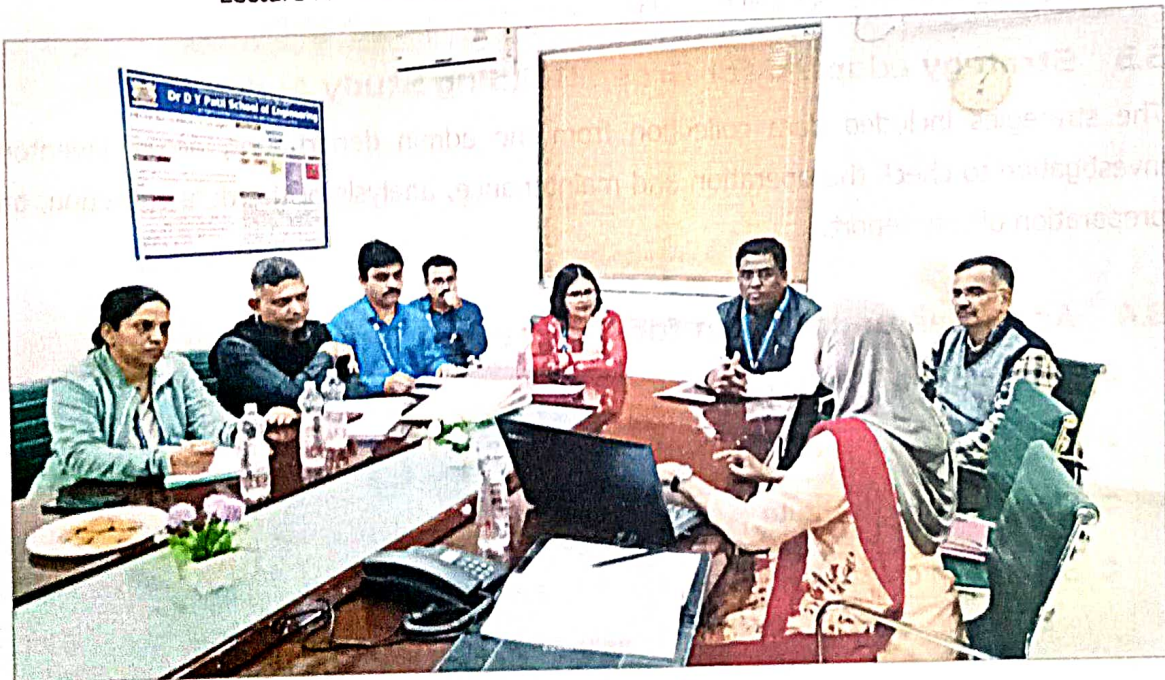
The staff data shows the premises had a total of **168 Staff Members**.



Discussion at the induction and clarification meeting



Lecture for the students and staff members on subject of visit



Exit meeting with the Team

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

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 of 639 kW in the premises.

4.1.2 Secondary sources

These are available in the form of Gas cylinders for general purposes and the UPS, batteries as a backup.

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.	Academic Year	Months	Years	Units consumed	Amount
1	2020-21	June	2020	58,216	9,48,675
2		July	2020	55,001	8,95,391
3		Aug	2020	54,082	8,88,820
4		Sep	2020	58,982	9,48,939
5		Oct	2020	60,452	9,65,942
6		Nov	2020	63,500	10,03,759
7		Dec	2020	63,742	10,05,438

8		Jan-21	2021	41,506	7,18,920
9		Feb-21	2021	19,932	4,80,315
10		Mar-21	2021	12,586	4,04,985
11		Apr-21	2021	28,985	5,96,816
12		May-21	2021	47,940	8,20,085
13	2021-2022	Jun-21	2021	66,351	10,36,444
14		Jul-21	2021	67,582	10,44,872
15		Aug-21	2021	54,875	8,88,236
16		Sep-21	2021	62,468	9,84,394
17		Oct-21	2021	78,127	11,77,826
18		Nov-21	2021	55,059	8,96,021
19		Dec-21	2021	77,366	11,65,373
20		Jan	2022	28,709	5,97,732
21		Feb	2022	25,612	5,67,783
22		Mar	2022	85,419	12,75,770
23		Apr	2022	90,853	13,42,435
24		May	2022	82,204	12,45,227

Table 3: 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 following research has been conducted by the College and shared for documentation.

Sr. No.	Month	Total Energy In (Watt)	Unit consumed	Solar Generation In Units	% of Utilization	Energy Saving In Lakh for year	Energy Saving In Lakh per month	Total Energy In (Watt)
1	Nov-21	38,540	55,059	38,540	69.998	39,94,365	3,32,864	6,33,825
2	Dec-21	30,229	77,366	30,229	39.073			
3	Jan-22	53,774	28,790	53,774	186.78			
4	Feb-22	64,835	25,612	64,835	253.143			
5	Mar-22	54,018	85,419	54,018	63.239			
6	Apr-22	54,168	90,853	54,168	59.622			

7	May-22	62,864	82,204	62,864	76.473			
8	Jun-22	59,636	70,166	59,636	84.993			
9	Jul-22	47,894	74,648	47,894	64.16			
10	Aug-22	57,701	73,944	57,701	78.033			
11	Sep-22	54,960	91,630	54,960	59.98			
12	Oct-22	55,206	74,751	55,206	73.853			
Total		6,33,825	8,30,442	6,33,825	92.446			

Table 4: Details of the solar study

The summary of the above study shows there has been a positive impact by the installation of solar panels. Ample efforts are under process to make the premises a 'Net Zero Energy Premises'

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

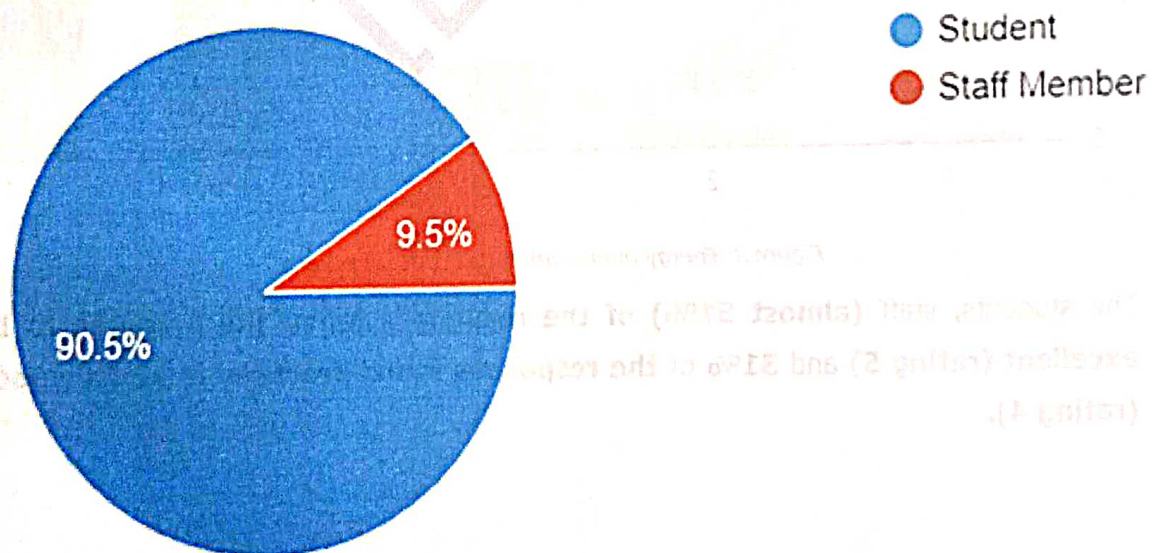


Figure 1: Participation analysis in the survey

A total of **904 responses** were received out of which 91% 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%)

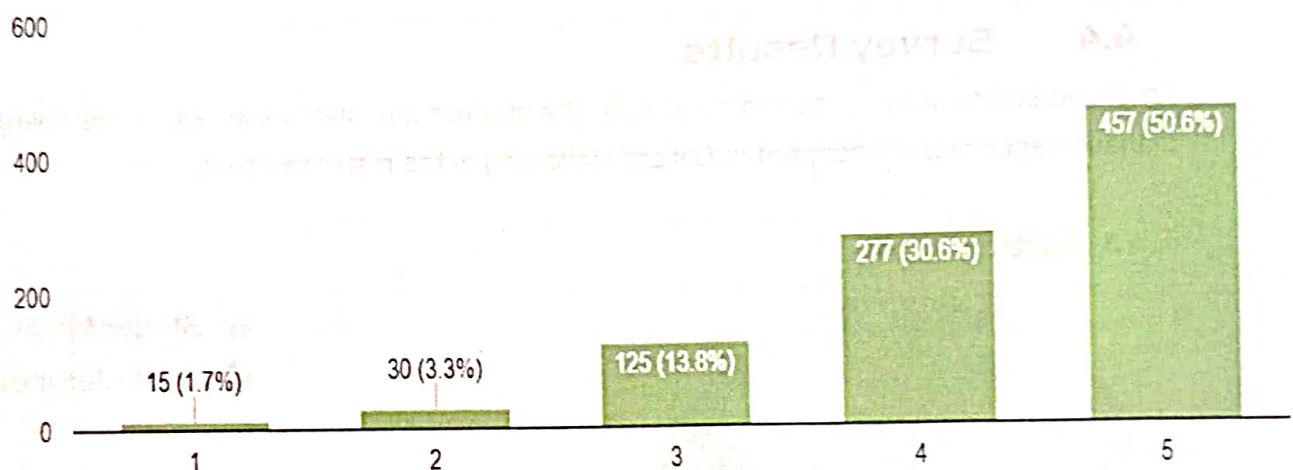


Figure 2: Energy management practices in college

The students, staff (almost 51%) of the responses found the practices to be excellent (rating 5) and 31% 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.

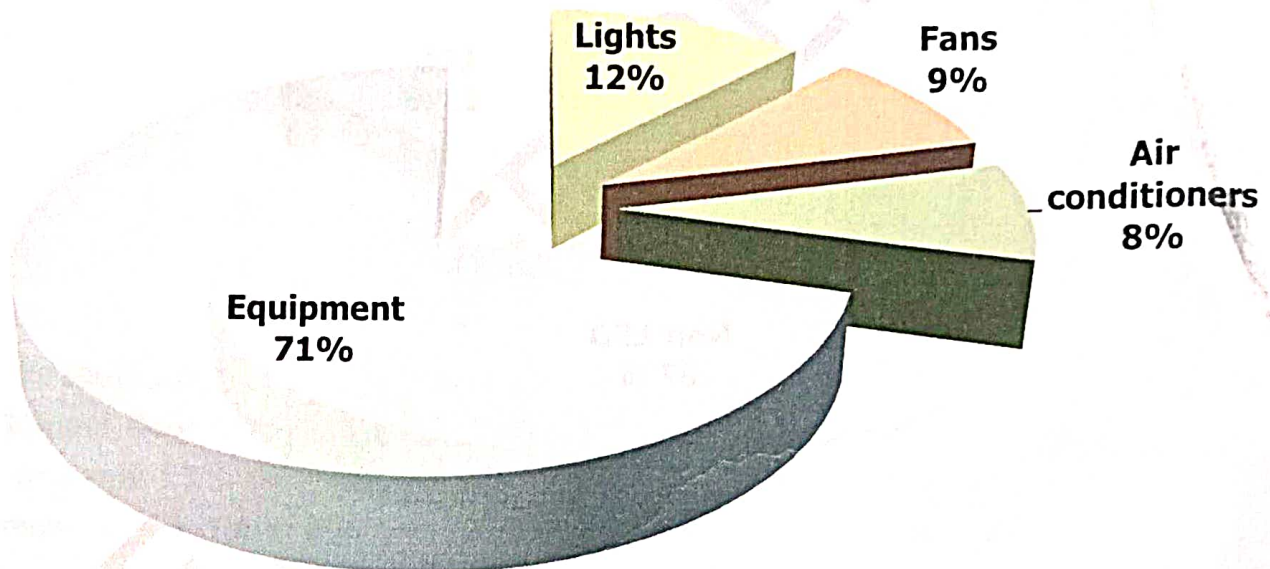


Figure 3: Summary of the calculated electrical consumption as per inventory

The above graph shows that Equipment consumes 71% followed by Lights consuming 12% while the Fans consume 9% whereas the air conditioners 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 **1,116 lights on the premises**; the following table shows the various types of lights on the premises.

S. No.	Type	Nos.
1	LED	406
2	Non-LED	710

Table 5: 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 **87,905 kWh** of energy.

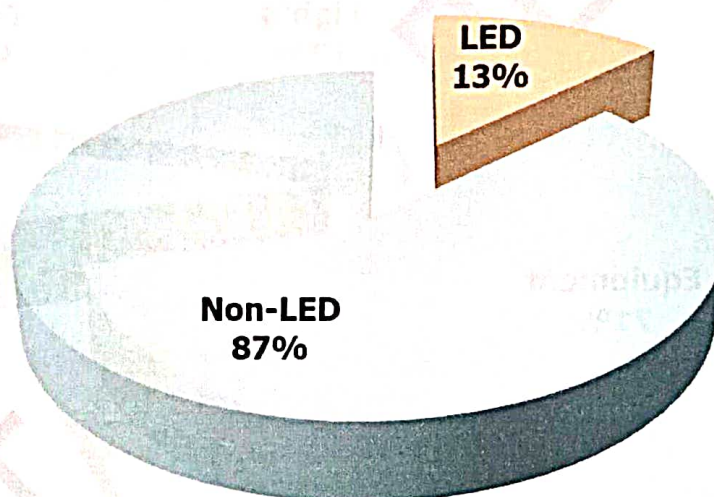


Figure 4: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights on-premises shows **Non-LED lights consume 87%** followed by **LED lights consume 13%**

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. The College utilizes 92.46% of power generated by on grid solar system is being given back to the grid.

4.6.3.2 Percentage of lighting power requirement met through LED bulbs

The premise has LED Lights contribute to 36% in terms of number and **13% 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 study is conducted only for the Non-LED lights in the premises.

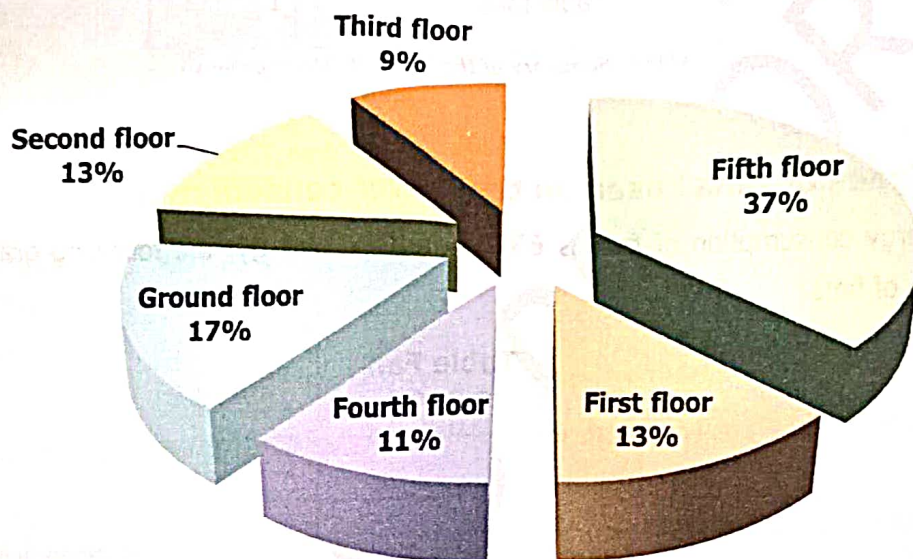


Figure 5: Energy consumed by lights floor wise

The above analysis shows the lights in the **Fifth floor** consume 37%; the ones in the **Ground floor** consume 17% whereas the ones in the **Second and First floor** consumes 13% each while the ones in the **Fourth floor** consume 11% and the ones in the **Third floor** consume 9% of the total power consumed by lights. Whenever there is an opportunity for general replacement the first priority should be given to lights in the Fifth floor.

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 **843 fans** in the premises. The following table shows the various types of fans in the premises.

S. No.	Type	Nos.
1	Ceiling fans	842
2	Table fans	1

Table 6: 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 **65,478 kWh** of energy; the following graph shows the type of fans.

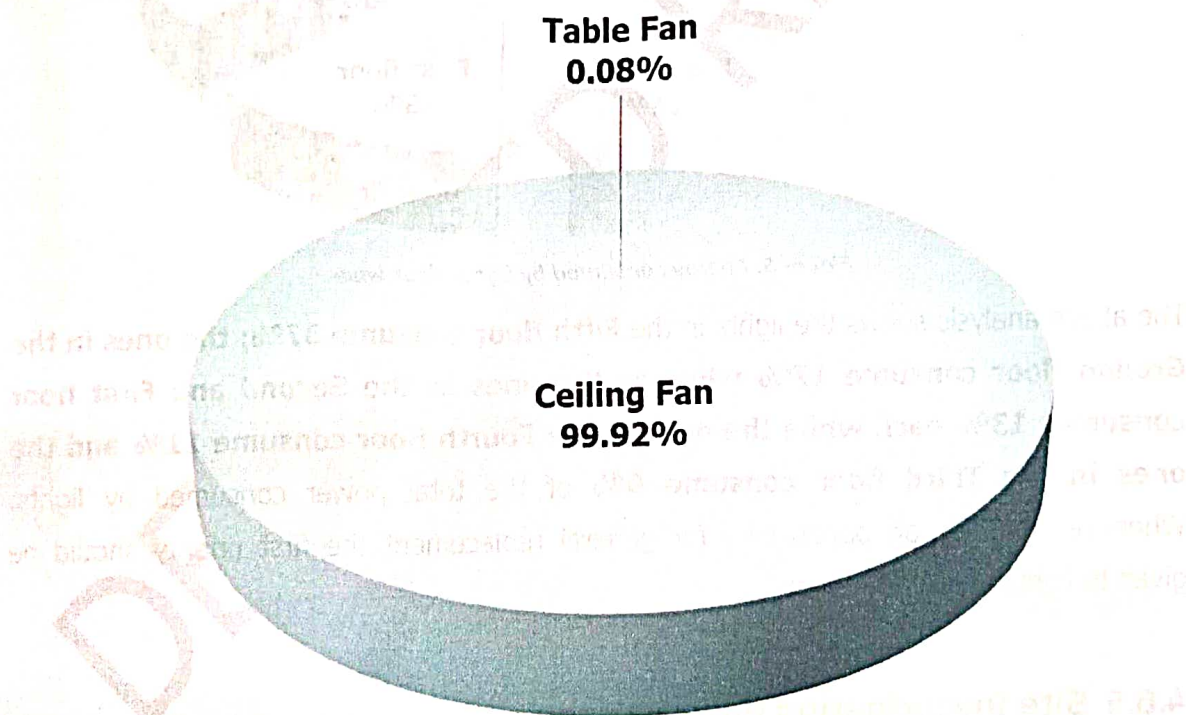


Figure 6: Energy consumed by types of fans in the premise based on the usage study

The analysis of the types of fans in premises shows **Ceiling fans consume 99.92%**; **whereas the Table fans consume 0.08%** of the total power consumed by fans.

4.7.3 Floor -wise consumption analysis

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

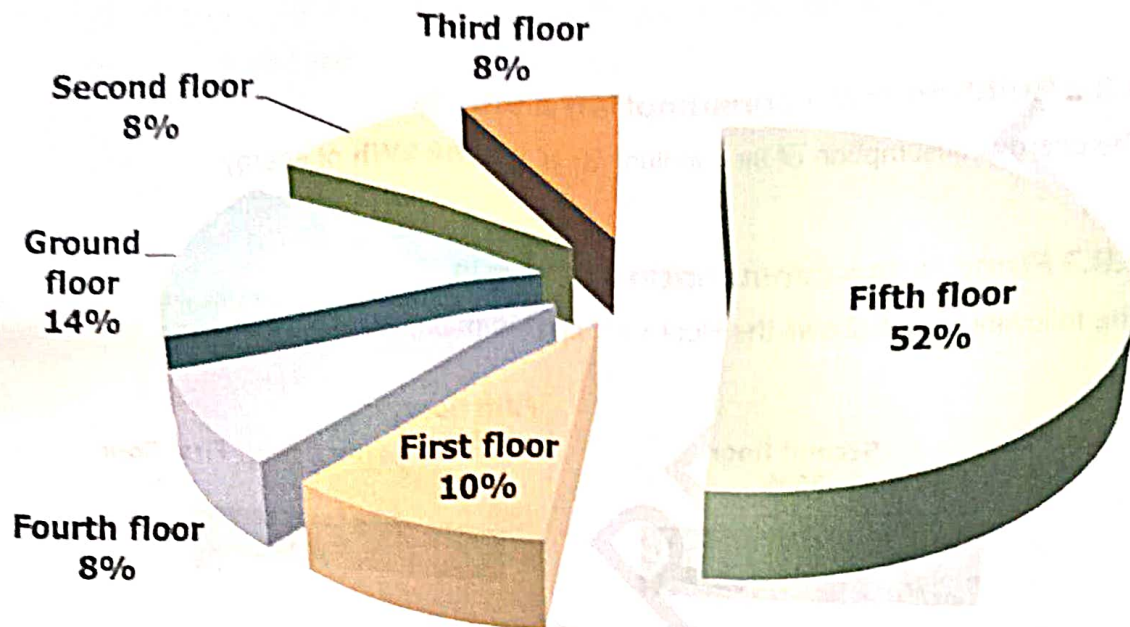


Figure 7: Energy consumed by fans floor wise

The above analysis shows the fans in the **Fifth floor consume 52%**; the ones in the **Ground floor consume 14%** whereas the ones in the **First floor consumes 10%** while the ones in the **Fourth, Second and Third floor consume 8%** each of the total power consumed by fans. Whenever there is an opportunity for general replacement the first priority should be given to lights in the Fifth floor.

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

4.8.2 Building-wise consumption analysis

The energy consumption of air conditioners is **58,208 kWh** of energy.

4.8.3 Floor -wise consumption analysis

The following graph shows the Floor wise consumption.

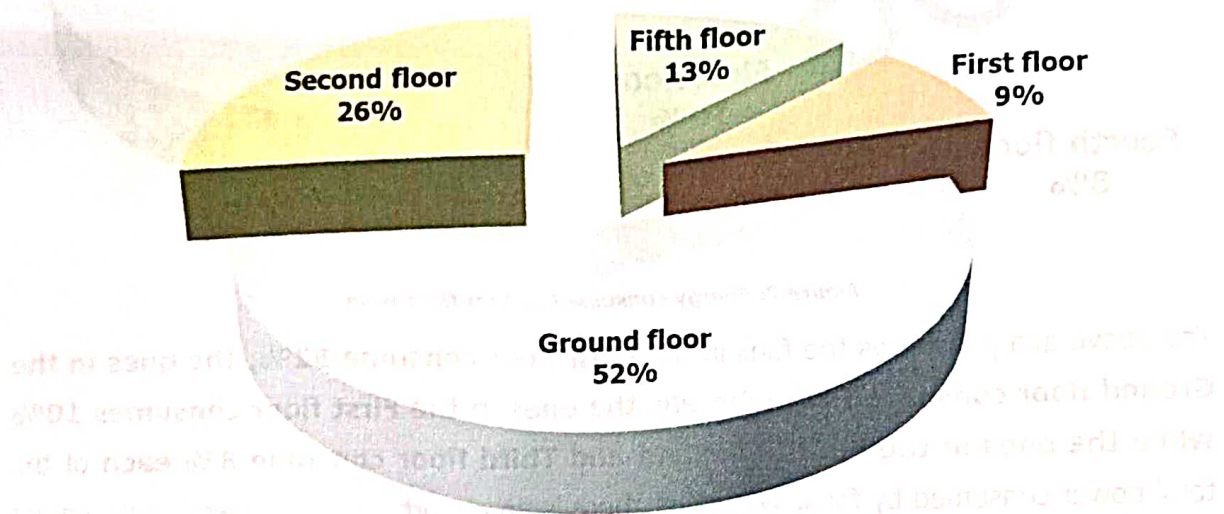


Figure 8: Energy consumed by air conditioners floor wise

The above analysis shows the air conditioners in the **Ground floor consume 52%**; the ones in the **Second floor consume 26%** whereas the ones in the **Fifth floor consumes 13%** and the ones in the **First floor consumes 9%** of the total power consumed by air conditioners.

4.8.4 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.

4.8.5 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 **19 types of equipment totalling to 621** in the premises as follows; (The College is 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	Wi-fi router	45
2	CCTV	35
3	Printer	40
4	Scanner	7
5	Water cooler	12
6	Xerox machine	2
7	Projector	25
8	Refrigerator	1
9	Lift Motor pump	1
10	LED/ LCD TV	2
11	Microwave oven	1
12	Sanitary vending machine	1
13	Sanitary incinerator	6
14	Intercom	21
15	BioMetric	2
16	Desktop computers	400
17	Android TV	6
18	Smart board	10
19	Speakers	4

Table 7: 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 5,16,978 kWh of energy.

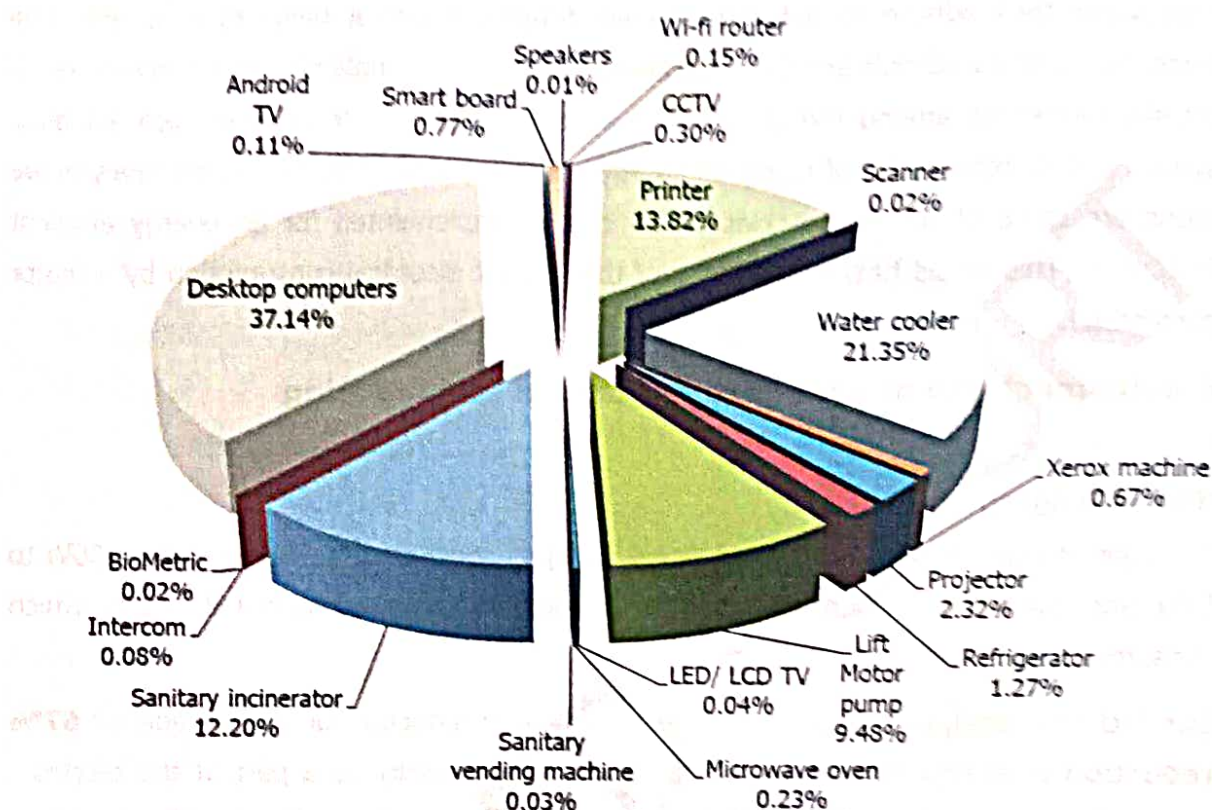


Figure 9: Summary of Energy consumed by equipment in the premises

The above summary shows that **desktop computer** consumes more energy at **37.14%** while **water cooler** consumes **21.35%** and the **printer** consumes **13.82%** these are maximum consumers as compared to other equipment.

Batteries and UPS (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.

Electromechanical systems - Electrical and Lighting

Section 1 - Lights

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 - Fans

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.

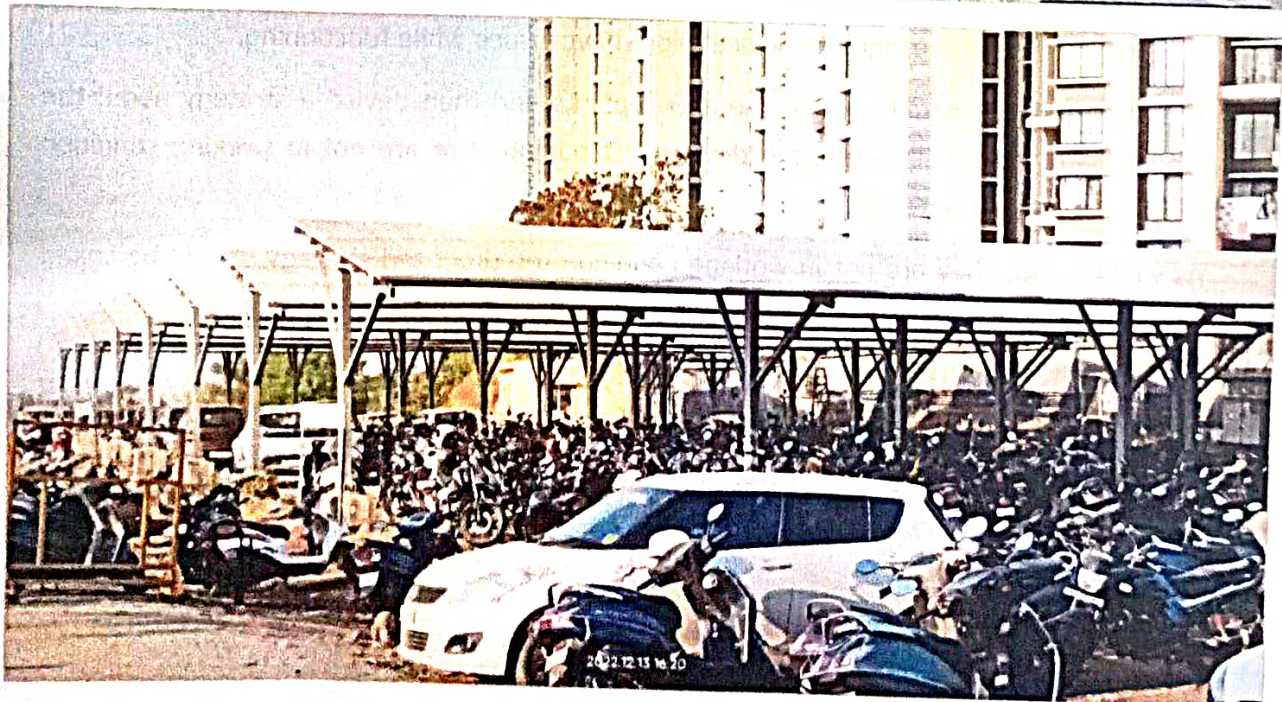
This replacement is however is dependent on a variety of factors as follows.

- 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.

On-site investigation and physical verification
Energy consumption practices in the premises



5. References

1. Uniform Plumbing Code – India, 2008
2. IGBC Green Existing Buildings – Operation & Maintenance (O&M) Rating system, Pilot version, Abridged Reference Guide, April 2013
3. IGBC Green Landscape Rating system, March 2013
4. BOMA Canada Waste Auditing Guide, Best Environmental Standards, BOMA BEST – Canada
5. Used only for understanding Universal design - Universal accessibility Guidelines for Pedestrian, Non-motorized vehicle and Public Transport Infrastructure – Report guidelines by Samarthyaam (National centre for Accessible Environments) – an initiative supported by Shakti Sustainable Energy Foundation.

