ENERGY AUDIT

2019-20 & 2020-21

AUDIT REPORT

Studied for

Government College for Women (Autonomous)

Sambasiva Pet, Guntur. Pin- 522001,
Andhra Pradesh, India

Analysed by

Greenvio Solutions

19 March 2022

Background reference image Janko Ferlic on pexels

Disclaimer

The Audit Team has prepared this report for the **Government College for Women (Autonomous)** located at *Sambasiva Pet, Guntur. Pin- 522001, Andhra Pradesh, 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 has completed audits of multiple Institutes including Technical, State University, Private University and Single Faculty Colleges for a total of more than 45 lakhs+ sq. ft. of Built-up area audited till date Pan India 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

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Acknowledgement

The Audit Assessment Team thanks the **Government College for Women (Autonomous), Guntur, Andhra Pradesh** for assigning this important work of Environment Audit. We appreciate the cooperation extended to our team during the entire process.

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

Our heartfelt thanks to Chairperson of the entire process **Dr. V. R. Jyotsna Kumari,** Principal, for the valuable inputs.

We are also thankful to **College's Task force the faculty members - Green Audit Coordinators** who have collected data required **Dr. A. V. Kavitha,** Vice Principal, IQAC coordinator; **Dr. K. Padmaja ,** Academic Coordinator; **Dr. G. Padmini Devi,** Lecturer in Home Science; Home Science Department **(Special mention for the excellent coordination)** and **P. Nirmala Kumari,** Lecturer in Mathematics.

We highly appreciate the assistance of **G. Gopala Krishna,** Administrative Officer 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 functioning of the Institution

Government College for Women (A), Guntur established in 1942, in 10 acres, is fully equipped with laboratories and ICT enabled classrooms. It has completed 76 years of committed service enabling the rural women students in terms of education and employability.

The staff of the institution are qualified and selected through College Service Commission and work with commitment, dedication, and research orientation. A great number of the staff of this college are Ph.D holders and are acting as Resource Persons, Content Generators, Authors and Research Supervisors.

From 2011 to 2017, seven MRPs were completed and six more projects are going on. The teachers are highly committed, follow student-centered methods and most of them are honoured as the best teachers by the State Government and other agencies.

The institution is conscious of the eco system and from time to time enough focus is laid on campus cleanliness and beautification through measures like avoiding plastic on the campus. Green cover is maintained and rain - water harvesting is taken up to preserve the water tables during summer.

The staff and the students along with the NSS and NCC units of the college adopt villages and spread the green consciousness among villages that surround the institution. The staff and the students of the college campaigned against Open Defecation System in the surrounding villages as part of the Swatch Bharat programme.

The college is an autonomous institution, a District Resource Centre, it has a separate Placement Cell (Jawahar Knowledge Centre), which trains the students in Communication Skills and Soft Skills, the institution has MOUs with employing agencies. Fibergrid, a digital networking platform is sanctioned to this college to connect it digitally to other government colleges to provide extended academic support to other institutions using the expertise of the staff of this institution.

The core strengths of the college lie in the **transparent administrative measures, good teaching-learning and evaluative practices, professional ethics, graduation outcomes and outreach activities.**

1.2 Statements of the Institution

Vision - To empower women students of first generation families from marginalised sections with 21st century skills to grow as global citizens with values for a holistic personality.

Mission

1) Imparting knowledge, skills and values through need based and flexible curriculum through student - centered teaching methods
2) Facilitating research temper, critical and creative thinking skills among teachers and learners through digital resources
3) Providing an objective and participatory atmosphere and facilities for developing self-confidence, self-esteem, employability, entrepreneur skills and overall development
4) Integrating a serving spirit, integrity, accountability, dedication and commitment among the teaching and non-teaching staff and the students through transparent and participative administration.
5) Creating an eco-friendly ambience through green practices, and offering value based education through community help and extension activities.

1.3 About the Institution

The aim of the college is to continuously enhance the teaching methods in order to provide students with an opportunity for their all-round development. It also strives for excellence in academics and makes an effort to induce passion for learning along with the inspiration for decisive thinking and assessment, thereby helping them to become the best professionals in their chosen careers. **The Institution is an Autonomous Organization and it offers the following courses.**

- **Graduation** – It offers the following Undergraduate courses.
  - Faculty of Humanities - H.E.P. (History, Economics, Political Science), H.ST.Soc.(History, Spl. Telugu, Sociology), E.P.CE.(Economics, Political Science, Communicative English), H.SE.TTM.(History, Spl .English, Tourism & Travel Management), E.P.Psy.(Economics, Political Science, Psychology), H.P.FE(History, Political Science, Financial Economics)

- Faculty of Commerce - B.Com.(General), B.Com.(Computer Applications) , B.Com. B.F.I.(Banking, Financial Services, Insurance and Exim trade), B.Com. (Accounting and Taxation)
- Faculty of Science & Technology - M.P.C.(Maths, Physics, Chemistry), M.P.Cs.(Maths, Physics, Computer Science), M.St.Cs.(Maths, Statistics, Computer Science), M.P.E(Maths, Physics, Electronics), M.E.Cs.(Maths, Electronics, Computer Science), M.Cs.Mm.(Maths, Computer Science, Multimedia), M.Cs.Cc.(Maths, Computer Science, Cloud Computing), CS.St.DS(Computer Science, Statistics, Data Science), Chemistry (Honours), B.Z.C.(Botany, Zoology, Chemistry), Mb.B.C.(Micro-Biology, Botany, Chemistry) , Mb.Z.C.(Micro-Biology, Zoology, Chemistry), B.Bc.C.(Botany, Bio-Chemistry, Chemistry), Z.Bc.C.(Zoology, Bio-Chemistry, Chemistry), B.Bt.C.(Botany, Bio-Technology, Chemistry), Bt.Bc.C.(Bio-Technology, Bio-Chemistry, Chemistry), HS.(Home Science (Clinical Nutrition and Dietetics)), B.Z.C.(Botany, Zoology, Chemistry), C.Z.At.(Chemistry, Zoology, Aquaculture Technology), Bc.Mb.Ft.(Bio-Chemistry, Micro-Biology, Food Technology)
- UGC Vocational Degree Programmes (B. Voc) - B.Voc. Multimedia and Animation, B.Voc. Software Development

- **Post-Graduation** – It offers the following Post Graduation courses.
  - Faculty of Humanities - Masters of Arts (M.A.) in Telugu, Economics and English
  - Faculty of Science & Technology – Masters of Science (M. Sc) in Chemistry and Zoology

The College works towards training young 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 **Guntur district of Andhra Pradesh State** with immense peace and calmness in the surroundings. The College is surrounded by Educational Buildings on the North side, Residential and Commercial areas on the macro front from all the sides. There is a frontal approach which provides quite a

beautiful appreciation space while approaching the premises; this area is surrounded by huge trees which positively complement the background-foreground aspect in terms of Natural space and built-form Architecture. It also provides ample shade which enhances the micro climate of the region. The location of College is feasible to the nearby essential amenities such as Public Health Center, Fire Station, Civic body-Public administrative buildings, Recreational gardens and Police Station.

1.5 Assessment of the College

1.5.1 Certification

The institute has received the following Certifications

- ISO – The College has received ISO 9001:2015 Certification for providing educational services in August, 2021.
- NIRF – The College applies every year for the National Institutional Ranking Framework (NIRF).
- AISHE – The College's code is C-32670

1.5.2 Accreditation

NAAC – The College has completed 3 cycles of NAAC and it received a CGPA of 2.92 with a B++ Grade in its third cycle of Accreditation. The College is due to enter its fourth cycle of NAAC soon.

1.5.3 Recognitions

The college has achieved the following recognitions:

- University Grant Commission (UGC) under section 2 (f) & 12 (B) of the UGC Act, 1956 by University Grants Commission, New Delhi.
- The college has been granted the **Autonomous status by UGC**

1.6 Achievements of the College

The College has a tremendous track record of excellence in Built form and educational services provided and it recognized as the **"College with Potential for Excellence (CPE)"** by UGC for a period of five years in 2016

2. Institution overview

2.1 Populace analysis for Academic year 2019-20

2.1.1 Students data

The student data (shared by the College) shows there were a total of **2,097 Girls** students in the premises.

2.1.2 Staff data

Type	Male	Female	Total
Admin Staff	07	02	**09**
Teaching Staff	23	60	**83**
Non-Teaching Staff	17	21	**38**
Total Staff Members	**47**	**83**	**130**

Table 1: Staff data of the Institution for 2019-20

The staff data shows the premises had a total of **130** Staff Members.

2.2 Populace analysis for Academic year 2020-21

2.2.1 Students data

The student data (shared by the College) shows there were a total of **2,414 Girls** students in the premises.

2.2.2 Staff data

Type	Male	Female	Total
Admin Staff	7	2	**9**
Teaching Staff	27	64	**91**
Non-Teaching Staff	13	21	**33**
Total Staff Members	**47**	**87**	**133**

Table 2: Staff data of the Institution for 2020-21

The staff data shows the premises had a total of **133** Staff Members.

2.3 Total College Area & College Building Spread Area

The **total site area is 10.8 Acres** and the **total Built-up area of College is 54,467 sq. ft.** for **a total of 2,547 footfalls.**

2.4 College Infrastructure

2.4.1 Establishment

The College was established in 1942. 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.

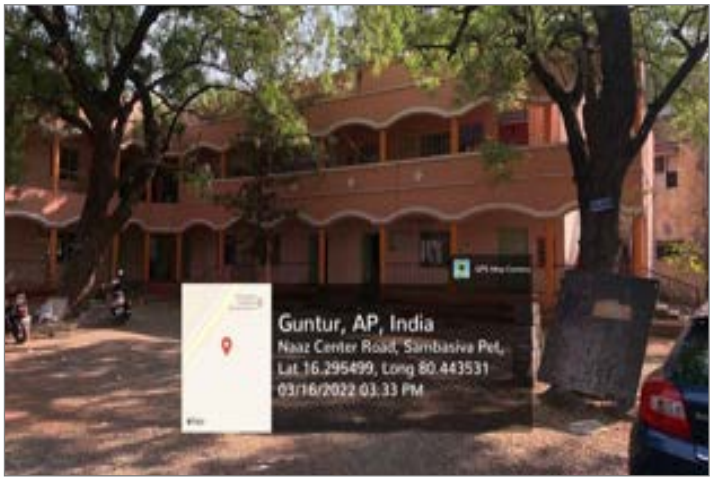
The floor to floor height is more than 10 feet. There is no provision for lifts in the premises, whereas there are amenities such as CCTV, Fire extinguishers, Library and first aid box.

2.4.4 Operation and Maintenance of the premises

The interview session with the staff regarding the operation and working hours is summarized in the table. The Institutions are open Monday to Saturday for full day. Sunday is an off for all. Below mentioned in the table are the average working hours. The detail wise timing for each is mentioned below.

S. No.	Section	Spaces	Time	Hours / day	Days in a year
1	Main Institutional College	Student areas and Teaching faculty	Monday to Friday (10:00 a.m. to 05:00 p.m.)	7	280
2	General areas	Admin areas and library, Passage, staircase, toilet	Monday to Friday (10:00 a.m. to 05:00 p.m.)	7	300

Table 3: Schedule of the timings of the premises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COLLEGE FOR WOMEN

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, AC, Equipment
- Renewable energy
- Scope for reducing the current energy bills if any
- Improvement in the thermal comfort of the campus

Green Audit

- Green initiatives
- Hygiene audit
- Water Audit - Analysis of the current water consumption of campus; Scope to include Rain water harvesting and Waste water treatment in campus
- 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 campus
- 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

- 08 March 2022 – Discussion with the College
- 10 March 2022 – Allotment and Initiation by the College
- 10 March 2022 – Induction Meeting
- 12 March 2022 – Survey of the Student and staff submitted
- 15 March 2022 – Data submitted by College
- 19 March 2022 – Submission of the Report

4. Energy Audit

4.1 Sources of Energy consumption

The premise uses following sources of energy consumption.

4.1.1 Primary sources

1. **Electrical (Metered) –** Light, Fans, AC, Equipments, Pumps consume approximately 3,943 units per month for Rs. 32,829/- per month (average).
2. **Renewable Energy –** There are 14 nos. of Poly-crystalline (Alpex Solar Diamond) solar panels located on the rooftop.

4.1.2 Secondary sources

1. **Inverter –** There is 4 Inverter in the premises.
2. **UPS –** There are 8 UPS used in the premises, whenever necessary amount is spent only towards the repairs.
3. **Batteries –** There are 4 Batteries required per month in the premises and Rs. 200/- is spent towards the same.
4. **Gas cylinders –** There are 2 gas cylinders required per month and Rs. 2,800/- is spent towards the same.

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**.
- There are **no Ultra-violet lights and any other harmful lights used** in the premise.

4.3 Actual Electrical Consumption as per Bills

The admin department had shared the bills for Meter which is connected to all Buildings and is main source of energy supply. The supplier is Andhra Pradesh Southern Power Distribution Corporation Limited. The analysis of actual electrical energy consumption is summarised below. The solar panels were installed in recently post which the cost of electricity has been reduced. The details of unit consumption meter wise is as follows.

S. No.	Month	Year	Units	Amount
1	June	2020	176	4,811
2	July	2020	1,098	11,301
3	August	2020	1,358	13,256
4	September	2020	1,348	13,071
5	October	2020	3,476	28,215
6	November	2020	2,897	24,902
7	December	2020	3,777	31,048
8	January	2021	4,873	40,070
9	February	2021	5,319	43,898
10	March	2021	7,530	56,856
11	April	2021	7,304	55,828
12	May	2021	4,255	34,064
13	June	2021	961	10,483
14	July	2021	1,654	15,242
15	August	2021	3,486	28,385
16	September	2021	4,587	42,399
17	October	2021	4,775	43,720
18	November	2021	6,136	47,010
19	December	2021	5,919	46,667
20	January	2021	6,185	49,283
21	February	2021	5,679	48,895
Total			**82,793**	**6,89,404**

Table 4: Study of the electricity consumption of the meters in premise

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

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

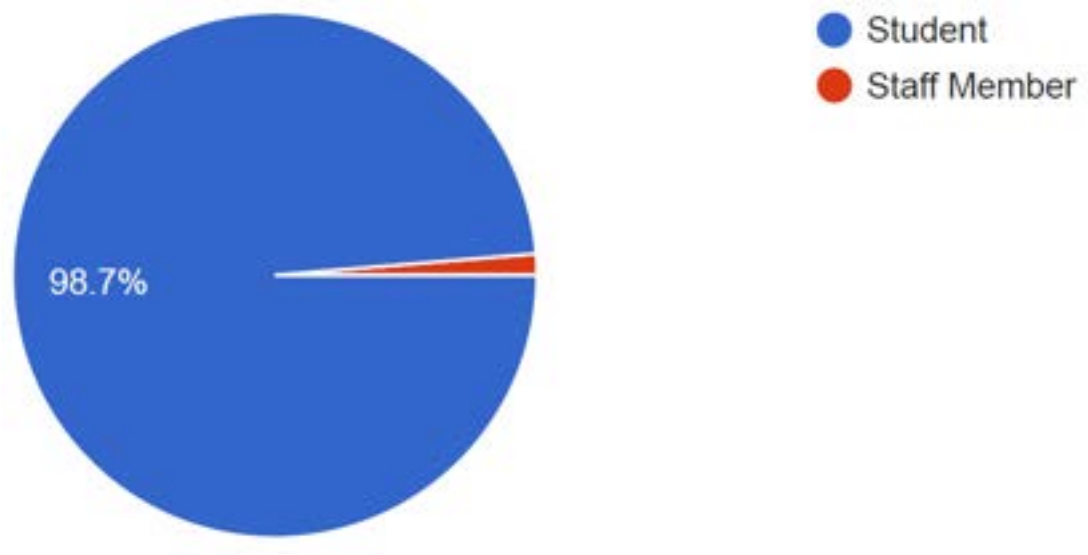

Figure 1: Participation analysis in the survey

A total of **153 responses** were received out of which 99% 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%)

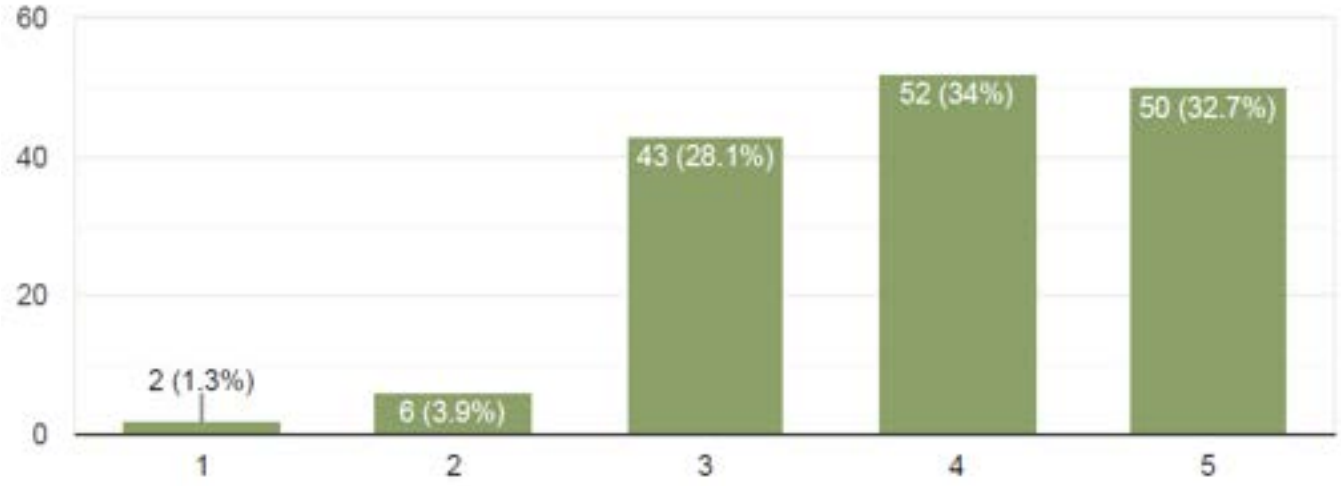

Figure 2: Energy management practices in college

The students, staff **(almost 33%) of the responses found the practices to be excellent** and **34% of the responses found practices to be good.**

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, ac, 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.

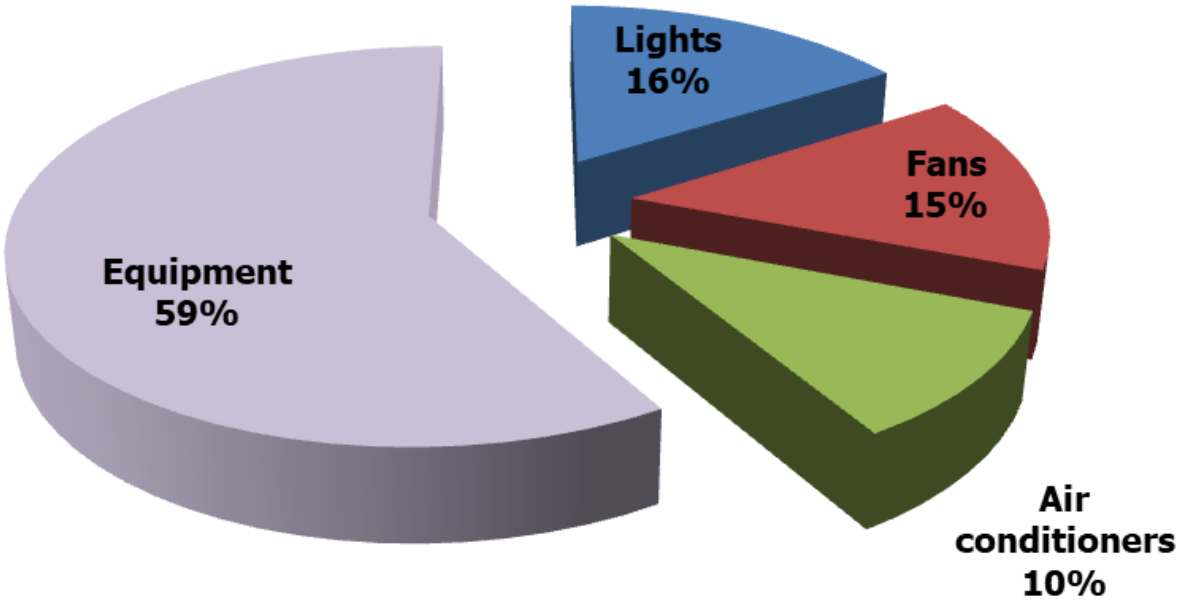

Figure 3: Summary of the calculated electrical consumption as per inventory

The above graph shows that Equipment consumes 59% followed by light at 16% the fans at 15% and the air conditioners at 10% of the total calculated electrical energy.

4.6 Lights

4.6.1 Types of lights

There are a total of **442 lights in the premises;** the following table shows the various types of lights in the premises.

S. No.	Type	Nos.
1	LED	21
2	Non-LED	421
Total		**442**

Table 5: Summary of the types of lights in premise

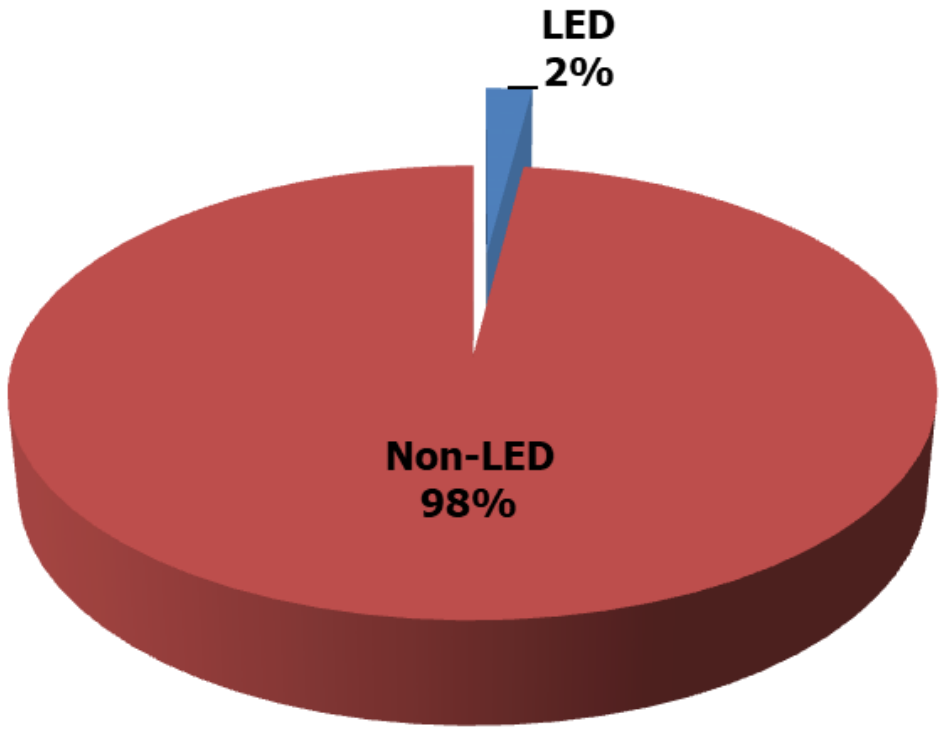

Figure 4: Energy consumed by types of lights in the premise based on the usage study

The analysis of the types of Lights in premises shows **Non-LED lights 98%** followed by **LED lights consuming 2%**

4.6.2 Block-wise consumption analysis

The energy consumption of Lights is **33,071 kWh** of energy; the following graph shows the block wise consumption.

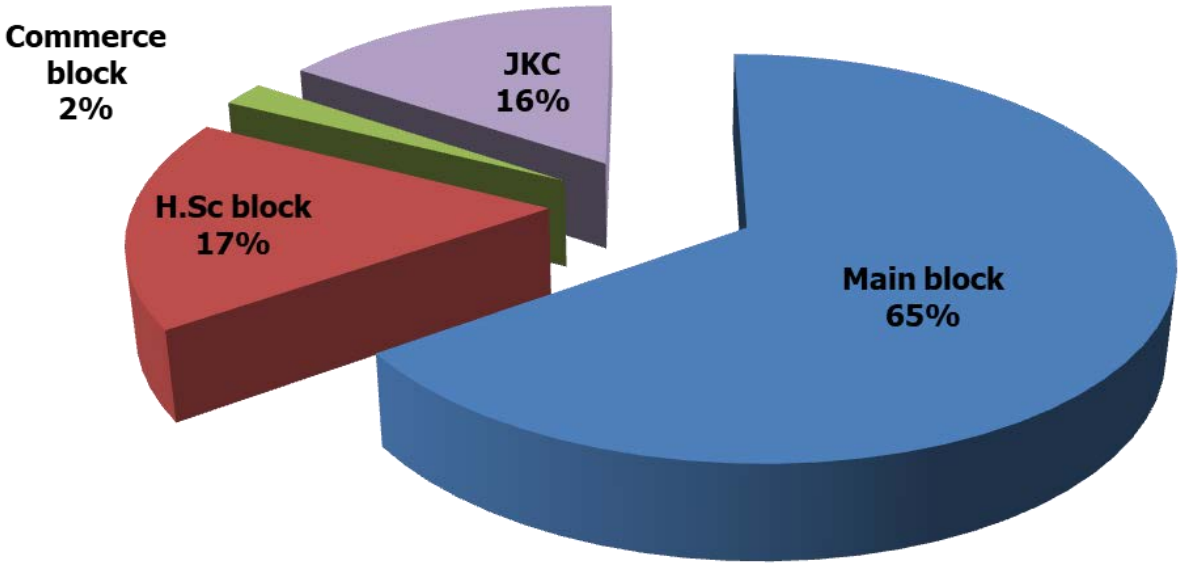

Figure 5: Energy consumed by lights block wise

The above analysis shows the lights in the **Main block consumes 65% the ones in H.Sc block consumes 17% the ones in JKC block consumes 16% and the ones in Commerce block consume 2%**

4.6.3 Requirement of NAAC

4.6.3.1 Alternative Energy Initiative

Percentage of power requirement met by renewable energy sources – 60% of the energy produced is given back to the grid thus *40% of the power requirement is met and utilized in the premises.*

4.6.3.2 Percentage of lighting power requirement met through LED bulbs

The premise has LED Lights contribute to 5% in terms of number and **2% of the power requirement** is met through the same. As per our study we could conclude that both of these are highest contributions among all the types of lights.

4.6.4 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

There are a total of **343 fans** in the premises. The following table shows the various types of fans in the premises.

S. No.	Type	Nos.
1	Table fans	4
2	Ceiling fans	331
3	Exhaust fans	8
Total		**343**

Table 6: Summary of the types of fans in premise

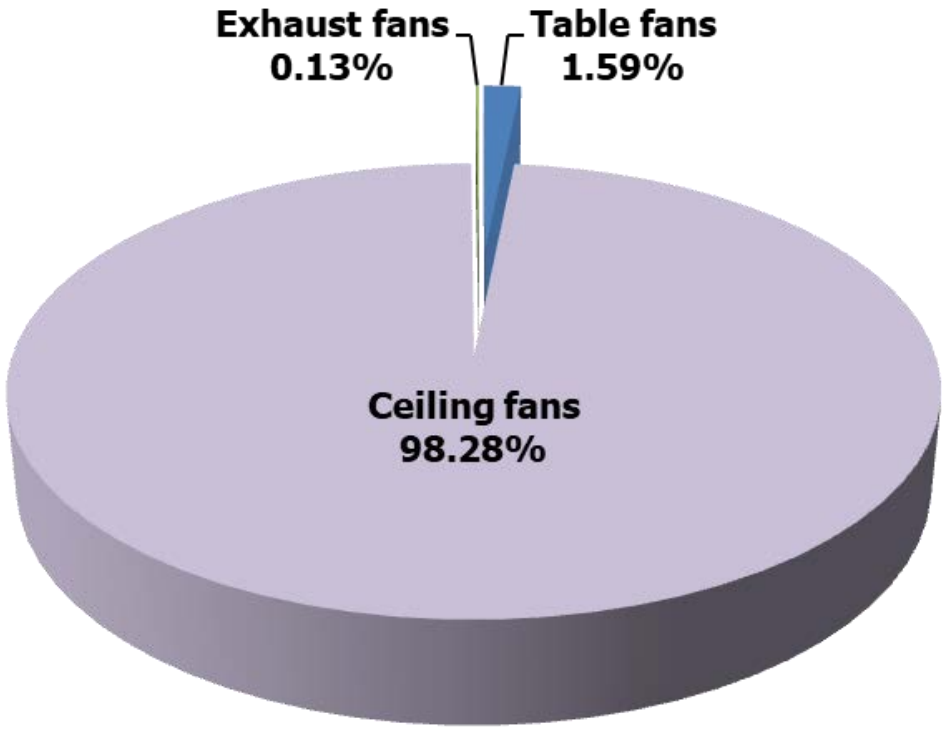

Figure 6: Energy consumed by types of fans in the premise based on the usage study

The analysis of the types of fans in premises shows **Ceiling fans consume 98.28%** the **Table fans consume 1.59%** while the **Exhaust fans consume 0.13%**

4.7.2 Block-wise consumption analysis

The energy consumption of fans is **31,782 kWh** of energy; the following graph shows the block wise consumption.

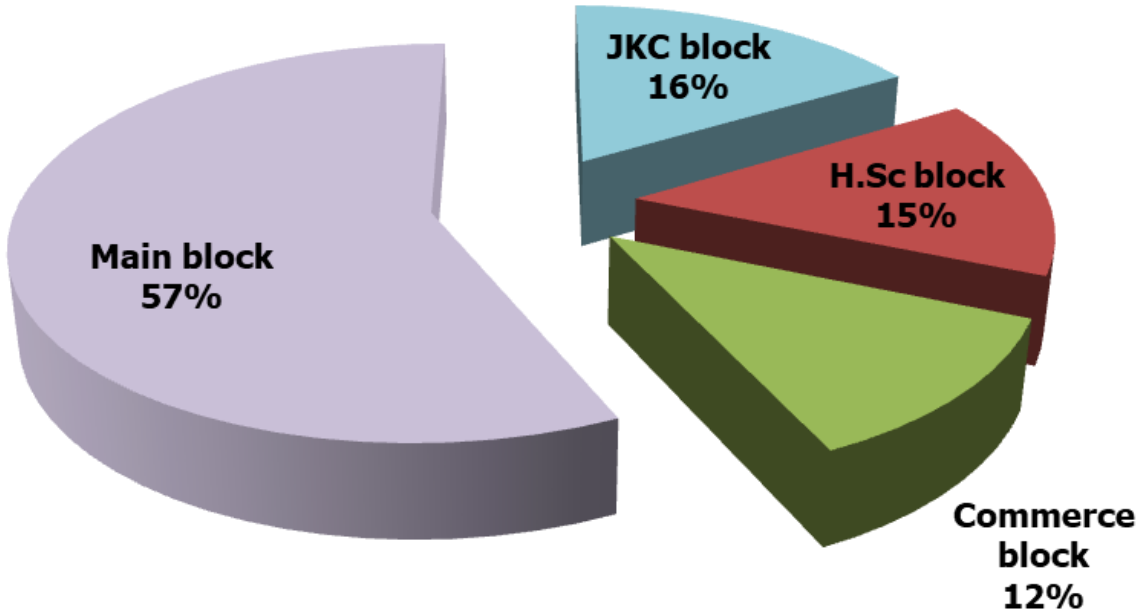

Figure 7: Energy consumed by fans block wise

The above analysis shows the fans in the **Main block consume 57%; the ones in JKC Block consume 16%; in H.Sc block consume 15% and the Commerce block consumes the least at 12%**

4.7.3 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

There are **12 air conditioners** in the entire premise. The details mentioned as follows.

Sr. No	Room Name	Building Name	Floor	Nos
1	12	Main block	Ground floor	1
2	15	Main block	Ground floor	1
3	22	Main block	Ground floor	1
4	23	Main block	Ground floor	2
5	TTM dept.	H.Sc block	Ground floor	1
6	Lab 3	JKC	First floor	1
7	95	JKC	First floor	2
8	Exam Cell	JKC	First floor	2
9	Net Stop	JKC	First floor	1
Total				**12**

Table 7: Details of the air-conditioner in premise

4.8.2 Block-wise consumption analysis

The energy consumption of air conditioners is **22,583 kWh** of energy; the following graph shows the block wise consumption.

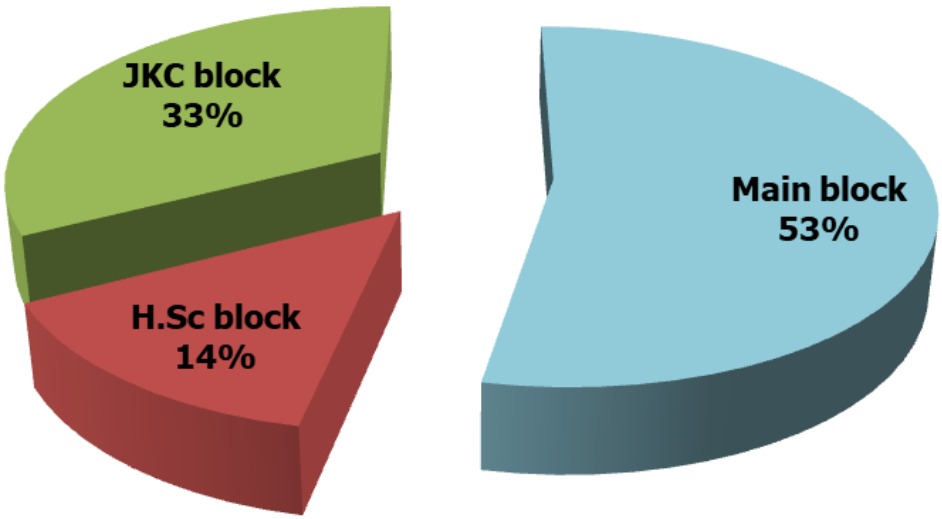

Figure 8: Energy consumed by air conditioners block wise

The above analysis shows the equipment in the **Main block consume 53% the JKC block consumes 33% the H.Sc block consumes 14%**

4.8.3 Site investigation observations

Some of the points noticed are as follows:

1. Daily monitoring and check is done by the maintenance staff and admin staff in an excellent manner.
2. The Outdoor Unit is properly cleaned and maintained well.
3. The Outdoor Unit does not have any dust collection problem.

4.8.4 About the replacement of Current AC

The current air conditioners are well maintained, through there is not an immediate requirement for replacement however, whenever the college undergoes redevelopment or a new block is constructed 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 a total of **263 equipment** in the premises. The various types and their detailed study are mentioned as follows.

Sr. No	Building Name	Floor	Equipment name	Equipment nos.
1	Main block	Ground floor	Autoclave	1
2	Main block	Ground floor	Autoclave	13
3	Main block	Ground floor	Autoclave	1
4	Main block	Ground floor	Automatic shaker	1
5	Main block	Ground floor	Binocular microscope	1
6	Main block	Ground floor	Binocular microscope	1
7	Main block	Ground floor	Binocular microscope	1
8	Main block	Ground floor	Centrifuge	1
9	Main block	First floor	Conductivity meter	1
10	Main block	First floor	CRO	1
11	Main block	Ground floor	Desktop Computer	13
12	Main block	Ground floor	Desktop Computer	1
13	Main block	Ground Floor	Desktop Computer	1
14	Main block	Ground Floor	Desktop Computer	1
15	Main block	Ground Floor	Desktop Computer	1
16	Main block	Ground Floor	Desktop Computer	1
17	Main block	Ground Floor	Desktop Computer	1
18	Main block	Ground Floor	Desktop Computer	14
19	Main block	Ground floor	Desktop Computer	1
20	Main block	Ground floor	Desktop Computer	5
21	Main block	Ground floor	Desktop Computer	1
22	Main block	Ground floor	Desktop Computer	1
23	Main block	Ground floor	Desktop Computer	2
24	Main block	Ground floor	Desktop Computer	1
25	Main block	Ground floor	Desktop Computer	1
26	Main block	Ground floor	Desktop Computer	1
27	Main block	Ground floor	Desktop Computer	1

28	Main block	Ground floor	Desktop Computer	1
29	Main block	Ground floor	Desktop Computer	15
30	Main block	Ground floor	Desktop Computer	1
31	Main block	Ground floor	Desktop Computer	11
32	Main block	Ground floor	Desktop Computer	2
33	Main block	Ground floor	Desktop Computer	1
34	Main block	Ground floor	Desktop Computer	1
35	Main block	First floor	Desktop Computer	1
36	Main block	First floor	Desktop Computer	3
37	Main block	First floor	Desktop Computer	1
38	Main block	First floor	Digital Board	1
39	Main block	First floor	Digital Board	1
40	Main block	First floor	Digital TV	1
41	Main block	First floor	Digital TV	4
42	Main block	First floor	Digital TV	4
43	Main block	First floor	Dough Mixer	1
44	Main block	First floor	Electrical balance	1
45	Main block	First floor	Freezer	3
46	Main block	First floor	Grinder	1
47	Main block	First floor	Hot air oven	6
48	Main block	First floor	Hot air oven	3
49	Main block	First floor	Hot air oven	1
50	Main block	First floor	Hot air oven	2
51	Main block	First floor	Hot air oven	1
52	Main block	First floor	Incubator	1
53	Main block	First floor	Incubator	2
54	Main block	First floor	Incubator	1
55	Main block	First floor	Incubator	2
56	Main block	First floor	Laminar Air Flow	1
57	H.Sc block	Ground floor	Laminar Air Flow	13
58	H.Sc block	Ground floor	Laminar Air Flow	1
59	H.Sc block	First floor	Laminar Air Flow	1
60	H.Sc block	First floor	Mic Stand	1
61	H.Sc block	First floor	Orbital shaker	1

62	H.Sc block	First floor	Oven	1
63	H.Sc block	First floor	Printer	1
64	H.Sc block	First floor	Printer	1
65	H.Sc block	First floor	Printer	1
66	H.Sc block	First floor	Printer	1
67	Commerce block	Ground floor	Printer	1
68	Commerce block	Ground floor	Printer	1
69	Commerce block	Ground floor	Printer	1
70	H.Sc block	First floor	Projector	1
71	Commerce block	Ground floor	Projector	1
72	Commerce block	First floor	Projector	1
73	JKC	Ground floor	Projector	1
74	JKC	Ground floor	Projector	1
75	JKC	Ground floor	Projector	1
76	JKC	Ground floor	Projector	1
77	JKC	Ground floor	Projector	1
78	JKC	Ground floor	Projector	1
79	JKC	Ground floor	Projector	1
80	JKC	Ground floor	Projector	1
81	JKC	Ground floor	Projector	1
82	JKC	Ground floor	Projector	1
83	JKC	Ground floor	Projector	1
84	JKC	Ground floor	Projector	2
85	Main block	First floor	Refrigerator	1
86	Main block	First floor	Refrigerator	1
87	JKC	Ground floor	Refrigerator	1
88	JKC	Ground floor	Refrigerator	1
89	JKC	Ground floor	Scanner	1
90	JKC	Ground floor	Sewing machine	1
91	JKC	Ground floor	Solar Connection	1
92	JKC	Ground floor	Speakers	1
93	JKC	Ground floor	Speakers	2
94	JKC	Ground floor	Spectrophotometer	1
95	JKC	Ground floor	Spectrophotometer	1

96	JKC	First floor	Spectrophotometer	27
97	JKC	First floor	Stove	7
98	JKC	First floor	Trans illuminator	19
99	JKC	First floor	Water bath	5
100	JKC	First floor	Water cooler	2
101	JKC	First floor	Weighing balance	2
102	JKC	First floor	Xerox machine	1
103	General	Underground	Water pump	3
104	Main block	Ground floor	RO Plant	1
Total				**263**

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

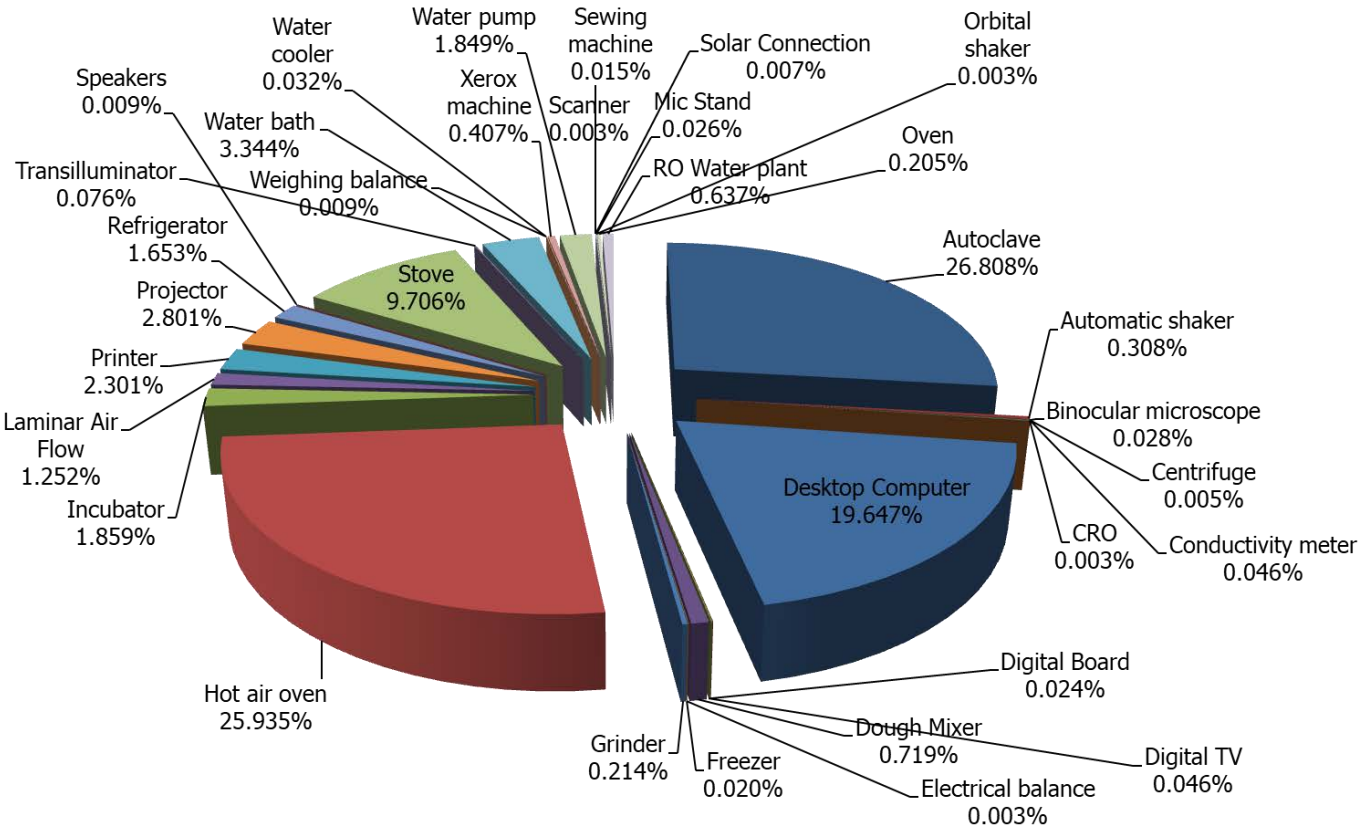

Figure 9: Summary of Energy consumed by equipment in the premises

The above summary shows that **Autoclave consumes more energy at 26.808%** while **Hot air oven consumes 25.935%** the **Desktop computer consumes 19.647%** and the **Stove consumes 9.706%** these are maximum consumers as compared to other equipment. UPS 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.

4.9.2 Block-wise consumption analysis

The energy consumption of Equipment is **1,25,892 kWh** of energy; the following graph shows the block wise consumption.

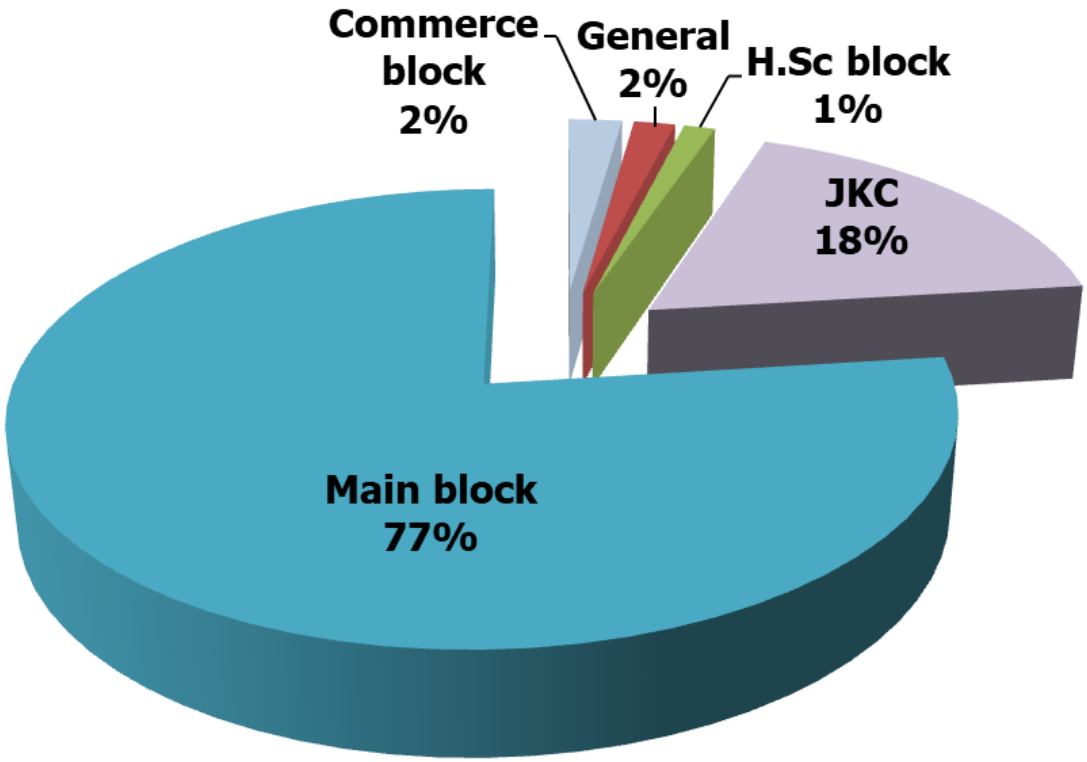

Figure 10: Energy consumed by equipment block wise

The above analysis shows the equipment in the **Main block consumes 77% the JKC block consumes 18% the Commerce and General (Considered for the motor starter for water) blocks consume an approximate of 2% each and the H.Sc block consumes 1%**

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.

4.10.1 Electromechanical systems – Electrical and Lighting

Section 1 – Lights

Non-LED and CFL Lights

The current light analysis shows that Non-LED tube lights consume anywhere between 24W, 36W and 40W when in use; similarly the CFL lights consume more than 25 to 28W when is use; these should be replaced with LED lights which consume on an average 16-20W when in use.

Our technical analysis shows that there would be a reduction of an average of **70% reduction** in energy consumption through lights specifically as a part of the electro - mechanical system if all **Non-LED and CFL lights on all floors and blocks** 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 60W when in use. These should be replaced with energy efficient fans consuming 32W when in use. Our detailed study states that is all the **ceiling fans in all Buildings** if replaced with star rated appliance results in a reduction of average of **47% 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 and Residential 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 University 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.

4.10.2 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 scheduling.
- Space temperature Setback - A temperature setback is a simple strategy to help save utility cost 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.


RUSA

5. Towards a Healthy & Sustainable Institution

5.1 Inputs by Greenvio Solutions

Based on the analysis of the study of premises in addition to the recommendations provided in each section of Ecological, Water, Waste and Energy Audit the College can adopt the following strategies towards a Healthy and Sustainable Institution practices.

a) **Terrace farming -** There can be provision of kitchen garden practices 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 vegetables grown which would be used in Canteen. It helps in capacity building as well as the smaller steps taken have huge impacts when each student would adopt these practices in their homes or societies and grow kitchen garden, terrace garden there will be a long term benefit for the environment as a whole.

b) **Cutlery in the Canteen –** The regular plastic and steel plates, spoons used in Canteen can be replaced with eco-friendly and organic leaves, paper straw, disposable plates, edible spoons and tables made out of sugarcane waste or bamboo. This will be first of its kind initiative to be adopted and practiced thus also inculcating the healthy practices in students.

c) **Additional fire safety -** Measures such as Hose reel, signages, fire-fighting tank, fire alarm and sprinkler system should be adopted.

d) **Waste vio –** Stepping up a little further an initiative can be undertaken wherein College can tie up with an organisation and students can be encouraged to collect dry waste and electronic waste such as newspapers, old computers and others and hand over to organisation on a weekly or monthly basis thereby making a waste reduction approach in the community. This has benefits such as awareness, eco-friendly habits in becoming a responsible citizen.

e) **Signages –** In addition to the signages being in regular language there can be additional signages in braille language for the specially abled students.

5.2 Survey Results

An online survey was conducted to analyse the student and staff views about what changes according to you can be undertaken for Green audit improvement in College premise and activity, some of the key responses are listed below. Whereas many responses **stated there were no changes requires because the present practices are excellent.**

- College is present very beautiful
- No changes, it was going wonderfully

Some of the suggestions by the Students and staff are listed below:

- The college should sweep every day....or at least one time per two days
- More dustbins and also cleaning the corridors along with classes
- They should have to promote frequently about green awareness programs

However, it should be noted that the College has taken up multiple initiatives and because of Pandemic the students have not practically visited the campus so many of these points are not mandatory at the moment.

6. 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-motorizes vehicle and Public Transport Infrastructure – Report guidelines by Samarthyam (National centre for Accessible Environments) – an initiative supported by Shakti Sustainable Energy Foundation.


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