Sadakathullah Appa College

*An Autonomous Institution, Re-Accredited by NAAC at an 'A' Grade, * ISO 9001: 2015 Certified *

CRITERION VII

INSTITUTIONAL VALUES AND BEST PRACTICES

7.1.6

Quality Audits on Environment and Energy

Energy Audit

Submitted to

THE NATIONAL ASSESSMENT AND ACCREDITATION COUNCIL (NAAC)

August 2022

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ENERGY AUDIT

2019-20 & 2020-21

AUDIT REPORT

Studied for

Sadakathullah Appa Educational Society's

Sadakathullah Appa College (Autonomous)

Rahmath Nagar, Tirunelveli - 627011, Tamil Nadu

Analysed by

Greenvio Solutions

26 January 2022

Background reference image Janko Ferlic on pexels

Disclaimer

Green Audit Team has prepared this report for the **Sadakathullah Appa Educational Society's Sadakathullah Appa College (Autonomous)** located at *Rahmath Nagar, Tirunelveli - 627011, Tamil Nadu* 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 on-site 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 along with Ar. Nahida Shaikh as an Accredited Green Building Professional.

Greenvio Solutions

Developing Healthy and Sustainable Environments

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Acknowledgement

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

Contents

1. Introduction

1.1 About the Sadakathullah Appa Educational Society

It was established in the year 1971. The College with a vision by the Society for providing quality higher education to all, especially the Muslim, both men and women, and other deprived, disadvantaged, underprivileged sections of the society, is equally committed to inculcate the students with spiritual and moral values..

It is one of the premier Educational Societies in the country including some of the most distinguished and eminent Institutions and providing quality education with best state of the art facility and Infrastructure to the students.

1.2 Statements of the College

Vision - Sadakathullah Appa College, founded by the Muslim minority community, is committed to provide quality higher education to all especially the Muslims, both men and women and other deprived, disadvantaged, underprivileged sections of the society. It is equally committed to inculcate the students with spiritual and moral values. The college aims at producing good and useful citizens worthy of the great land.

Mission – The College has the following mission:

- To Offer Undergraduate And Postgraduate Courses In Humanities, Arts And Sciences
- To Undertake, Initiate And Promote Research Both Pure And Applied At M.Phil \ Ph.D Levels.
- To Offer Extension Services.

1.3 About the Institution

Ever since the British period the twin towns of Tirunelveli and Palayamkottai, intersected by the Perennial River Thamirabarani, have been great centres of learning. The Tirunelveli district has a sizeable Muslim population which necessitated the need for an institution of higher education. Due to the dedicated and sincere efforts of the Muslim elite, a College of

Arts and Sciences, named after the renowned Arabic scholar Sadakathullah Appa, was started in 1971. The motto of the College is My Lord, Vouchsafe Me Wisdom.

The College is located on a 40 acre sprawling campus and is run by Sadakathullah Appa Educational Society. It was first affiliated to Madurai Kamaraj University for 20 years. With the birth of the Manonmaniam Sundaranar University in 1990, the College was affiliated to it. It became co-educational in 1997.

The College aims at producing holistic personalities by introducing globally relevant subjects and imbibing in them aptitude for learning, internalizing of best practices, Institutional culture and commitment towards community. The Institution offers the following courses affiliated to Manonmaniam Sundaranar University, a dynamic institution of higher learning, set in a rural milieu of southern Tamil Nadu.

- **Graduation** – It offers the following Undergraduate courses.
  - Bachelor of Arts (B.A.) – Arabic, Tamil, English, History
  - Bachelor of Commerce (B. Com)
  - Bachelor of Science (B. Sc) – Chemistry, Microbiology, Nutrition and Dietetics, Physics, Zoology, Mathematics, Computer Science,
  - Bachelor of Computer Applications (B.C.A.)
  - Bachelor of Science (B. Sc I.T.) Information Technology
  - Bachelor of Library Science (B.L.I.Sc)
- **Post-Graduation** – It offers the following Post Graduation courses.
  - Masters in Arts (English, History)
  - Masters in Commerce
  - Masters in Science (Chemistry Physics, Mathematics, Computer Science, Microbiology, Zoology)
  - Masters in Philosophy (Physics, History, Maths)
- **Study Center –** The Institute has the following Study Centres in the premises.
  - Affiliated to M.S.University Distance Education Courses, Tamil Nadu
  - Affiliated to Indira Gandhi National Open University (I.G.N.O.U.), Delhi

1.4 The surrounding premises around the Institution

The Premises is situated amidst the landscape serene of **Tirunelveli district of Tamil Nadu State** with immense peace and calmness in the surroundings. The college is surrounded by Educational Buildings on the East side, Religious Buildings on the South-West in terms of important micro area divisions and Residential areas on the macro front from all the sides. There is a frontal approach which provides quite a beautiful appreciation space while approaching the premise; 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 enhance 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

Affiliations - The College is affiliated to Manonmaniam Sundaranar University, Tamil Nadu.

Certification – The institute has received the ISO, NIRF and AISHE Certifications

Recognitions - University Grant Commission (UGC) by 2(f) 12(b)

Accreditation - The following are details of the reaccreditation of the College.

Cycle	First	Second	Third
CGPA	75.00	3.11	3.40
Grade	B+	A	A
Year	2003	2009	2015

Table 1: NAAC Accreditation details of the College

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

1.6 Achievements of the College

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

1. The College was declared **an ISO 9001:2000 certified institution in 2009.**
2. The College was declared **an ISO 9001:2008 by the British Standards Institution (BSI) in 2011.**
3. The College was **conferred an Autonomous Status in 2007-2008.**

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 total of **1,587 Girl and 2,069 Boys** students students and **a total of 3,656 students** in the premises.

2.1.2 Staff data

Type	Male	Female	Total
Teaching staff	76	91	**167**
Non-Teaching staff	49	35	**84**
Admin staff	06	02	**08**

Table 2: Staff data of the Institution for 2019-20

The staff data shows the premise has a total of **259** 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 total of **1,520 Girl and 2,214 Boys** students and **a total of 3,734 students** in the premises.

2.2.2 Staff data

Type	Male	Female	Total
Teaching staff	79	86	**165**
Non-Teaching staff	53	34	**87**
Admin staff	06	02	**08**

Table 3: Staff data of the Institution for 2020-21

The staff data shows the premise has a total of **260** staff members.

2.3 Total College Area & College Building Spread Area

The **total site area is 40.52 acres** and the **total Built-up area of College is 1,01,000 sq.ft** for **a total of 3,994 footfalls.**

2.4 College Infrastructure

2.4.1 Establishment

The College is run by **Sadakathullah Appa Educational Society, Tamil Nadu**. 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 Premise 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 premise, 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	8:00 a.m. to 6:15 p.m.	10:15	280
2	General areas	Admin areas and library, Passage, staircase, toilet	8:00 a.m. to 6:30 p.m.	10:30	300

Table 4: Schedule of the timings of the premises

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 premise 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 campus

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

- 09 August 2021 – Allotment and Initiation by the College
- 03 October 2021 – Survey of the Student and staff submitted
- 22 November 2021 – Data submitted by College
- 26 January 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 8,014 units per month for Rs. 66,951/- per month (average).
2. **Electricity (Solar - Photovoltaic cells are used for solar energy) –** There are solar panels available in premise at present. The Solar Rooftop Power Plant is of 20 kW solar (Rooftop Solar Power Generation System, 3 Phase grid). These are available at all Buildings in the premises. Through each of these locations the energy is transferred to electrical appliances in the premises.

4.1.2 Secondary sources

1. **Inverter –** There are 14 Inverters in the premises.
2. **Diesel Generator –** There are 8 Diesel Generators in the premises.
3. **UPS –** There are 8 UPS of various capacities in the premises.
4. **Batteries** – There are 119 Batteries in the premises.
5. **Gas cylinders –** There are 51 gas cylinders in the premises.

Around Rs. 50,000/- is spent on a monthly basis towards the all of the Secondary sources of energy consumption. The section wise information is represented below.

Room Name	LPG		Diesel Generator		UPS		Inverter		Battery
	Nos.	Required	Nos.	Capacity (kVa)	Nos.	Capacity (kVa)	Nos.	Capacity (W)	
Principal							1	1000	1
Vice Principal							1	625	1
Office					1	5	1	875	16
B. Com (Aided) Department							1	1050	1
Chemistry Department	5	1 year					1	875	1
MMD Lab					1	5	1	1050	11
Dean Office							1	1050	1

Zoology Department	1	1 year					1	1050	1
B. A (English& Tamil) Department							1	875	1
B. Sc Computer Science (Aided) Department							1	875	1
Computer Lab-I					2	7.5	1		30
IQAC Office							1	875	1
Attendance Department							1	875	1
Maths Aided Department							1	875	1
History (PG & Research) Department							1	-	
B. Com (S. F) Department							1	875	1
Canteen	10	Per Month					1	700	1
Computer Science (PG & Research) Dept.					1	-			10
COE Office					1	5	1	860	11
Seminar Hall							1	1600	2
e-library					1	5	1		10
Auditorium							1	1600	2
Microbiology Department	3	1 year					1	1050	1
B.A English							2	875	1
B.B.A & Maths (S. F)							1	875	1
Physics Lab							1	875	1
Nutrition Department							1	875	1
Physics Department	2	Per Month	1				1	875	1
Library					1	7.5	1	1100	6
Committee Office							1	875	1
Mosque							1	1050	1
Boys Hostel	30	Per Month	4						
Outside the Building			1	125					
			1	63					
			1	15					
Total	***51***		***8***		***8***		***14***		***119***

Table 5: Details of the Secondary source of energy consumption

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 Tamil Nadu Generation and 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.

Duration	Units	Amount
Meter No. 070110182298		
Jun-19	470	6,570
Apr-19	830	592
Meter No. 070110181184		
Jan-20	12,066	1,01,977
Dec-19	9,448	81,234
Nov-19	9,916	85,061
Oct-19	16,562	1,37,422
Sep-19	21,408	1,75,617
Aug-19	16,509	1,37,027

Meter No. 070110181205		
Aug-19	3,600	32,124
Jun-19	2,100	20,300
Meter No. 070110181041		
Aug-19	5,600	45,600
Jun-19	2,810	23,503
Meter No. 0701101827		
43,617	3,670	31,247
43,556	7,200	59,040

Table 6: 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

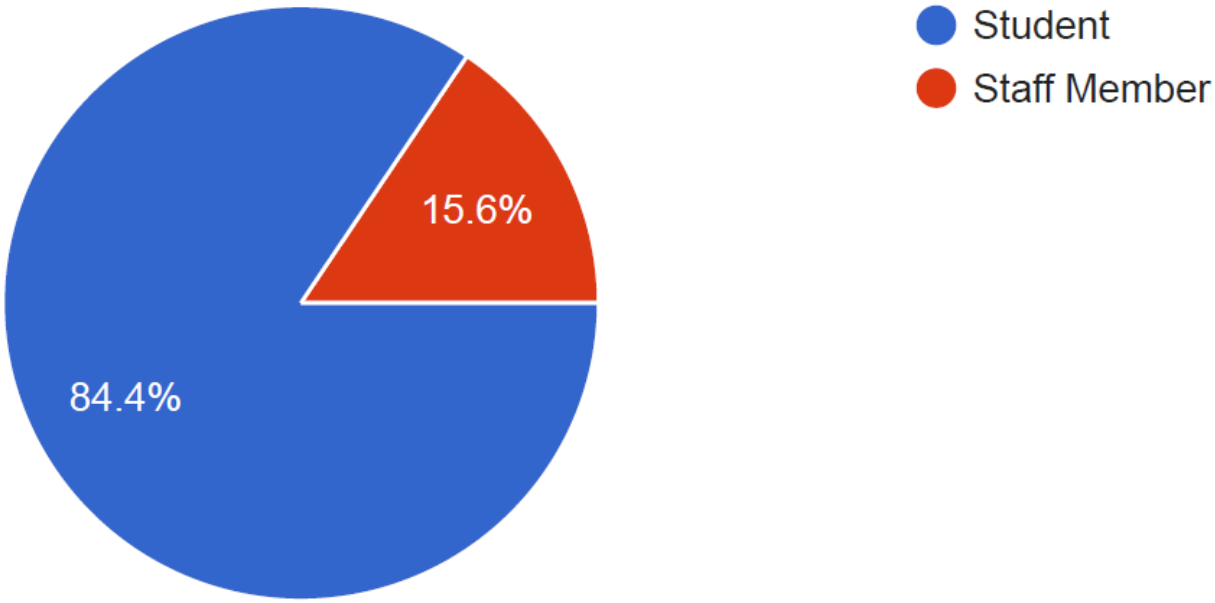

Figure 1: Participation analysis in the survey

A total of **475 responses** were received out of which 84% 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%)

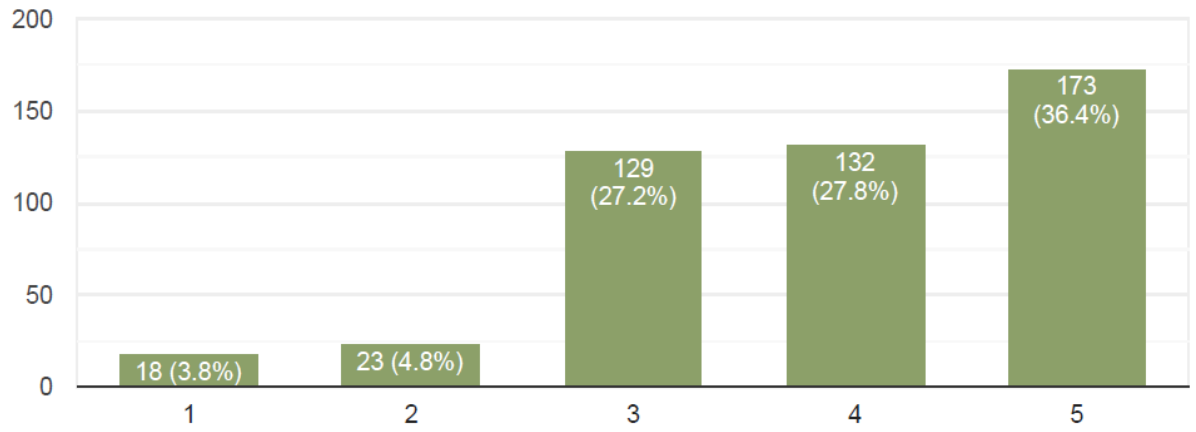

Figure 2: Energy Management practices in College

The students, staff **(almost 36%)** of the responses found the practices to be Excellent.

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 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.

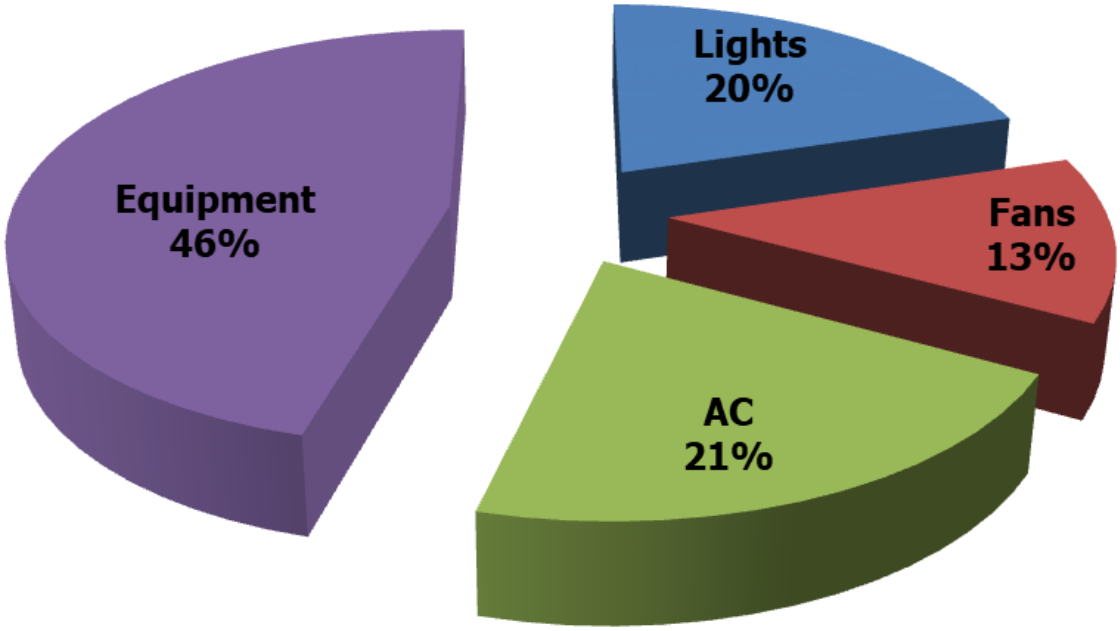

Figure 3: Summary of the Calculated Electrical Consumption as per inventory

The above graph shows that Equipment consumes 46% followed by AC at 21% Lights at 20% and Fans at 13% of the total calculated electrical energy.

4.6 Lights

4.6.1 Types of lights

There are a total of **1,402 Lights in the premises;** the following table shows the various types of lights in the premises.

S. No.	Type	Nos.
1	CFL	56
2	Halogen	27
3	LED	607
4	Low intensity incandescent	46
5	Mercury vapour lamp	1
6	Sodium vapour lamp	1
7	Non-LED	652
8	Solar lights	12
Total		**1,402**

Table 7: Summary of the types of Lights in premise

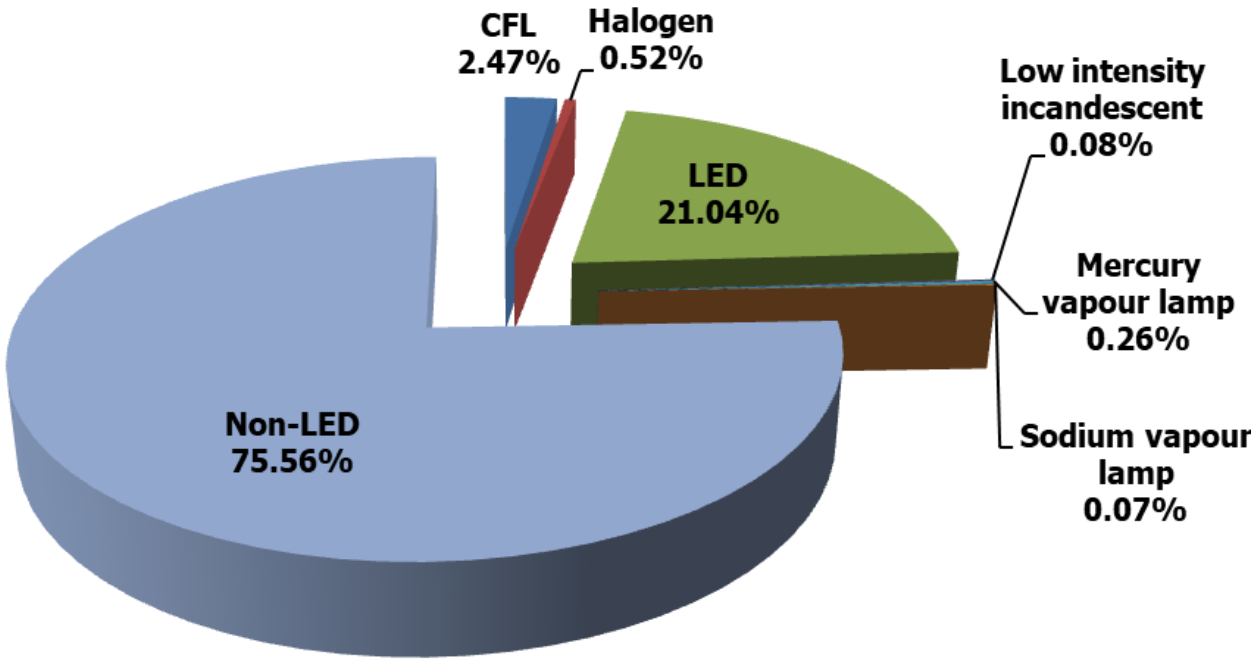

Figure 4: Energy consumed by Types of Lights in the premise based on the usage study

The analysis of the types of Lights in premises shows **Non-LED Tubelights consume 70,310 kWh at 75.56%** followed by **LED lights consuming 19,578 kWh at 21.04%** the **CFL consumes 2,300 kWh at 2.47%** whereas the **Halogen lights consume 486 kWh at 0.52%** the **Mercury vapour lamps consume 238 kWh at 0.26% the Low intensity incandescent lights consume 75 kWh at 0.08% and the Sodium vapour lamp consumes 69 kWh at 0.07% .** *There are 12 solar lights powered by natural light since they do not contribute to electrical power consumption they are excluded in this study.*

4.6.2 Floor-wise consumption analysis

The energy consumption of Lights is **93,056 kWh** of energy; the following graph shows the floor wise consumption. This section analysis constitutes all buildings as a single entity.

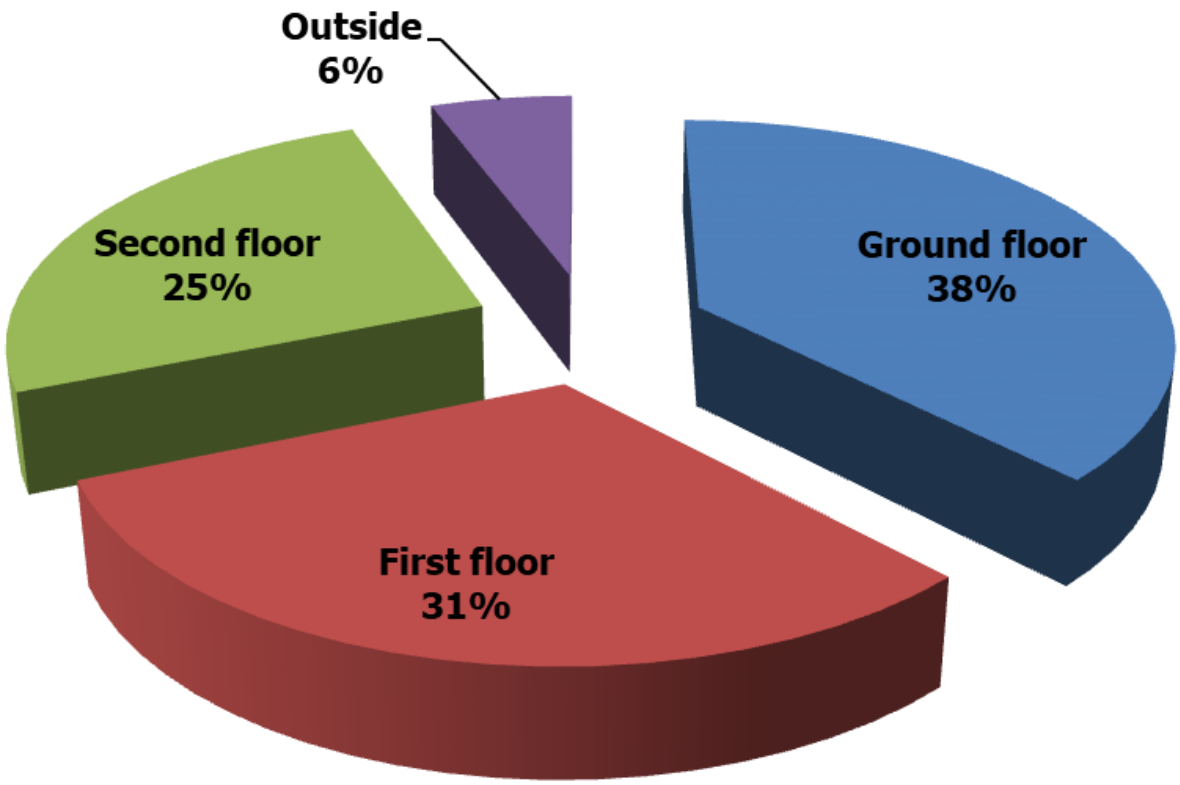

Figure 5: Energy consumed by Lights floor wise

The above analysis shows the Lights in the **Ground floor consumes 35,129 kWh at 38%** while the **First floor consumes 28,888 kWh at 31%** the **Second floor consumes 23,762 kWh at 25%** and the **ones in the Outside zone consume 5,277 kWh at 6%**

4.6.3 Section-wise consumption analysis

The energy consumption of Lights is **93,056 kWh** of energy; the following graph shows the section wise consumption. This section analysis constitutes all buildings as a single entity.

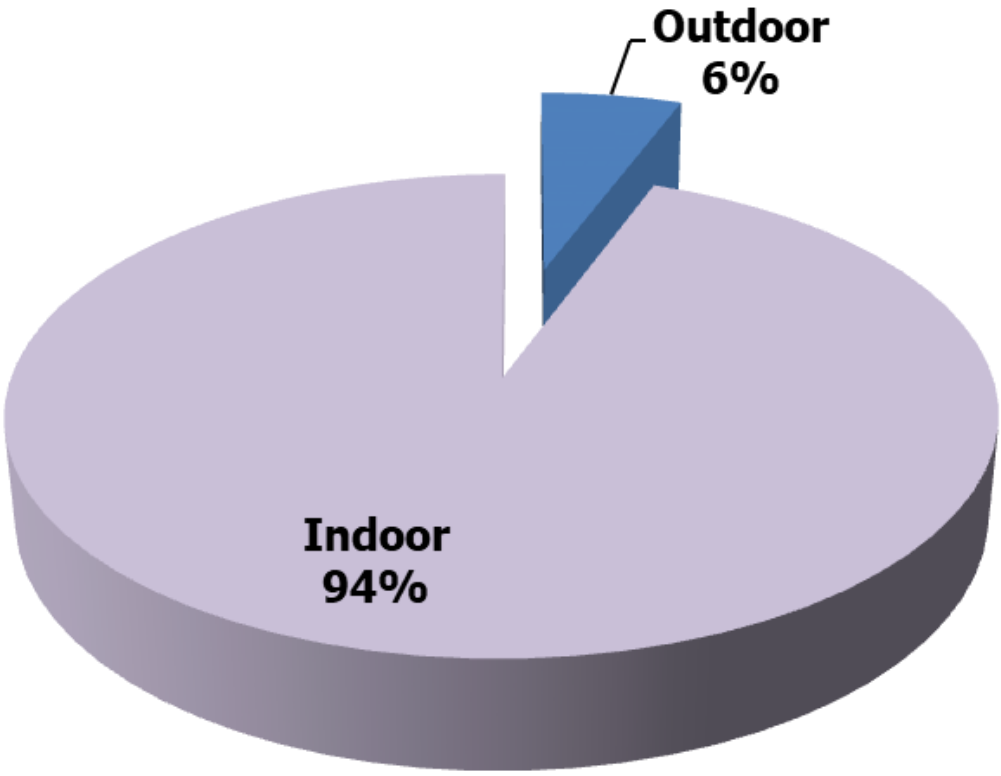

Figure 6: Energy consumed by Lights section wise

The above analysis shows the Lights in the **Indoor sections consume 87,779 kWh at 94%** while the ones in **Outdoor section consumes 5,277 kWh at 6%**

4.6.4 Building-wise consumption analysis

The energy consumption of Lights is **93,056 kWh** of energy; the following graph shows the Building wise consumption. This section analysis constitutes all buildings as a single entity.

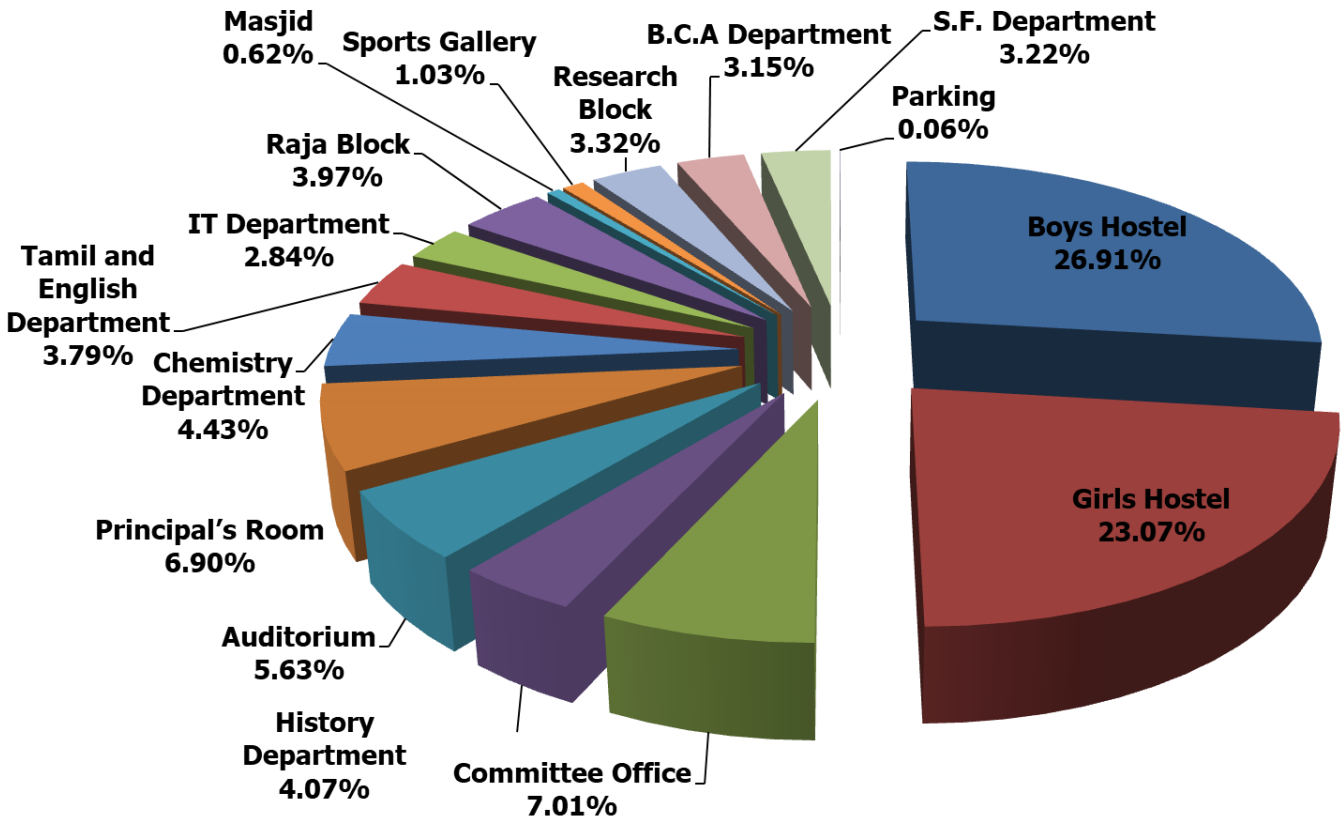

Figure 7: Energy consumed by Lights Building wise

The above analysis shows the Lights in the **Boys Hostel consumes 25,037 kWh at 26.91%** the **Girls Hostel consumes 21,468 kWh at 23.07%** the **Committee Office consumes 6,523 kWh at 7.01%** the **Principal's Room consumes 6,421 kWh at 6.90%** the **Auditorium consumes 5,235 kWh at 5.63%** the **Chemistry Department consumes 4,127 kWh at 4.43%** the **History Department consumes 3,786 kWh at 4.07%**

The **Raja Block consumes 3,692 kWh at 3.97%** the **Tamil and English Department consumes 3,527 kWh at 3.79%** ***the*** **Research Block consumes 3,086 kWh at 3.32%** the **S.F. Department consumes 2,996 kWh at 3.22%** the **B.C.A Department consumes 2,931 kWh at 3.15%** the **IT Department consumes 2,642 kWh at 2.84%** the **Sports Gallery consumes 955 kWh at 1.03%** the **Masjid consumes 575 kWh at 0.62%** and the **Parking consumes 55 kWh at 0.06%**

4.6.5 Requirement of NAAC

4.6.5.1 Alternative Energy Initiative

Percentage of power requirement met by renewable energy sources – There are solar panels available in premise at present. The Solar Rooftop Power Plant is of 20 kW (Rooftop Solar Power Generation System, 3 Phase grid) for Purchase power agreement with local Municipality. The specifications are as follows:

- A 20 kW solar panel was installed.
- The 20 kW solar meters reading for the month of March 2021 is 31,512 - 34250 units.

100% of the energy produced is utilised by the Buildings in the premises.

4.6.5.2 Percentage of lighting power requirement met through LED bulbs

The premise has LED Lights contribute to 43% in terms of number and **21% 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.

4.6.6 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 **631 fans** in the premise. The following table shows the various types of fans in the premises.

S. No.	Type	Nos.
1	Ceiling fan	610
2	Exhaust fan	9
3	Pedestal fan	6
4	Wall Mounted fan	6
Total		**631**

Table 8: Summary of the types of fans in premise

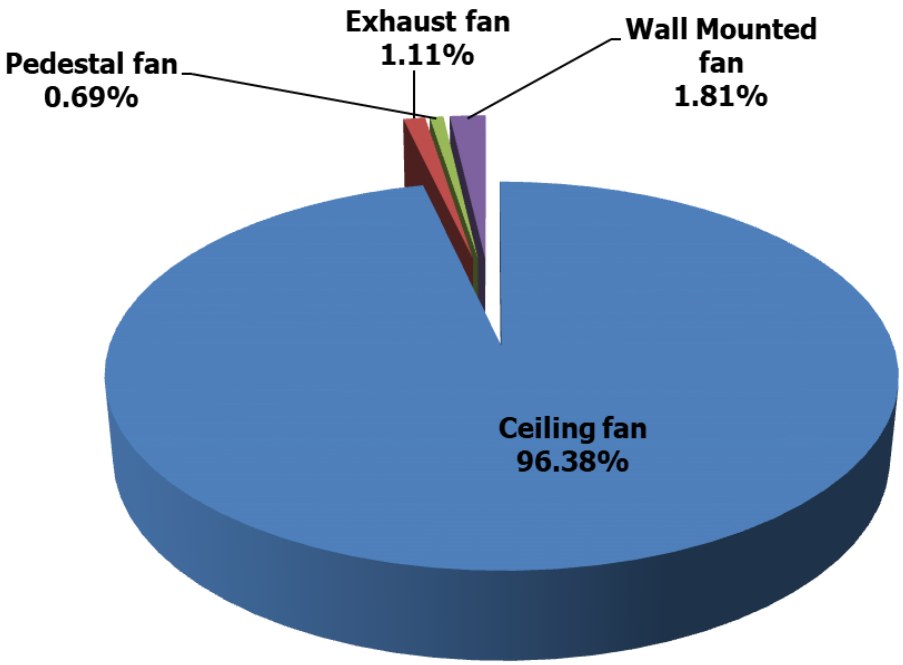

Figure 8: Energy consumed by Types of Fans in the premise based on the usage study

The analysis of the types of fans in premises shows **Ceiling fans consume 55,952 kWh at 96.38%** the **Wall Mounted fans consume 1,050 kWh at 1.81%** while the **Exhaust Fans consume 647 kWh at 1.11%** and the **Pedestal fans consume 403 kWh at 0.69%**

4.7.2 Floor-wise consumption analysis

The energy consumption of Fans is **58,051 kWh** of energy; the following graph shows the floor wise consumption. This section analysis constitutes all buildings as a single entity.

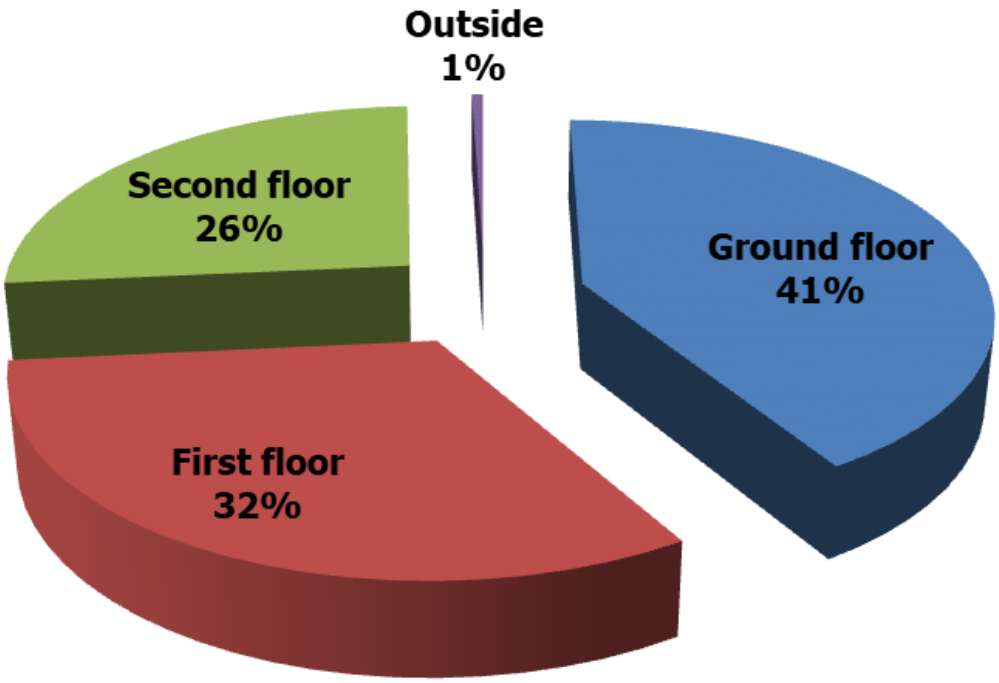

Figure 9: Energy consumed by Fans floor wise

The above analysis shows the Fans in the **Ground floor consumes 23,986 kWh at 41%** while the **First floor consumes 18,683 kWh at 32%** the **Second floor consumes 15,080 kWh at 26%** and the **ones in the Outside zone consume 302 kWh at 1%**

4.7.3 Section-wise consumption analysis

The energy consumption of Fans is **58,051kWh** of energy; the following graph shows the section wise consumption. This section analysis constitutes all buildings as a single entity.

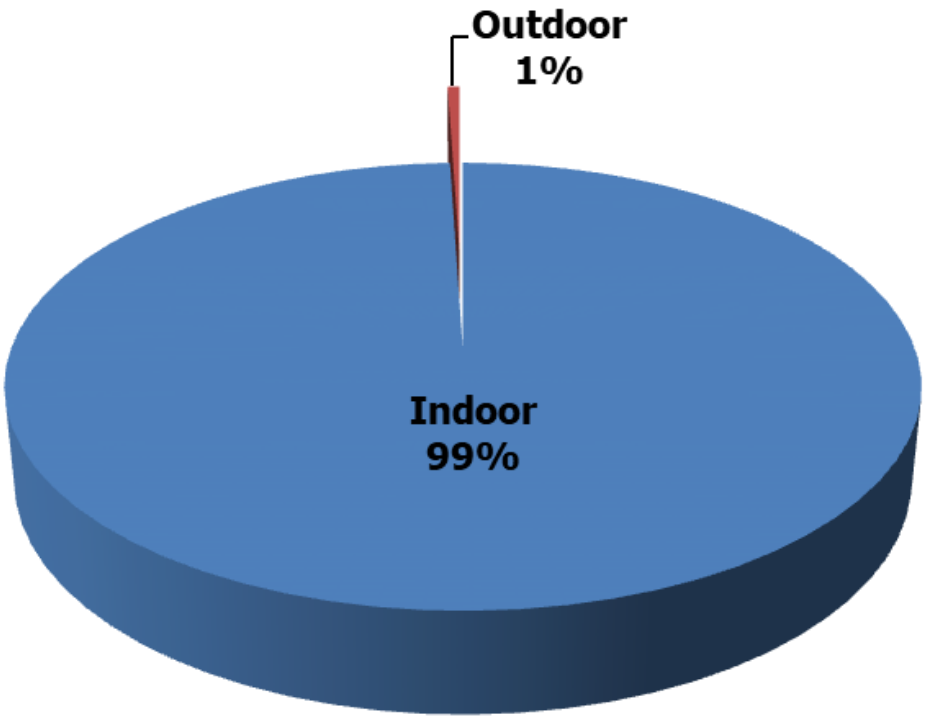

Figure 10: Energy consumed by Fans section wise

The above analysis shows the Fans in the **Indoor sections consume 57,750 kWh at 99%** while the ones in **Outdoor section consumes 302 kWh at 1%**

4.7.4 Building-wise consumption analysis

The energy consumption of Fans is **58,052 kWh** of energy; the following graph shows the Building wise consumption. This section analysis constitutes all buildings as a single entity.

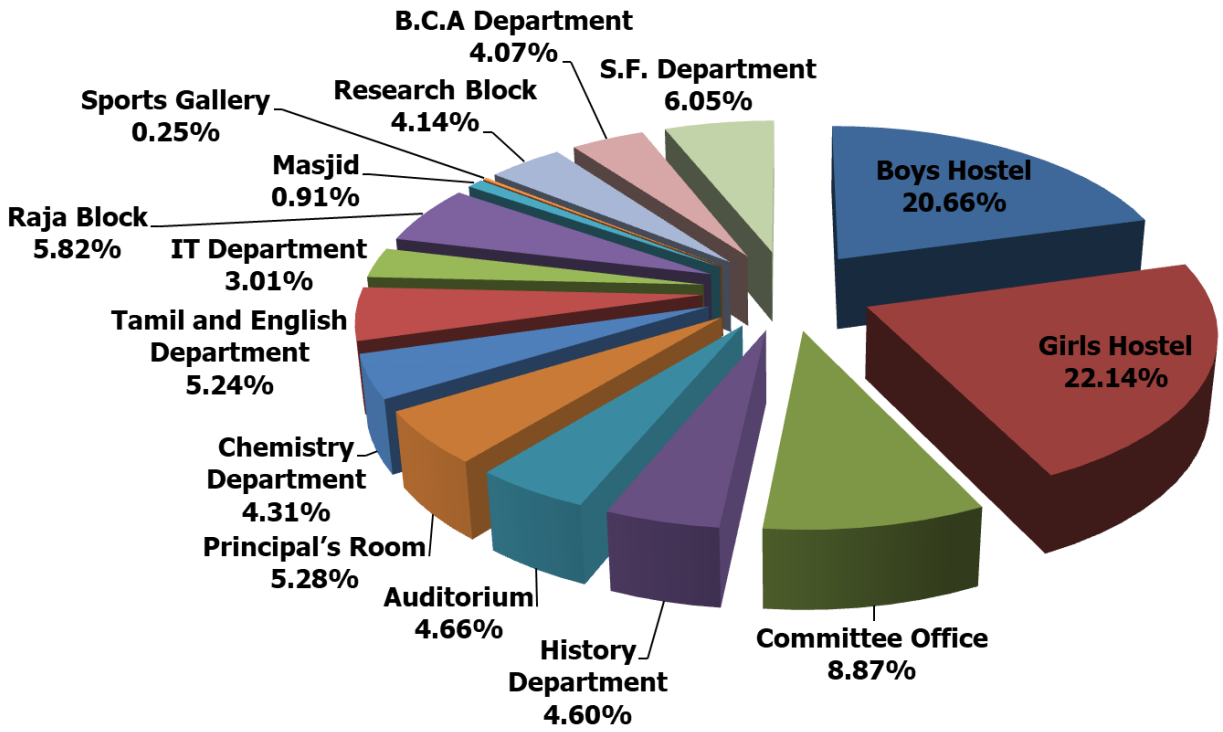

Figure 11: Energy consumed by Fans Building wise

The above analysis shows the Fans in the **Girls Hostel consumes 12,852 kWh at 22.14%;** the ones in **Boys Hostel consumes 11,995 kWh at 20.66%;** the **Committee Office consumes 5,151 kWh at 8.87%;** the **S.F. Department consumes 3,511 kWh at 6.05%;** the **Raja Block consumes 3,377 kWh at 5.82%;** the **Principal's Room consumes 3,066 kWh at 5.28%;** the **Tamil and English Department consumes 3,041 kWh at 5.24%;** the **Auditorium consumes 2,705 kWh at 4.66%;** the **History Department consumes 2,671 kWh at 4.60%;** the **Chemistry Department consumes 2,502 kWh at 4.31%;** the **Research Block consumes 2,405 kWh at 4.14%;** the **B.C.A Department consumes 2,360 kWh at 4.07%;** the **IT Department consumes 1,747 kWh at 3.01%;** the **Masjid consumes 527 kWh at 0.91%** and the **Sports Gallery consumes 143 kWh at 0.25%**

4.7.5 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 AC

4.8.1 Types of AC

There are **47 air conditioners** in the entire premise. The details are further studied and mentioned as follows.

S.No	Room Name	Building	Floor	AC Nos.
1	Committee Office	Committee Office	First Floor	3
2	Guest room			1
3	Microbiology Department	Auditorium		2
4	Auditorium			10
5	Principal's Room	Principal's Room	Ground Floor	1
6	Vice-Principal's Room			1
7	Office			2
8	Chemistry Department	Chemistry Department		1
9	Computer Lab-I	Tamil and English Department		5
10	IT Lab	IT Department		5
11	Hall No.34			2
12	Hall No.37			4
13	Masjid	Masjid		4
14	Doctoral committee	Research Block	Second Floor	1
15	B.C.A Lab	B.C.A Department		5
Total				**47**

Table 9: Details of the air-conditioner in premise

4.8.2 Floor-wise consumption analysis

The energy consumption of AC is **97,178 kWh** of energy; the following graph shows the floor wise consumption. This section analysis constitutes all buildings as a single entity.

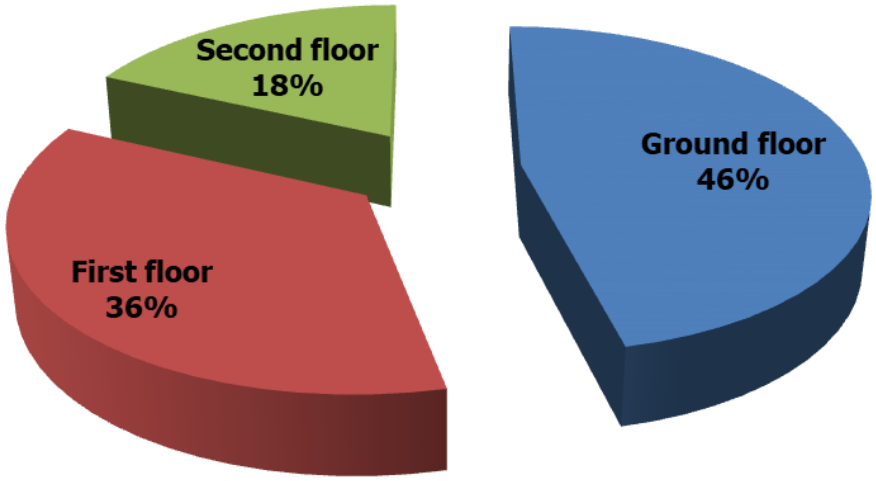

Figure 12: Energy consumed by AC floor wise

The above analysis shows the AC in the **Ground floor consumes the highest amount of energy which is 45,118 kWh at 46%** while the **First floor consumes 34,461 kWh at 36% and the Second floor consumes 17,600 kWh at 29%**

4.8.3 Building-wise consumption analysis

The energy consumption of AC is **97,178 kWh** of energy; the following graph shows the Building wise consumption. This section analysis constitutes all buildings as a single entity.

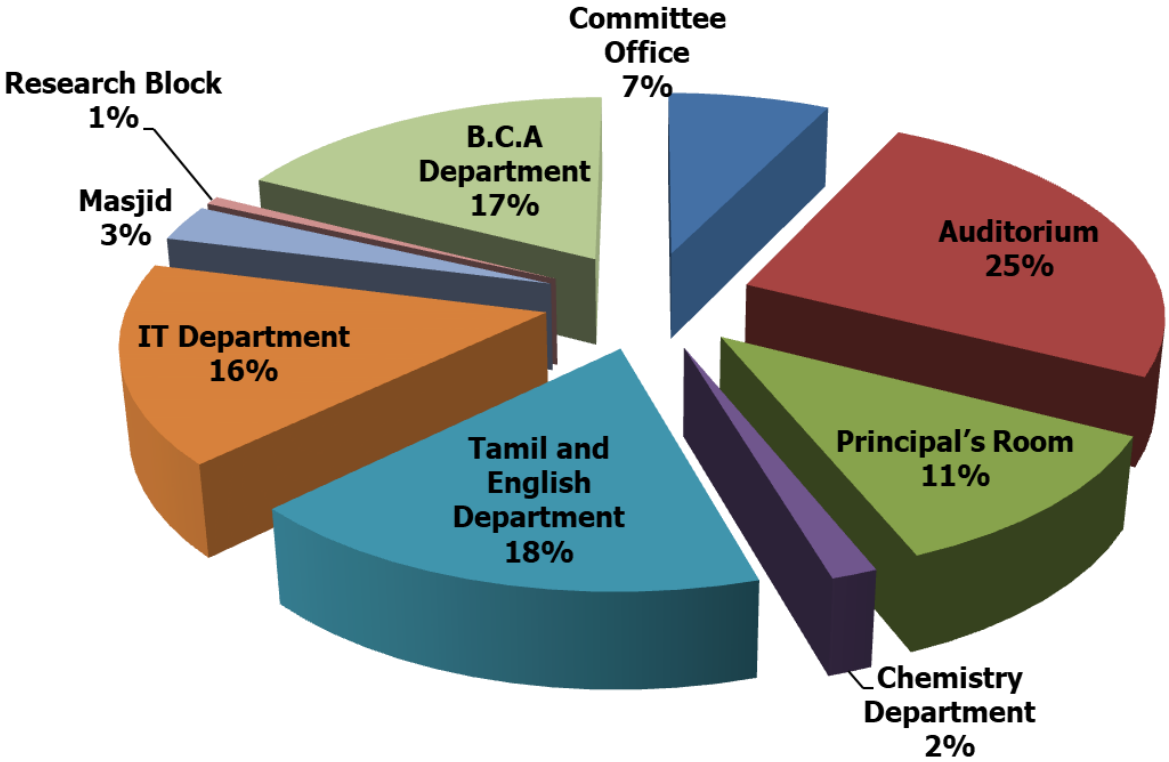

Figure 13: Energy consumed by AC Building wise

The above analysis shows the AC in the **Auditorium consumes 24,517 kWh at 25%;** the **Tamil and English Department consumes 16,940 kWh at 18%;** the **B.C.A Department consumes 16,940 kWh at 17%;** the **IT Department consumes 15,673 kWh at 16%;** the **Principal's Room consumes 11,026 kWh at 11%;** the **Committee Office consumes 7,084 kWh at 7%;** the **Masjid consumes 2,860 kWh at 3%;** the **Chemistry Department consumes 1,478 kWh at 2%** and the **Research Block consumes 660 kWh at 1%**

4.8.4 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.

4.9 Equipment

4.9.1 Types of Equipment

There are a total of **30 types of equipment totalling to 345 in number** in the premise. The various types are mentioned in the table below.

S. No.	Name	Nos.
1	Amplifier	4
2	Autoclave	1
3	Bore Motor	1
4	Chapathi cutting machine	1
5	Deep freezer	1
6	Dough making machine	1
7	Knife sharpening machine	1
8	LED TV	1
9	Illuminar	1
10	Hot plate	1
11	Microwave oven	4
12	Mono block motor	1
13	Muffle furnace	2
14	Pressure Motor	1
15	R.O.	1
16	Priojector	2
17	TV	1
18	Vegetable cutting machine	1
19	Weighing machine	1
20	RO Mini Motor	1
21	Water cooler	1
22	Xerox Machine	1
23	Desktop Computer	251
24	FM Radio Speaker	7
25	Grinder	2
26	Incubator	3
27	Mixie	2

28	Printer	37
29	Pumping Motor	2
30	Refrigerator	11
Total		**345**

Table 10: Types of equipment in the premise as per the quantity

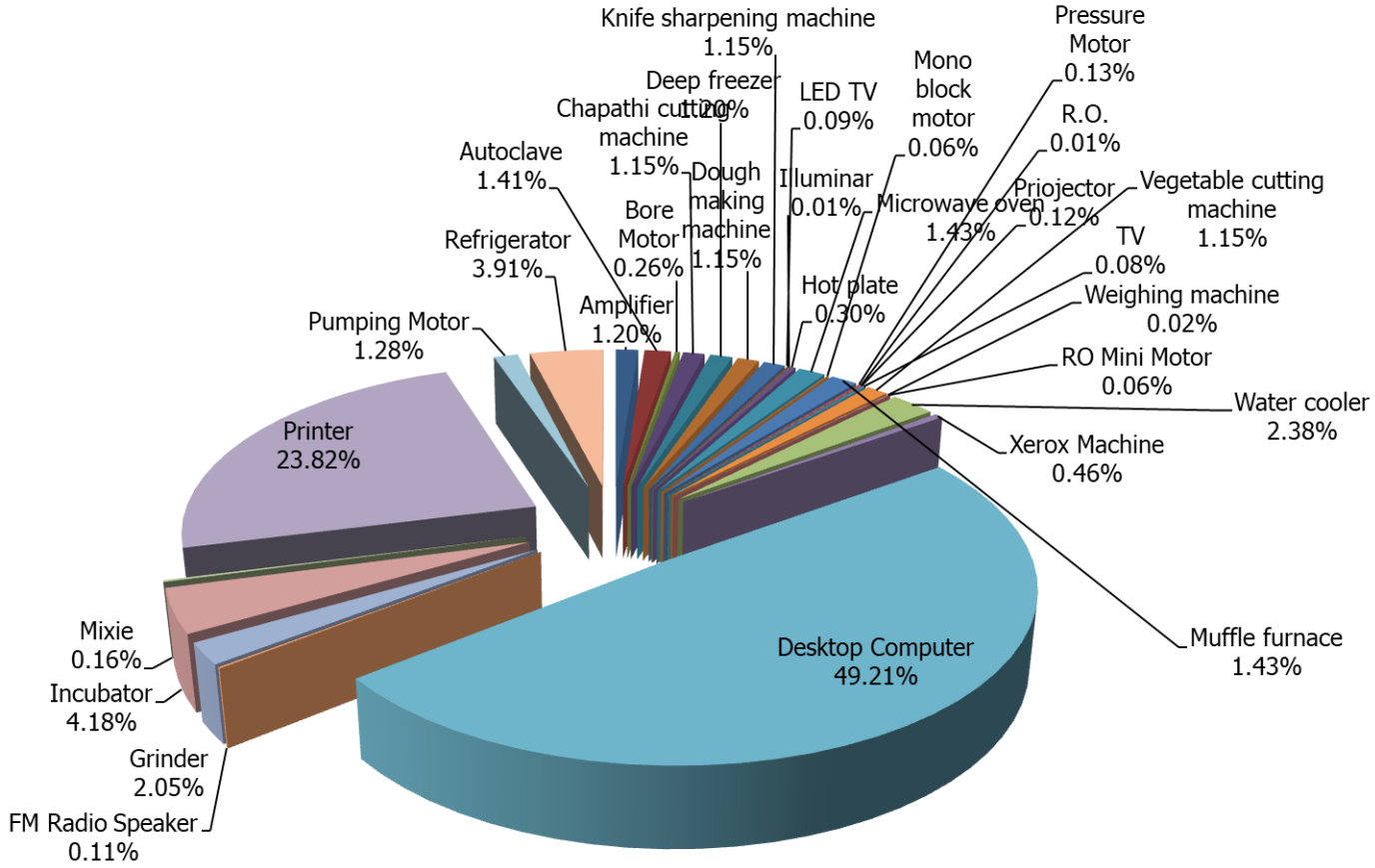

Figure 14: Summary of Energy consumed by Equipment in the premises

The above summary shows that **Desktop computer consumes more energy at 49.21%** while **Printer at 23.82%** and the **Incubator consumes 4.18%** 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 Floor-wise consumption analysis

The energy consumption of Equipment is **2,10,788 kWh** of energy; the following graph shows the floor wise consumption. This section analysis constitutes all buildings as a single entity.

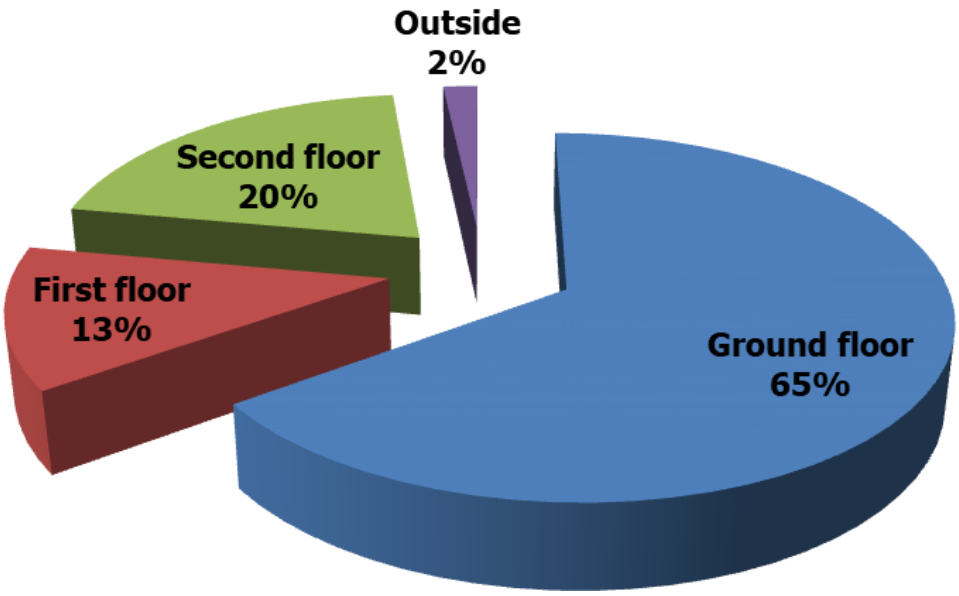

Figure 15: Energy consumed by Equipment floor wise

The above analysis shows the Equipment in the **Ground floor consumes 1,37,326 kWh at 65%** while the **Second floor consumes 42,944 kWh at 20%** the **First floor consumes 26,872 kWh at 13%** and the ones in **Outside zone consume 3,645 kWh at 2%**

4.9.3 Section-wise consumption analysis

The energy consumption of Equipment is **2,10,788 kWh** of energy; the following graph shows the section wise consumption. This section analysis constitutes all buildings as a single entity.

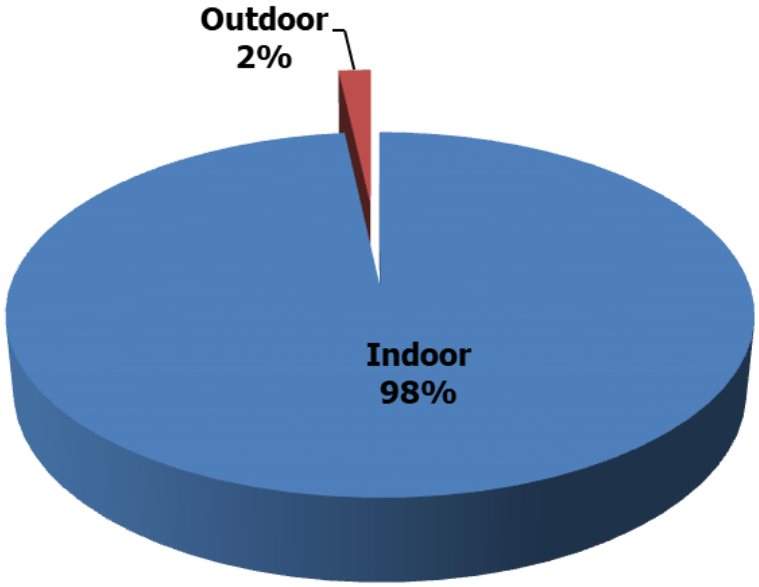

Figure 16: Energy consumed by Equipment section wise

The above analysis shows the Equipment in the **Indoor sections consume 2,07,143 kWh at 98% and the ones in Outdoor section consumes 3,645 kWh at 2%**

4.9.4 Building-wise consumption analysis

The energy consumption of Equipment is **2,10,788 kWh** of energy; the following graph shows the Building wise consumption. This section analysis constitutes all buildings as a single entity.

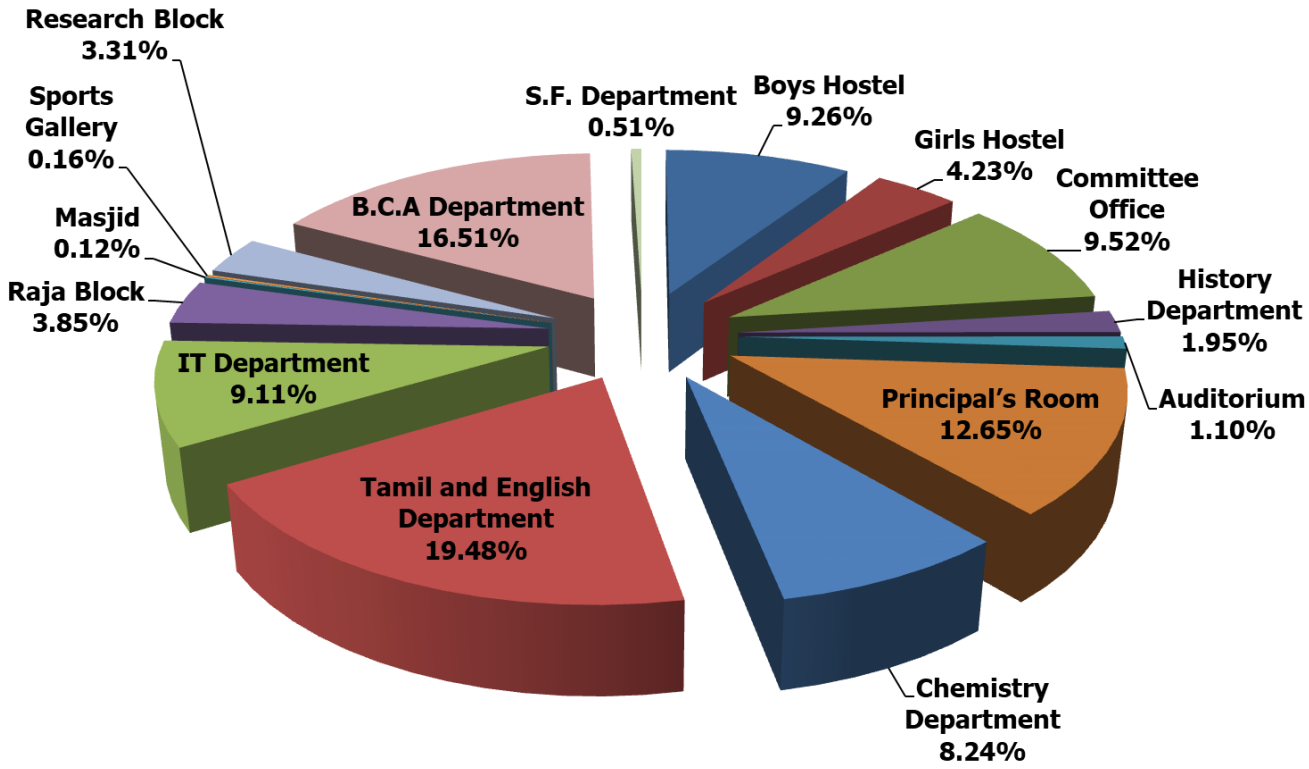

Figure 17: Energy consumed by Equipment Building wise

The above analysis shows the Equipment in the **Tamil and English Department consumes 41,054 kWh at 19.48%;** the **B.C.A Department consumes 34,796 kWh at 16.51%;** the **Principal's Room consumes 26,656 kWh at 12.65%;** the **Committee Office consumes 20,065 kWh at 9.52%;** the **Boys Hostel consumes 19,527 kWh at 9.26%;** the **IT Department consumes 19,213 kWh at 9.11%;** the **Chemistry Department consumes 17,365 kWh at 8.24%;** the **Girls Hostel consumes 8,910 kWh at 4.23%;** the **Raja Block consumes 8,119 kWh at 3.85%;** the **Research Block consumes 6,971 kWh at 3.31%;** the **History Department consumes 4,106 kWh at 1.95%;** the **Auditorium consumes 2,322 kWh at 1.10%;** the **S.F. Department consumes 1,080 kWh at 0.51%;** the **Sports Gallery consumes 347 kWh at 0.16%** and the **Masjid consumes 256 kWh at 0.12%**

4.9.5 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 Non-LED Tubelights

The current light analysis shows that Non-LED Tubelights lights consume anywhere between 24W, 36W and 40W when in use and these should be replaced with LED lights which consume on an average 16-20W when in use. The following graph shows a comparison of the current consumption and consumption of all **Non-LED Tubelights in all Buildings** if replaced with LED lights.

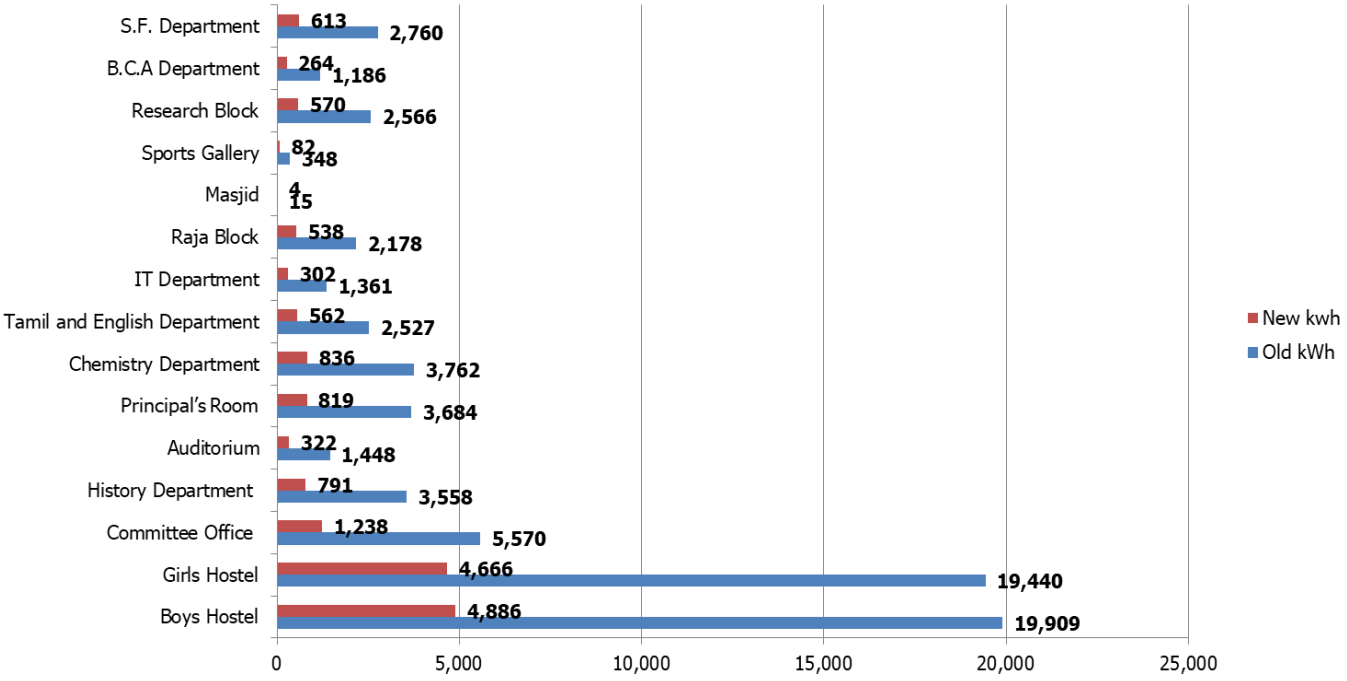

Figure 18: Analysis of current Non-LED and new LED Lights

The above analysis shows reduction of average of **77% reduction** in energy consumption if replaced with energy efficient appliance. *There are moderate numbers of CFL, Halogen, low intensity incandescent, Mercury vapour lamp and Sodium vapour lamp these too can be replaced with LED.* It will be suggested to either replace these now if College can have certain plans else the replacement can be done when lights get damaged or are not in working condition.

4.10.2 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.

The following graph shows a comparison of the current consumption and consumption of all **ceiling fans in all Buildings** if replaced with star rated appliance.

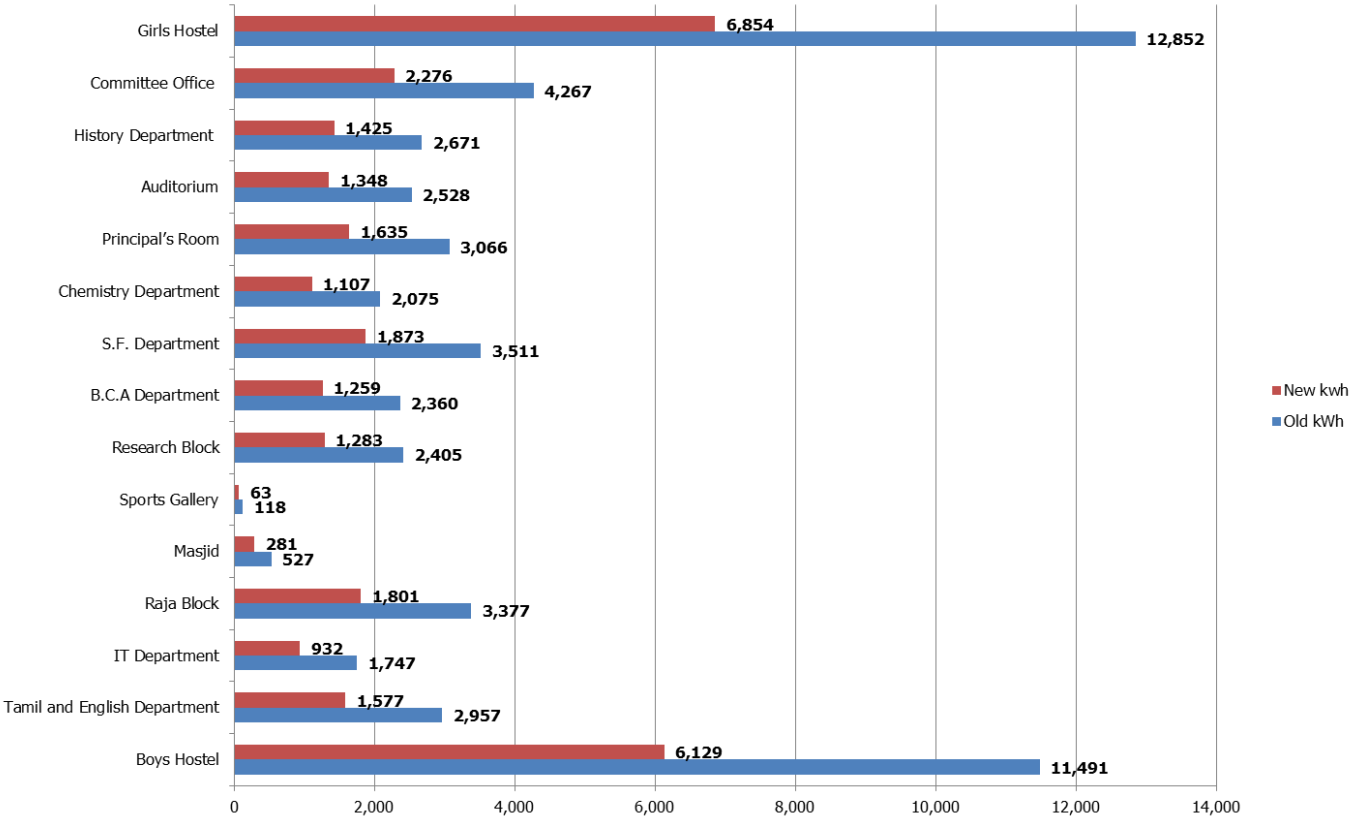

Figure 19: Analysis of current and new fans

The above analysis shows 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.

4.10.3 AC

The current Air conditioners have become old. Most of these are not star rated and are consuming more energy. These should be replaced with energy efficient and star rated air conditioners wherein 1.5 ton consumes 1,495W and 2 ton consumes 2,000W

The following graph shows a comparison of the current consumption and consumption of all the **air conditioners** if replaced with star rated appliance.

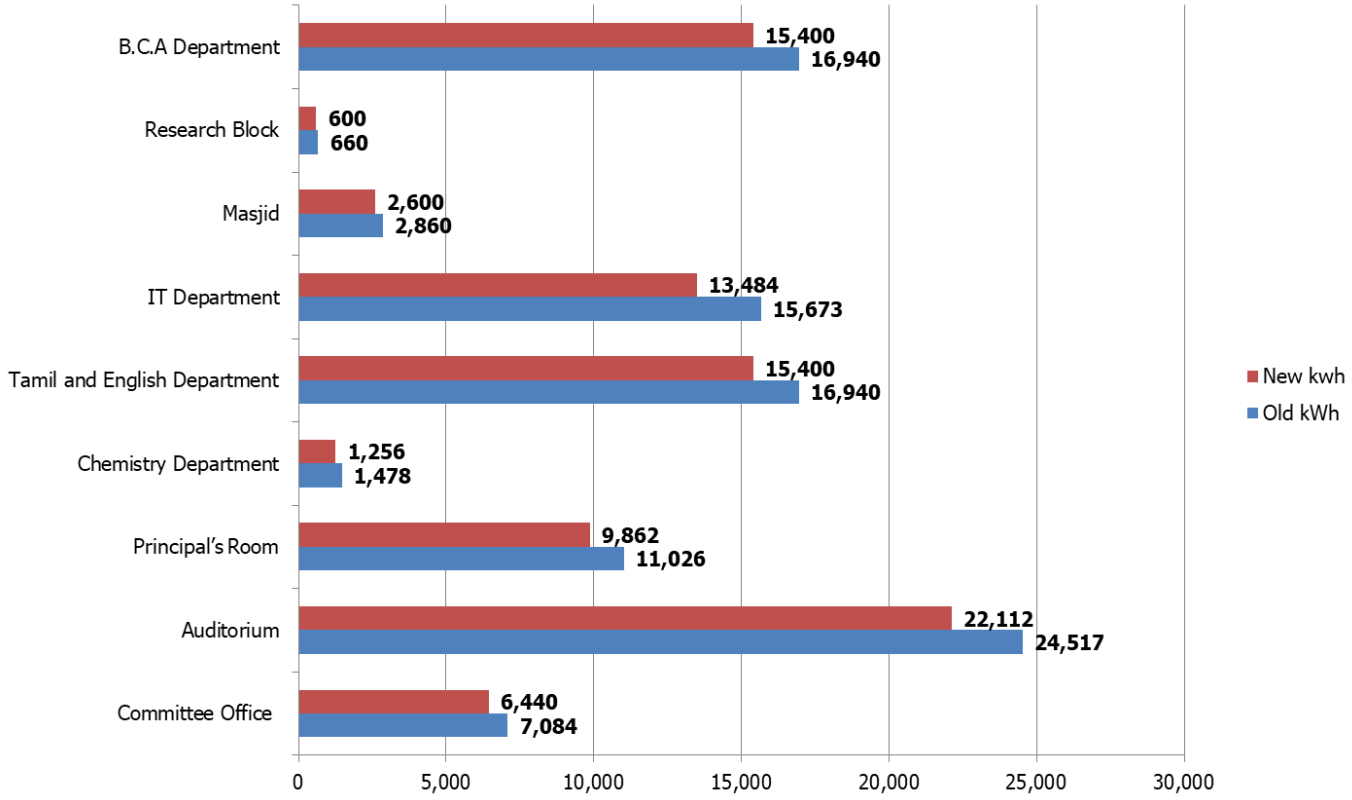

Figure 20: Analysis of current and new air conditioners

The above analysis shows reduction of average of **11% reduction** in energy consumption if replaced with energy efficient appliance, there is hardly much change in kWh consumption but it is better to be replaced.

It will be suggested to either replace these now if College can have certain plans else the replacement can be done when AC gets damaged or is not in working condition.

4.10.4 Equipment

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.

The following table shows a comparison of the current consumption and consumption of the **desktop computers in all Buildings** if replaced with laptops.

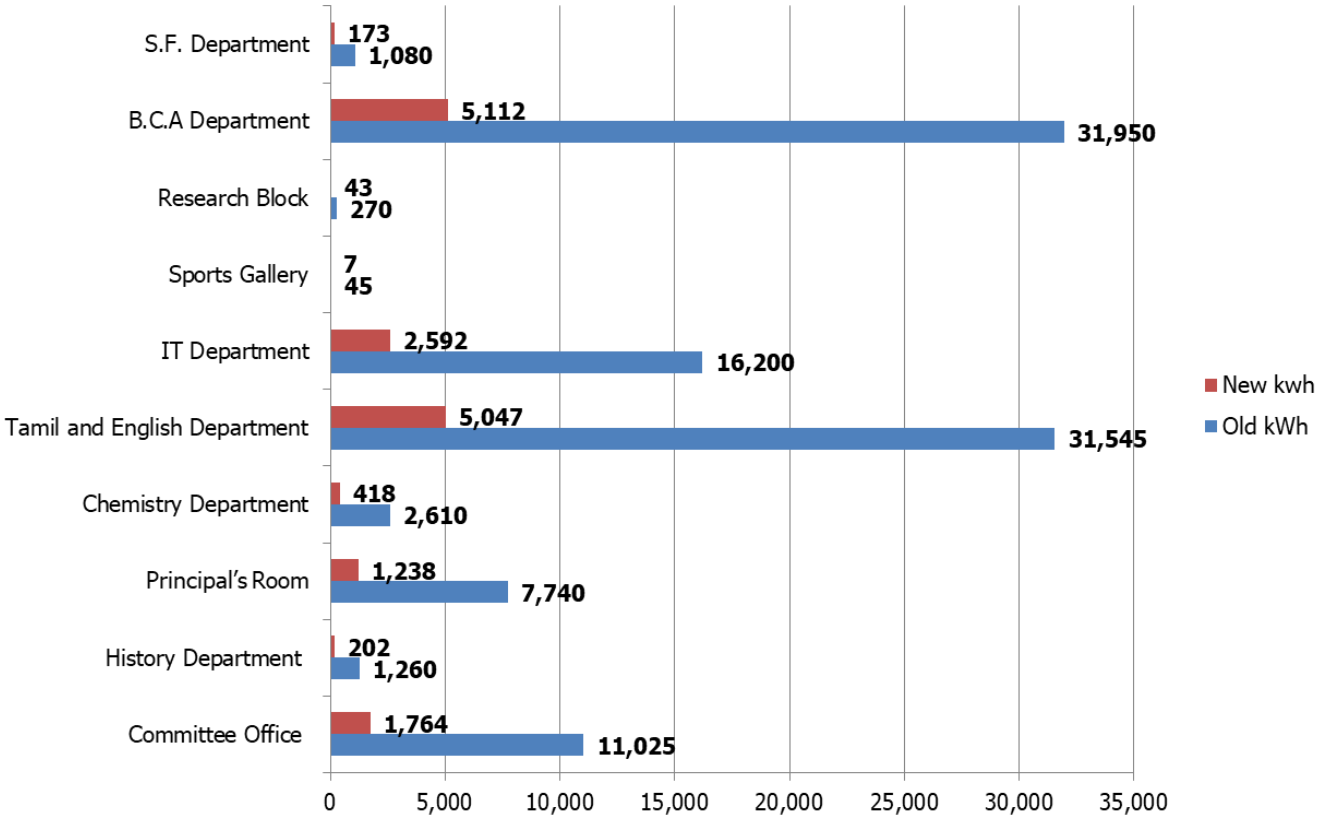

Figure 21: Analysis of current computers and new laptops

The above analysis shows reduction of average of **84% 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 the devices get damaged or are not in working condition.


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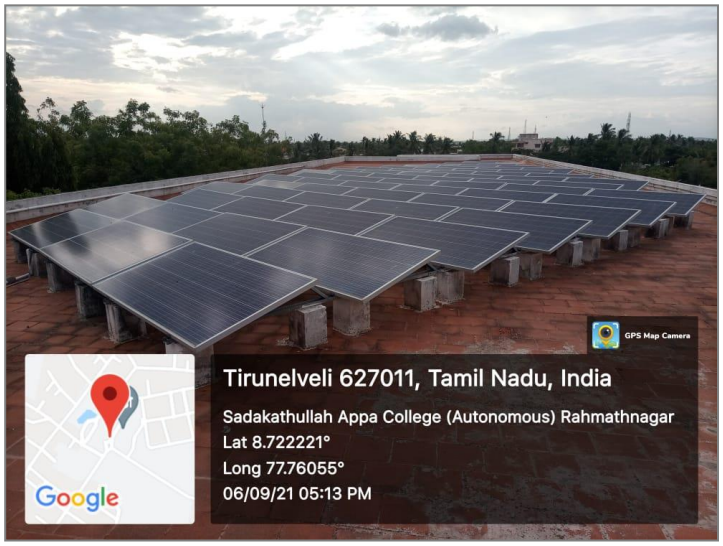
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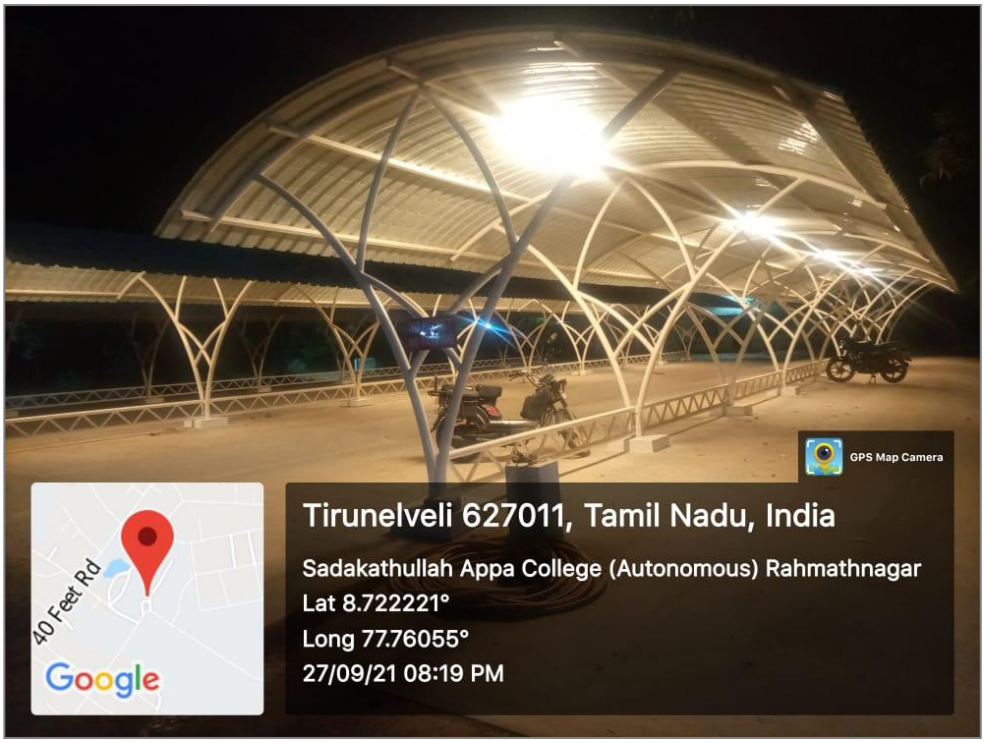
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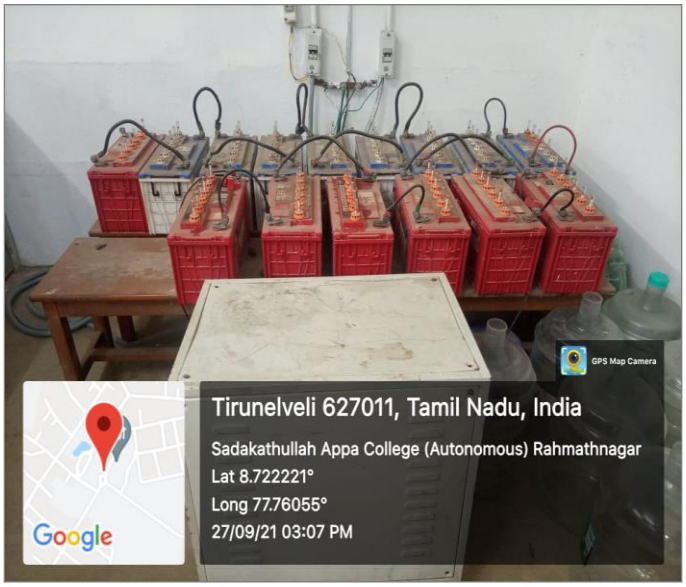
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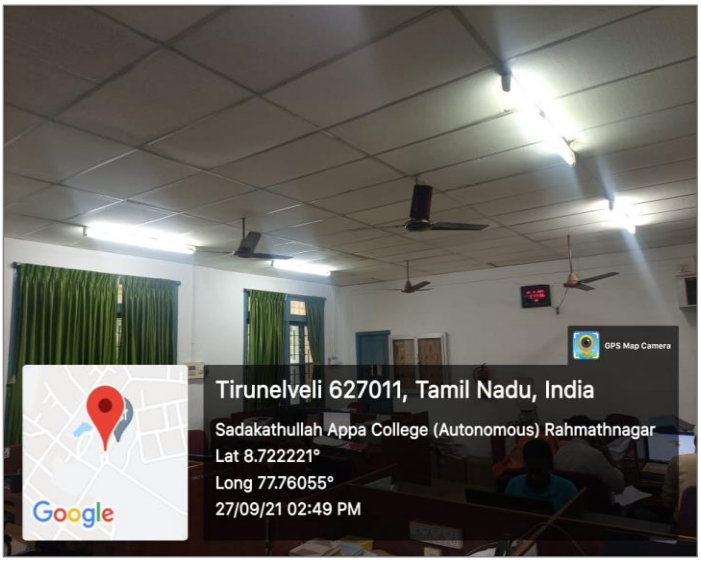
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5. Towards a Healthy & Sustainable Institution

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) **Kitchen garden -** 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. 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) **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.**

- Already there are many effective activities done.
- Nothing. It's already good.

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

- Empty land can be changed to medicinal garden, recycling of waste water.
- Making every individual to plant a tree.
- Usage Plastic bags in canteens can be avoided and separate dustbins for bio and non-bio degradable wastes.
- Need More awareness programs
- Our college is already practically well improved, but I would suggest to increase plantation of the sapling.
- Water scarcity can be avoided by going to water plants and trees such as hand washing water.

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. Climate data https://en.climate-data.org/asia/india/tamil-nadu/tirunelveli-2784/
6. 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.


Sadakathullah Appa College
WELCOMES