

# WAVOO WAJEEHA WOMEN'S COLLEGE OF ARTS & SCIENCE

## *Energy, Environment, Green Audit Report 2020-2021*

*Prepared by:*



*Department of Mechanical Engineering*

*National Engineering College,  
K.R Nagar, Kovilpatti - 628 503.*



# NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University, Chennai)  
K. R. Nagar, Kovilpatti – 628503, Thoothukudi Dist., Tamilnadu

## ENERGY AWARENESS & AUDIT CELL

Phone: +91 9500417696, +91 8056931350,  
Email: [energyaudit@nec.edu.in](mailto:energyaudit@nec.edu.in),  
Web: [www.nec.edu.in](http://www.nec.edu.in)

### TO WHOM SO EVER IT MAY CONCERN

This is to certify that the Energy, Environment and Green audit has been conducted at Wavoo Wajeeha Women's College of Arts and Science, Kayalpattinam has been conducted during 04.06.2021 & 05.06.2021. The recommendations for Energy, Environment and Green audit have been given in the report. We thank the management of Wavoo Wajeeha Women's College of Arts and Science, Kayalpattinam, Thoothukudi for providing the opportunity to conduct the audit and we also appreciate Wavoo Wajeeha Women's College of Arts and Science for taking these initiatives.

3.2.22

Er. K. SUDALAIYANDI  
ENERGY MANAGER  
EM-34488/22



## **ACKNOWLEDGEMENT**

**ENERGY AWARENESS AND AUDIT CELL (EAAC)** of National Engineering College, K.R. Nagar, Kovilpatti, Thoothukudi district, Tamilnadu – 628503, is thankful to the management Principal, Faculty and Technical team members of **WAVOO WAJEEHA WOMEN'S COLLEGE OF ARTS & SCIENCE**, Kayalpatnam, Thoothukudi District, Tamil Nadu -628204, for providing an opportunity to conduct a detailed Energy, Environment and Green Audit process for the college promises.

It is our great pleasure which must be recorded here that the management of WAVOO WAJEEHA WOMEN'S COLLEGE OF ARTS & SCIENCE extended all possible support and assistance resulting in expeditious completion of the audit process. The audit team appreciates the cooperation and guidance extended during course of site visit and measurements. We are also thankful to the all those who gave us the necessary inputs and information to carry out this very vital exercise of green audit.

Finally, we offer our sincere thanks to all the members in the energy division/ technical/non-technical and office members who were directly and indirectly involved with us during collection of data and conducting field measurements.

<b>Audit Team Members</b>	
<b>Mr. K. Sudalaiyandi</b>	BEE Certified Energy Manager - EA34488/21
<b>Mr. R. Jaya venkatesh</b>	Energy Consultant
<b>Mr. R. Vignesh Kumar</b>	Energy Consultant
<b>Dr. R. Vijayakumar</b>	Energy Consultant
<b>Dr. W. Beno Wincy</b>	Energy Consultant

# **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

## **1. INTRODUCTION TO ENERGY-ENVIRONMENT- GREEN AUDIT**

## **1. 1. Preface about the Institution:**

Alhaj Wavoo S. Seyed Abdur Rahman and his family founded the Wavoo Wajeeha Women's College of Arts and Science in Kayalpatnam in 2006 with the noble goal of bringing high-quality higher education to females in remote places where it was previously a privilege for a select few.

### **UG Programme:**

- ❖ B.A., Tamil Literature,
- ❖ B.A., English Literature,
- ❖ B.A., Economics,
- ❖ B.Com., Commerce,
- ❖ BBA., Business Administration,
- ❖ B.Sc., Mathematics,
- ❖ B.Sc., Physics,
- ❖ B.Sc., Computer Science,
- ❖ B.Sc., Information Technology.

### **PG Programme:**

- ❖ M.A., Tamil Literature,
- ❖ M.A., English Literature,
- ❖ M.Sc., Mathematics,
- ❖ M. Com., Commerce.

### **Diploma:**

- ❖ Diploma in Islamic Theology (1 year)

## **1. 2. Vision**

To give females in rural areas with higher education without regard to their caste, creed, or religion, bringing out their natural talents to create individuals who are highly qualified, morally upright, socially disciplined, and technically capable.

### 1. 3. Mission

1. Since our primary goal is to teach, we have made an effort to assemble a team of professors that are highly qualified, seasoned, and devoted. Students have the exceptional chance to learn from academics from various universities who routinely speak to them.
2. Getting the students to have huge aspirations and assisting them in realizing those dreams will undoubtedly help the college find its specialty. Additionally, the Trust intends to expand its educational initiatives in new directions.
3. By introducing student services, opportunities have been created to help kids from rural areas build integrated personalities.
4. May Allah grant us success in achieving the objectives set forth and a prosperous future for the pupils.

### 1. 4. Quality Policy:

**Wavoo Wajeeha Women's College of Arts and Science** is committed to improve the Quality Management System effectiveness in order to meet the regulatory requirements and expectations of students and relevant interested parties. This is achieved through quality placement support and students exposure to National level programs of practical relevance as well as Faculty Development.

### 1. 5. Major Activities in the Institution:

Knowledge  
Transferring  
through Teaching

Training Programs

Seminar and  
Workshops

National level  
Academic  
Activities

## **1. 6. Scope of the Audit Process :**

### **Energy Audit:**

- ❖ Conduct a detailed energy audit in the college campus with a main focus to identify judicious usage of electrical and thermal energy (where, when, why and how energy is being utilized).
- ❖ To ascertain the best practices to be followed in energy conservation, energy management, recommended safety measures and continuous energy monitoring system.

### **Environmental Audit:**

- ❖ Identification of history of activities, present environmental practices followed, monitoring records and known sources of environmental issues inside the college.
- ❖ Adoption of natural resources as input (such as energy and water), processing and utilization and generation of wastes (including hazardous and toxic),
- ❖ Handling and storage of all types of wastes (Solid, liquid and gouruses), transportation of waste from source to yard, reuse and recycling possibilities, storage mechanism and effective disposal.
- ❖ Measurement of effectiveness of pollution control (air, water and soil pollution), maintenance logs, emission test reports and routine analytical reports.
- ❖ Providing constant awareness to all stakeholders on Environment impacts, risk analysis and Ecology.

### **Green Audit:**

- Assessment on Campus greenery in terms of matured trees, flowing shrubs, bushes, medical plants, adoption of green energy generation and utilization, reduction of CO<sub>2</sub> due to green energy system and identification of possible implementation and enhancement of current greenery practices.

## **1. 7. Outcomes of the Audit Process:**

- Recommendations based on field measurement with achievable **Energy Conservation** (ENCON) proposals under **No cost/Low cost and Cost investment categories**.
- Minimization of present energy cost by adjusting and optimizing energy usage and reduction of energy wastage without affecting the regular activities.
- Determination of operating efficiency of each electrical system (more specifically on individual machines), comparison of design values and to identify feasible technical ways to improve it further in a cost effective manner.
- Formation of methodology for long term road map for energy savings and continuous improvements.
- Use as a basis for the development of environmental management policies or efforts to improve the existing plants.
- Identification of possible cost and energy saving from energy conservation, waste reduction, reuse and recycling.
- Development of rule based system to become a sustainable environment inside the college campus and nurture the importance of less energy and less environmental impacts.
- Formation of methodology for long term road map for maintaining green environment within the campus and encourage the stakeholders for continuous improvements.

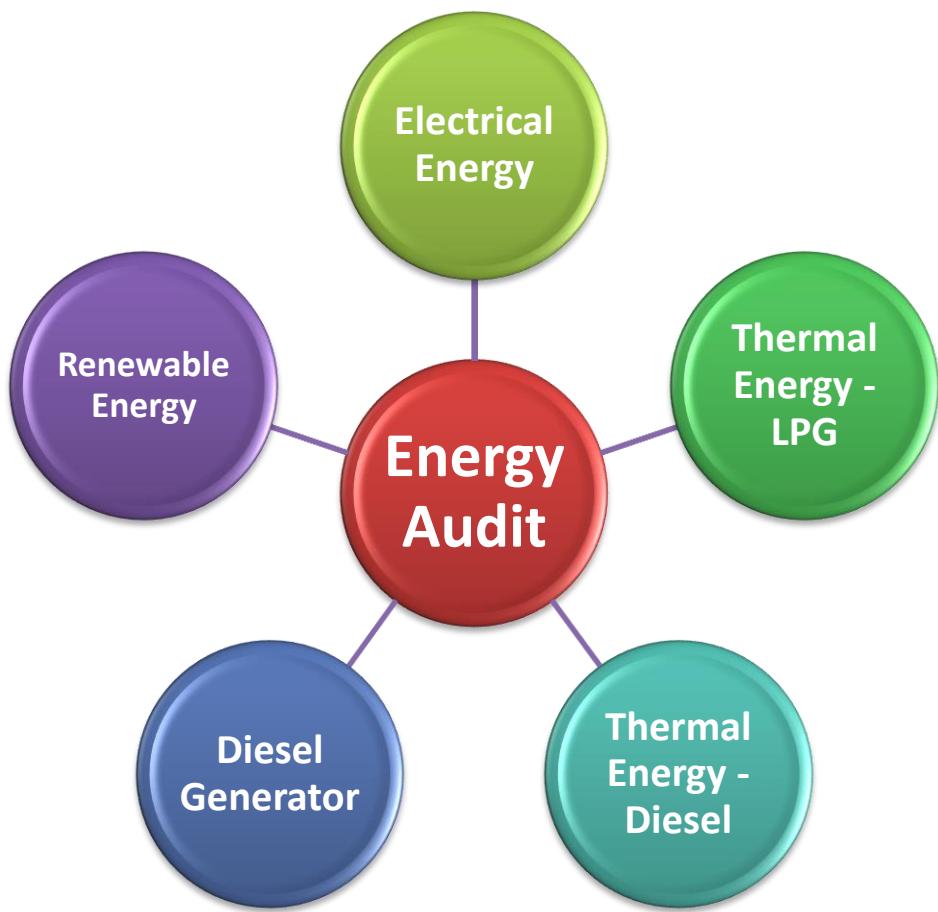
## **1. 8. Audit Approach:**

The audit team completed the assessment of energy consumption in the College premises and operating hours of each systems, appliance and instruments in labs using two approaches namely i) Objective Approach in which a detailed measurement was taken and ii) Subjective Approach in which a field data collected from the maintenance department.

### 1. 9. Standards Used:

- ❖ Bureau of Energy Efficiency (BEE) Guidelines to conduct the detailed energy audit process.
- ❖ The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard (Revised Edition) released by World Resources Institute & World Business Council for Sustainable Development – 2014.

### 1. 10. Coverage in Energy Audit Process:



## 1. 11. Focus Areas in the Environment & Green Audit Process:

- 1. • Energy Utilization
- 2. • CO<sub>2</sub> Estimation
- 3. • Water Management
- 4. • Solid Waste Management
- 5. • Chemicals/Acids/Salts Management
- 6. • Matured Trees
- 7. • CO<sub>2</sub> Neutralization

## 1. 12. List of Members Involved in Data Collection & Audit Process:

Name of the Team Member	Role and Responsibility
<b>Dr. R.ArunaJothi</b> Head of the Department Department of Tamil Literature	Chemical, Acids, Salts data collection, Fuel consumption in canteen.
<b>Mr. E.Maharajan</b> Transport Manager Maintenance Department	DG and Fuel consumed, Campus greenery, RO and Solid waste management.
<b>Mr. S.A.M. YasarArabath</b> System. Admin Maintenance Department	System, UPS, E-waste, and Rain Water Harvesting
<b>Mr.M.A.AbdulJabbar</b> Tech.Support (Electrical) Maintenance Department	Electrical data collection, Lighting, Fan.

# **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

## **PART -A: ENERGY AUDIT REPORT**

## **2. Study on Energy Consumption & Generation Pattern**

### **GIST**

1. Average power consumption of Wavoo Wajeeha Women's College of Arts & Science is Rs.42, 977 /- per month in 2020 - 2021.
2. Major Energy consumption from the energy analysis is Diesel (Transport & Power), which is 86% of the overall Energy spent.
3. Electricity cost for Wavoo Wajeeha Women's College of Arts & Science is Rs.9.26 per unit for the year 2020-2021.
4. It is recommended to install a 3kWp solar PV system for annual savings of Rs.34, 560 /- with return on investment of 104 months. This will help to reduce the CO<sub>2</sub> emission from the college.
5. As a low hang fruit, by replacing older tube light with LED tube light, savings per year is about Rs.81,907/- with return on investment of 9 months.

**Energy Consumption Pattern (Electrical and Thermal):**

<b>Sl.No.</b>	<b>Description</b>	<b>Details</b>		
<b>Electrical Energy (Consumption)</b>				
1.	Name of the consumer	Secretary		
2.	Type of Utility Supply, Service No.& Tariff	Low Tension Consumer Sc. No: 07-470-364-835 Tariff II (LM2B2)		
3.	Tariff Structure	Rs. 7.5/kWh		
4.	Energy Suppliers	Tamilnadu Generation & Distribution Corporation (TANGEDCO)		
5.	Permitted Demand	48 kW		
6.	Annual Electricity Consumption (kWh) (2020-21)	Bimonthly Min: 2410	Bimonthly Ave:4715.5	Bimonthly Max: 7153  28293 kWh/Annum
7.	Capacity of Diesel Generator (DG) Set	62.5 kVA-1 No.- Internal fuel tank (Air Cooled)  DGs are properly earthed (Body & Neutral)		
<b>Thermal Energy (Consumption)</b>				
8.	Types of Thermal Energy Used	Liquefied Petroleum Gas (LPG)		Cooking
		Diesel		Transport + DG
9.	Annual LPG consumption (2020-21)	Ave: 28.4 kg/ Bimonthly		
		170.4 kg/ Annum		
10.	Annual Diesel Consumption (2020-21)	Bimonthly Min:642.01	Bimonthly Ave:2356.05	Bimonthly Max:5521.4

		14136.3 Litre/ Annum
--	--	----------------------

**General Loads (Both Electrical and Thermal)**

11.	Lighting System	Most of the Indoor lighting are Florescent Tube Light (FTL). Outdoor lighting: All the street lightings are CFL based energy efficient lamps.
12.	Fan Loads (Ceiling)	Most of the Indoor ceiling fans are conventional fans.
13.	HVAC System	Unitary air conditioning system installed in the computer labs Three AC units are Non BEE star rated and 1 AC is BEE 2-star rated. Outdoor Units are mostly placed in top of the window shades. A Welcome step in the energy conservation is- All the air conditioned rooms are set with 24°C as room temperature as per BEE norms.
14.	Motors and Pump loads	Mainly used for water pumping.
15.	Uninterrupted Power System (UPS)	All the computer, server, surveillance system, telephonic units are connected with UPS

### **Energy Contribution**

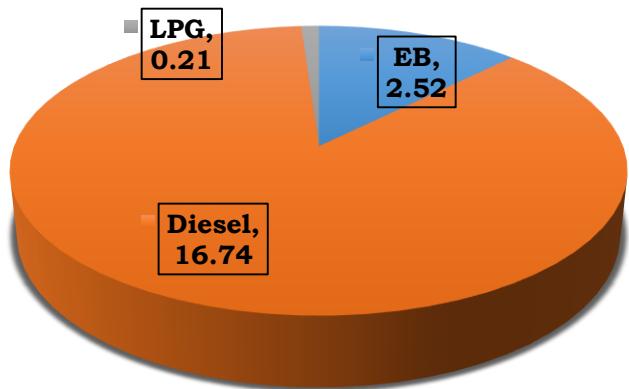
**Table 1** - Contribution of energy consumption & Energy conversion (Represented in MTOE)

<b>Energy Carrier</b>	<b>Annual Consumption</b>	<b>Conversion Factor</b>	<b>Energy (M Cal)</b>	<b>MTOE</b>	<b>Contribution %</b>
<b>Electricity (TANGEDCO)</b>	28293	860 kcal/kWh	24332	2.43	13.0
<b>Diesel*</b>	14136.3	11840 kcal/litre	167373	16.74	86.0
<b>LPG</b>	170.4	12500 kcal/kg	2130	0.21	1.0

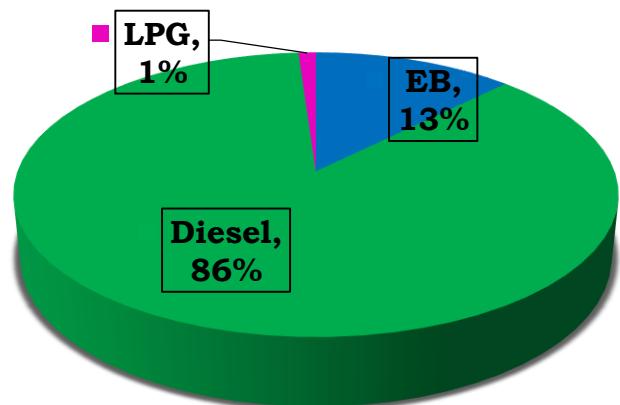
(\*Note: Specific Gravity of diesel is 0.8263 kg/litre & the above data as per 2020-21)

### **Contribution of Energy consumption represented in MTOE and Percentage**

**Energy distribution in mtoe**



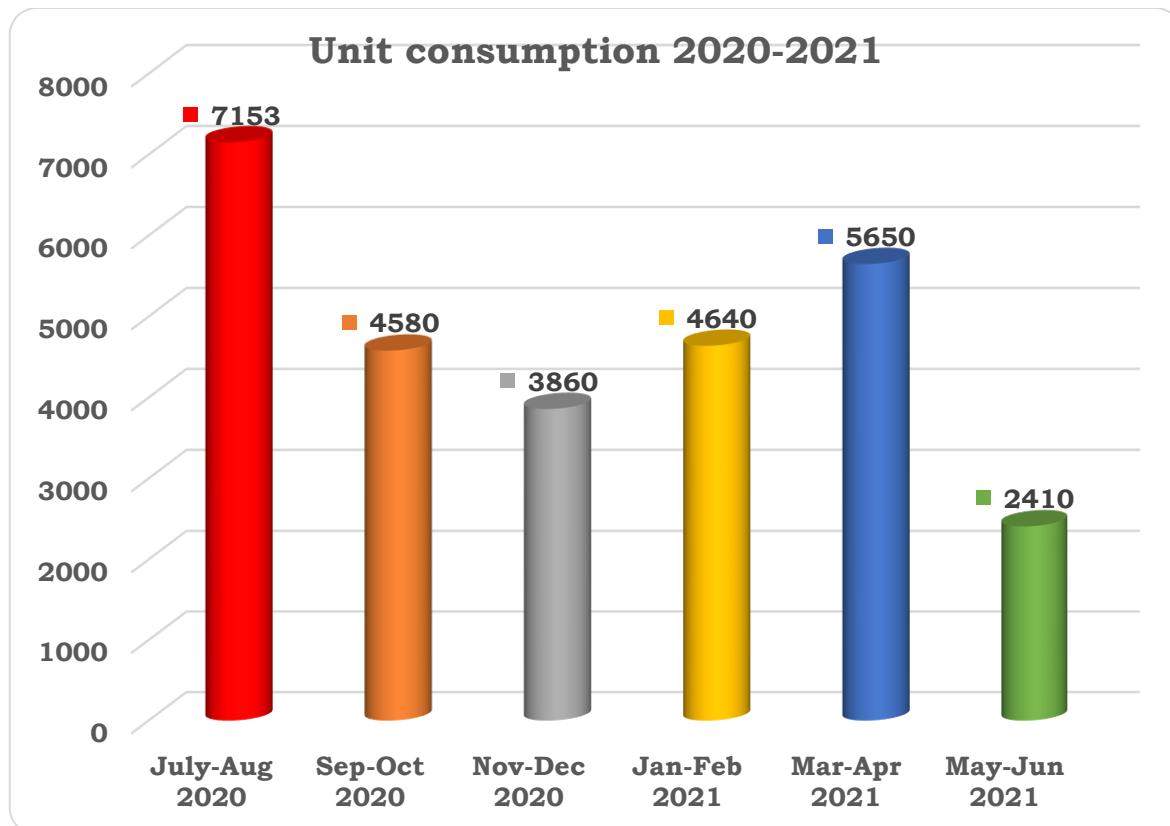
**Percentage Energy Distribution**



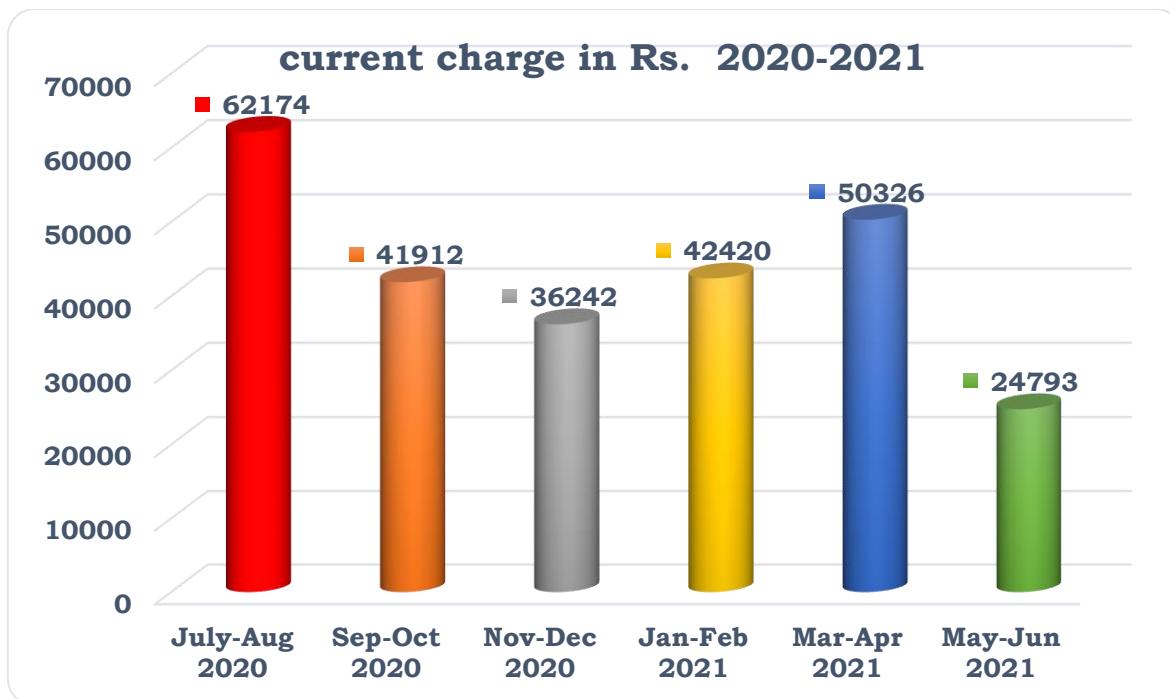
**Fig. 1&2** describes the energy distribution of the college in metric tonne of oil equivalent (MTOE) and Percentage wise

**Table 2** - Electricity bill analysis

<b>Month</b>	<b>kWh</b>	<b>Contract Demand (kW)</b>	<b>Recorded Demand (kW)</b>	<b>PF</b>	<b>CC Charges(Rs.)</b>	<b>Electricity Tax (Rs.)</b>	<b>Fixed Charges(Rs.)</b>	<b>Total bill (Rs.)</b>	<b>Unit Charges as per TNEB (Rs./kWh)</b>
July-Aug 2020	7153	48	13.99	0.78	53647.5	2766.4	5760	62174	8.69
Sep-Oct 2020	4580	48	13.76	0.78	34350	1801.5	5760	41912	9.15
Nov-Dec 2020	3860	48	13.77	0.75	28950	1531.5	5760	36242	9.39
Jan-Feb 2021	4640	48	19.87	0.79	34800	1860	5760	42420	9.14
Mar-Apr 2021	5650	48	11.48	0.83	42375	2190.8	5760	50326	8.91
May-Jun 2021	2410	48	8.1	0.77	18075	957.75	5760	24793	10.29



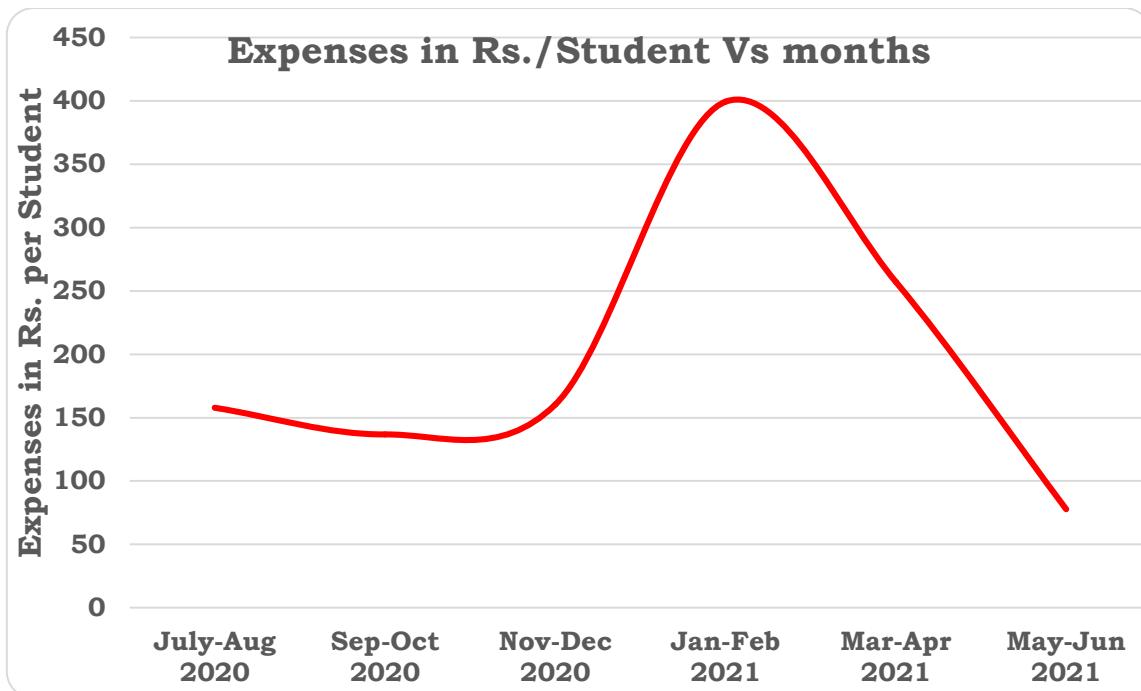
**Fig.3:** Unit consumption for the year 2020-2021



**Fig.4:** Power consumption charges for the year 2020-2021

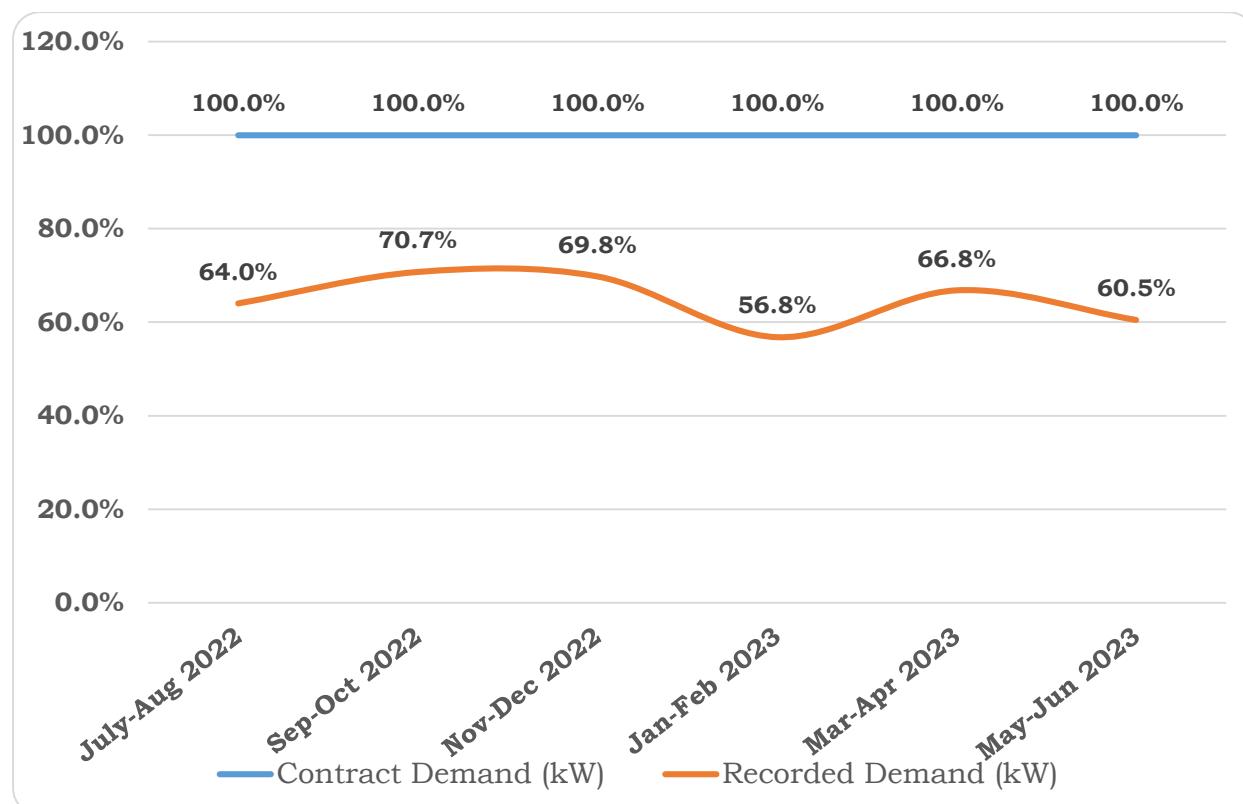
**Table-3:** Annual Consumption of Electrical & Thermal Energy Parameters (2020-21)

<b>S1. No.</b>	<b>Month</b>	<b>Units Consumed (kWh)</b>	<b>LPG consumed (kg)</b>	<b>Diesel Consumed (Litres)</b>	<b>Electricity Charges (Rs.)</b>	<b>Diesel Charges (Rs)</b>	<b>LPG Charges (Rs)</b>	<b>Total Expenses (Rs)</b>	<b>Total No of Students</b>	<b>Expenses/Student</b>
1	July-Aug 2020	7153	28.4	1535.8	62174	119792.4	17324	199290	1263	157.791
2	Sep-Oct 2020	4580	28.4	1475.3	41912	113598.1	17324	172834	1263	136.844
3	Nov-Dec 2020	3860	28.4	1948.7	36242	149073.26	17324	202639	1263	160.443
4	Jan-Feb 2021	4640	28.4	5521.4	42420	444472.7	17324	504217	1263	399.221
5	Mar-Apr 2021	5650	28.4	3013.1	50326	257019.14	17324	324669	1263	257.062
6	May-Jun 2021	2410	28.4	642.01	24793	56111.674	17324	98228.7	1263	77.7741



**Fig.5:** Per Capita Energy Expenses for the year 2020-2021

### Maximum demand



**Fig.6:** EB Power Demand details for the year 2020-2021

From the chart, it is clear that only 60 to 70 percentage of the demand is utilized. Hence the Contract demand can be reduced to 80 % of the present demand for the present loading condition.

**Lighting Assessment:**

**Connected Load details:**

**Table-4:** Lighting and Fan Connected Load details for all locations

LOCATION	T8 (30 W)	Tube light (40 W)	Fan (75 W)	WALL FAN(55W)	CFL(11W)	WATTAGE
PRINCIPAL	1	2	7			635
PRINCIPAL+ INNER		1		1		95
OFFICE			7			525
RECORD ROOM	1	1	2			220
DIRECTOR ROOM		2	2			230
CAREER GUIDANCE	1	1	2			220
CR 108	2	1	5			475
CR 109		4	5			535
TOILET GROUND FLOOR		4				160
PRAYER HALL		6	6			690
CR 112	1	4	5			565
CR 113	1	2	2			260
CR 110	3	3	5			585
DEPT CS 114		2	3		1	316
CR 115	2	4	5			595
INFO TECH LAB			7			525
CS LAB	4	2	7			725
CR 118	2	2	5			515
CR 119	2	2	4			440
CR 120		4	9			835
Toilet					1	11
Sick room	1		1			105
RECEPTION 102 A	1	2	3			335
MD ROOM 102			6		1	461
ELECTRICIAN ROOM 103		1	1			115

CR 202		2	4			380
CR 201		4	2			310
AUDITORIUM		12	12			1380
STAFF ROOM		2	2			230
CR 214			3		2	247
CR 213			3		2	247
Toilet					2	22
CR 211			5		2	397
CR 210	1		4		1	341
DEPT OF BBA	2		2			210
PRAYER HALL			2			150
LIBRARY 208	4	10	15		2	1667
CR 206	1	3	3			375
CR 205	1	1	3			295
DEPT OF PHYSICS 204	1		2			180
PHYSICS LAB 203 A	1	2	6		1	571
SEWING MACHINE LAB 212		2	4			380
Toilet					1	11
CR313	1	1	5			445
CR312		1	5			415
CR311	1		6			480
CR310						0
CR309	1	1	5			445
CR308		2	5			455
Toilet					2	22
CR307		2	3			305
CR306		1	4		1	351
Dept of economics		1	2		1	201
CR304		1	4		1	351
Tamil dept 303		1	4			340
CR302		1	3			265
CR301		2	4			380
Toilet					1	11
CR318		2	3			305
CR317		1	4			340
ENGLISH DEPT 316	1	2	3			335
Dept of Commerce			3		2	247
CR314	1		3			255

CR320 NAAC Room	1		3			255
PG						
135		3	6			510
133		2	3			265
132		2	3			265
131		2	3			265
130		2	3		1	280
129		2	3		1	280
128		2	3		1	280
127		2	3			265
126		2	3			265
VARANDA	2	6	2		30	720
PG VARANDA					4	60
PG Toilet					3	45
<b>Total</b>	41	132	272	1	64	26909

**Table-5:** Other Connected Load details

S1.No	APPLIANCE DETAIL	QTY	WATTAGE
1	Induction stove-1600W	6	9600
2	Computer	124	22320
3	Printer	12	480
4	Wifi Modem & LAN	28	280
5	Scanner cum printer	4	160
6	Scanner	1	40
7	Xerox machine	1	300
8	Fridge	1	250
9	Amplifier with mic	3	450
10	AC	4	6000
11	TV-50 inch	4	400
12	Ceiling light (2 CFL)	15	150
13	Projector	2	600
14	CCTV camera	38	190
15	Kettle	1	1500
16	TV-35 inch	1	40

17	Ceiling light LED	6	90
18	CCTV system	1	200
19	Table fan	1	55
20	Focus light-200W	3	600
21	Speaker big	2	160
22	Ahuja speaker-10W	16	160
23	Street light-30W	11	330
24	LED bulb in surrounding	6	90
25	Street light-60W	2	120
26	LED tube in surrounding	1	20
<b>TOTAL</b>			<b>44585</b>

Total Connected Load = 26909+44585 = **71494 Watts**

#### **Energy Performance Assessment of lighting system:**

Sl.No	Type of fitting	Wattage	Total Quantity	Load in kW	Daily working hrs	Monthly working days	Monthly kWh
1.	T8	30	41	1.23	4	30	147.6
2.	CFL	11	64	0.704	4	30	84.48
3.	Tube light	40	132	5.28	4	30	633.6

#### **Type wise lighting Distribution**

Type	Quantity	kW load	% Load
FTL	237	1137.6	100%

Observations: Almost all the CFL lamps are replaced with energy saving LED lights.

#### **Type wise Fan Distribution**

Type	Quantity	kW load	% Load
Normal Fan (75W)	272	2457	100%

Observations: Energy Saving Opportunity still exists in Fans.

**ECM 1 – Install On Grid/ Off Grid Solar System**

Solar Panel to be installed	3 kW
Total hours of operation	4 hrs.
Total Units Production	12
	Off Grid System
Total Unit savings per day	12
Electricity Cost	Rs.8/Unit
Annual Cost savings	Rs.34,560/-
Initial Investment	Rs.3,00,000/-
<b>Payback period</b>	<b>104 months</b>

**ECM 2 – Replace Older Tube lights to Energy efficient LED lights**

Present Scenario		Proposed Scenario	
Total Number Tube Lights	237	Total Number of LED	237
Wattage	40W	Wattage	20W
Total hours of operation	6 hrs.	Total hours of operation	6 hrs.
Total Units consumed	56.88	Total Units consumed	28.44
Total Unit savings per day		28.44	
Electricity Cost		Rs.8/Unit	
Annual Cost savings		Rs.81,907/-	
Initial Investment(Rs.250/LED lamp)		Rs.59,250/-	
<b>Payback period</b>		<b>9 months</b>	

# **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

## **PART -B: ENVIRONMENTAL AUDIT REPORT**

### **3. ESTIMATION OF CO<sub>2</sub> EMISSION AND NEUTRALIZATION (ELECTRICITY, DIESEL & LPG)**

**3.1: Assessment of Annual Energy Usage:**

Table-7 shows the types of energy carriers used for their regular operation in the college campus along with the application area and their source.

**Table-9: Energy Carriers, Application area and their sources used for college operation**

<b>S. No.</b>	<b>Type of Energy Carrier</b>	<b>Application area</b>	<b>Source of procurement</b>
1.	Electricity (HT)	Powering to all electrical/electronic / HVAC equipment	From TANGEDCO
2.	Diesel	Transport vehicles and Diesel Generator (Captive Generation)	From authorized distributor
3.	Liquefied Petroleum Gas (LPG)	Used only for cooking	
4.	Matured Trees	The college is located in a lush greenery and nearly 107 no's of various varieties of matured trees areavailable with more than 7-8 years old.	

**3.2: Environmental System: CO<sub>2</sub> Balance Sheet (2020-21):**

Environment audit is to assess the CO<sub>2</sub> emission and neutralization in the college and is a best tool to chalk out the plans to reduce itfrom the presentvalues. Table-8 provides the balance sheet indicating various energy carriers associated with the regular activities of the college and their CO<sub>2</sub> mapping.

**Table-6: Environmental System: CO<sub>2</sub> Balance Sheet (2020-21)**

<b>S. No.</b>	<b>Energy Consumption &amp; CO<sub>2</sub> Emission</b>			<b>CO<sub>2</sub> Neutralization</b>		
	<b>Description</b>	<b>Energy Quantity (Annum)</b>	<b>CO<sub>2</sub> Emission (Tons/Annum)</b>	<b>Description</b>	<b>Energy Usage</b>	<b>CO<sub>2</sub> Neutralized (Tons/Annum)</b>
1.	Electrical Energy	28,293 kWh	26.03	CO <sub>2</sub> Neutralized due to Matured Trees	107 nos.	2.33
2.	Diesel (Transport + DG)	14,136.3 liters	38.17			
3.	LPG Consumption	170.4 kg	0.511			
4.	<b>Total-Emission</b>		<b>64.71</b>	<b>Total-Neutralized</b>		<b>2.33</b>
Balance CO <sub>2</sub> to be Neutralized = 62.38 Tons/Annum & Per Capita CO <sub>2</sub> Consumption = 0.045 Tons/Annum <sup>1</sup>						

<sup>1</sup> Total strength of students - 1263 + Teaching and technical staff – 113 = 1,376

**Note:**

**During this academic year, COVID-19 pandemic situation occurs. For students, classes are handled in ONLINE mode. Thus Energy consumption is Minimum in this duration.**

**Observations:**

1. In the campus, the CO<sub>2</sub> emission from the diesel usage is the highest which is of 38.17tons/annum.
2. The total electrical consumption in the college campus is 28,293 kWh per annum which contributed to the CO<sub>2</sub> emission of 26.03 tons/annum.
3. Due to the less LPG consumption, the CO<sub>2</sub> emission from LPG is low which is of 0.511tons/annum.
4. The campus has grown several varieties of trees which have contributed to the CO<sub>2</sub> neutralization of 2.33 tons/year.
5. The college was planned to do many energy conservation measurements. Due to COVID-19 situation, They couldn't do the energy conservation activities.

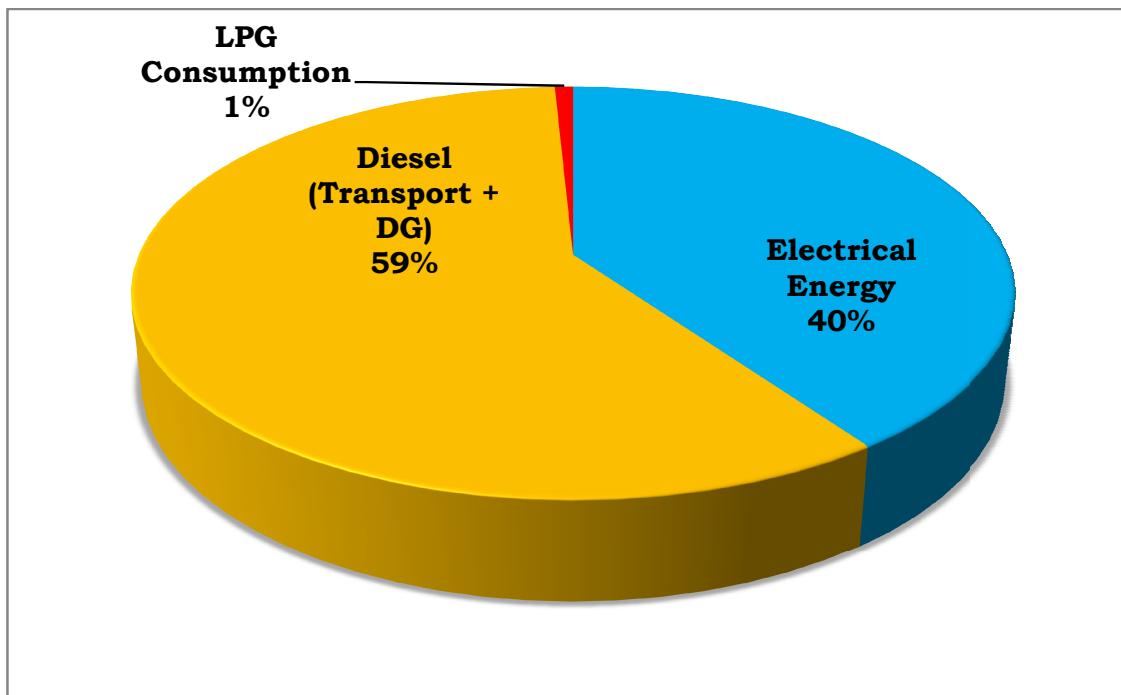


Fig.7: Percentage of CO<sub>2</sub>emission in the college campus from various sources

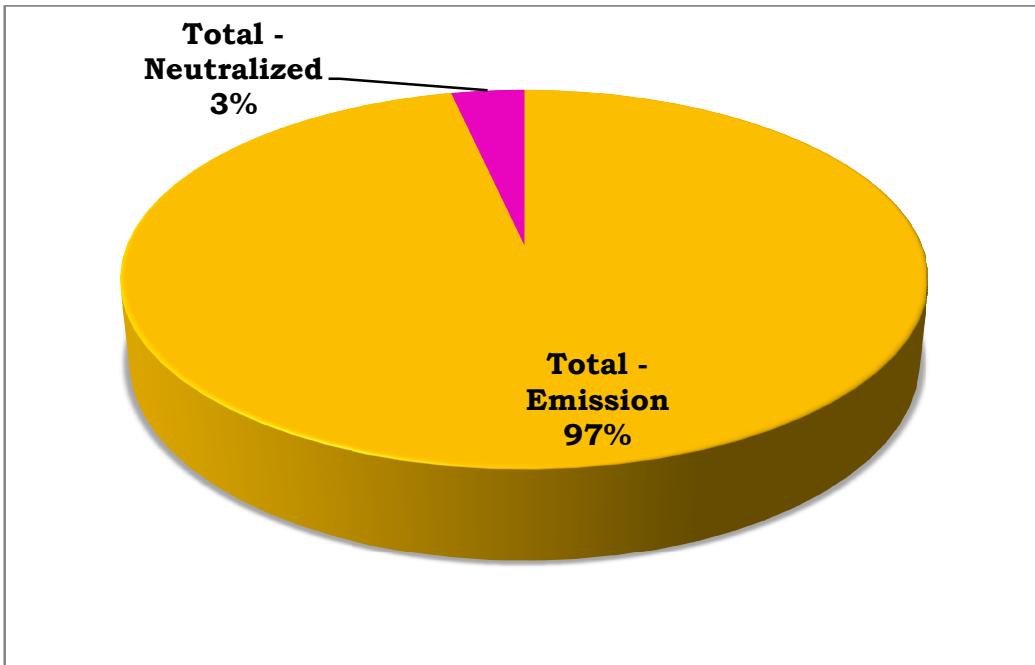


Fig.8: Percentage of CO<sub>2</sub> emitted and CO<sub>2</sub> neutralized inside the campus

## **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

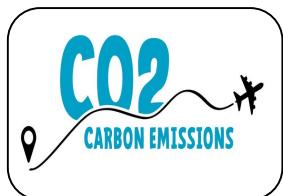
### **4. TRANSPORT & REFRIGERANT GASES IN AIR CONDITIONING SYSTEM**

#### 4.1. List of Transport Vehicles:

The college is committed to provide green environment not only in the campus; but also to the entire atmosphere. The list of transporting vehicles available in the college campus along with their fuel type and usage are represented in Table.

**Table 7: List of Transporting Vehicles available in the College.**

S.No.	Type of Vehicle	Make, Model & Year of Manufacture	Vehicle Number	Date of FC	Non Polluting Vehicle
1	Van	EICHER & 2018	TN B 9022	3/1/2024	Yes
2	Van	SML T 3500 & 2014	TN 69 AR 1877	4/26/2024	Yes
3	Van	SML T 3500 & 2007	TN 69 U 8589	4/20/2024	Yes
4	Bus	ASHOK LEYLAND & 2008	TN 69 S 2333	4/25/2024	Yes
5	Van	SML T 3500 & 2009	TN 69 S 6051	3/30/2024	Yes
6	Bus	ASHOK LEYLAND & 2009	TN 69 S 6078	2/21/2024	Yes
7	Van	SML T 3500 & 2010	TN 69 AY 1401	4/20/2024	Yes
8	Bus	ASHOK LEYLAND & 2010	TN 69 AY 1402	5/9/2024	Yes
9	Van	SML T 3500 & 2011	TN 69 AY 8377	4/19/2024	Yes
10	Van	SML T 3500 & 2011	TN 69 AY 8380	3/30/2024	Yes
11	Bus	ASHOK LEYLAND & 2013	TN 69 AT 5830	1/30/2024	Yes
12	Bus	SML S7 & 2014	TN 69 AR 1872	3/30/2024	Yes
13	Bus	MORCOPOLY & 2015	TN 92 0416	3/29/2024	Yes
14	Bus	ASHOK LEYLAND & 2017	TN 92 8107	3/23/2024	Yes
15	Bus	ASHOK LEYLAND & 2017	TN 92 A 8566	3/30/2024	Yes
16	Van	TATA 407 & 2006	TN 69U 5578	7/19/2024	Yes



Annual fuel consumption for transport (**2020 - 21**) is **14,136.3 Litres** which contributes CO<sub>2</sub> Emission of **38.17 Tons/Annum**

**Note: Due to COVID-19 & ONLINE classes, transports are utilized less than in actual.**

#### 4.2. List of Air Conditioning System along with its Refrigerant:

The list of ACs indicating their quantity, tonnage, refrigerant, GWP and ODP are shown in Table-14.

**Table-8: List of Multi-variant AC System, Type of Refrigerant, GWP and ODP Values**

S.No.	Location	Tonnage (TR)	Quantity	Refrigerant Used	Global Warming Potential (GWP)	Ozone Depletion Potential (ODP)
1	Computer Lab	2	2	R22	1810	Medium
2	Electronics Lab	2	2	R22	1810	Medium
3	Secretary Room	1.5	2	R22	1810	Medium

**Note:**

- ❖ The most environment-friendly refrigerants that are available in Indian market currently are “R-290” and “R-600A”. They are Hydrocarbons and their chemical names are “Propane” for R-290 and “Iso-Butane” for R-600A.
- ❖ They are completely halogen free, have no ozone depletion potential and are lowest in terms of global warming potential. They also have high-energy efficiency but are highly flammable as they are hydrocarbons.

## **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

### **5. WATER UTILIZATION, CONSERVATION & WATER MANAGEMENT**

**5.1. Source of Water, Storage and Distribution:**

Water is one of the main consumable in the college campus. WAVOO WAJEEHA WOMEN'S COLLEGE OF ARTS AND SCIENCE gets the water from three different sources i) Fresh water from the bore well, ii) Rain Water Harvesting (RWH) and iii) Purified water can from third party. Different source of water, location of storage along with their application is given in the table.

**Table 9: Types of water used in college campus along with application.**

Type of water	Source	Location of storage	Application
Fresh water	Well water (Near	3 HP under water pump used to lift the water to overhead tank of 1,50,000 litre capacity	Utensil Cleaning, Hand wash, toilet, labs and also for gardening purpose.
Fresh water	Bore water (Near transport) – 01 No. with 20 feet depth.	3HP pump is used to store water in separate sump with a capacity of 1200 litre capacity	Gardening and drip irrigation purpose.
Rain water	Rain Water collected through i) buildings run offs and ii) road runoffs	Percolated to underground	Used to increase the ground water level
Purified water	Purchased from third party	Purchased as 30L water can	Cooking and drinking purpose

### **5.2. Purified Water for drinking applications:**

- ❖ The college management is keen on providing uninterrupted, safe and healthy drinking water to all students and faculty members throughout the year.
- ❖ In order to fulfill the drinking water need management purchased purified water can from third party with sufficient quantity.
- ❖ Quality of the water (TDS value) is being checked frequently and ensures that the water is potable.
- ❖ Details about purified water are given in the table.

<b>S. No.</b>	<b>Description</b>	<b>Quantity</b>
1.	Purified water can (30L) per Month	300 Nos.
2.	Cost per unit purified water can	Rs. 30
3.	Drinking water cost per month	$  \begin{aligned}  &= (\text{water can quantity} * \text{unit price}) \\  &= (300 * 30) \\  &= \text{Rs. 9,000/-}  \end{aligned}  $
4.	Drinking water cost per Annum	$  \begin{aligned}  &= (9,000 * 6) \\  &= \text{Rs. 54,000/-}  \end{aligned}  $

**\*Note: COVID Pandemic**



Fig 9. Storage of purified water can for drinking application



Fig10. Fresh water distribution to wash rooms and toilet

## **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

### **6. USAGE OF CHEMICALS, SALTS & ACIDS (STORAGE, HANDLING, AND BEST OPERATING PRACTICES)**

**6.1: Policy of Chemicals/Salts/Acids used in the Laboratory:**

The science department uses chemicals for experimental applications and is having strict safety rules of thumb for handling and storage as follows.

- ❖ Well trained faculty and lab assistants are only allowed to handle the chemicals safely and have knowledge about the hazardous nature of each and every chemical.
- ❖ Strictly following the manufacturer's instruction on the container in order to prevent accidents.
- ❖ Volatile or highly odorous chemicals, fuming acids are stored in a ventilated area.
- ❖ Chemicals are stored in eye level and never on the top shelf of storage unit.
- ❖ All stored chemicals; especially flammable liquids are kept away from heat and direct sunlight. Also reactive chemicals are not stored closely.
- ❖ Hazardous and corrosive chemicals are kept on sand platform to avoid corrosion.
- ❖ First aid box and fire extinguishers are readily available in the laboratory.

**6.2: General Instructions given to the Students while working in the Laboratory:**

- ❖ Never work in the lab unless a demonstrator or a teacher is present.
- ❖ Never taste any chemicals and don't allow chemicals to come in contact with your skin.
- ❖ Don't throw waste into the sink; rather they must be thrown into the waste pins.
- ❖ Keep all the doors and windows open while working the laboratory.
- ❖ Sulphuric acid must be diluted only when it is in cold condition.
- ❖ Reagent bottles must never be allowed to accumulate on the work bench.
- ❖ Containers used for reactions must be properly labeled.

- ❖ Working space should be cleaned immediately.
- ❖ Protection and safety is most important.
- ❖ While entering the laboratory, everyone must wear lab coat and shoes.
- ❖ Prior knowledge on hazardous property of the chemicals is must.
- ❖ Seek the advice of faculty and technical staffs during emergency.
- ❖ Know the location of first aid box and fire extinguishers located in the laboratory.
- ❖ Don't attend any self-medical practices either for you or for your fellow students.

### **6.3: Storage of Chemicals/Salts/Acids:**

Less concentrated chemicals, salts and acids are stored in proper racks, cupboards and high concentrated acids are stored in separate area filled with sand. Storage practices are represented below in Fig. 11, 12 & 13.



Fig. 11: Chemical vessels storage



Fig. 12: Dilute acid Storage



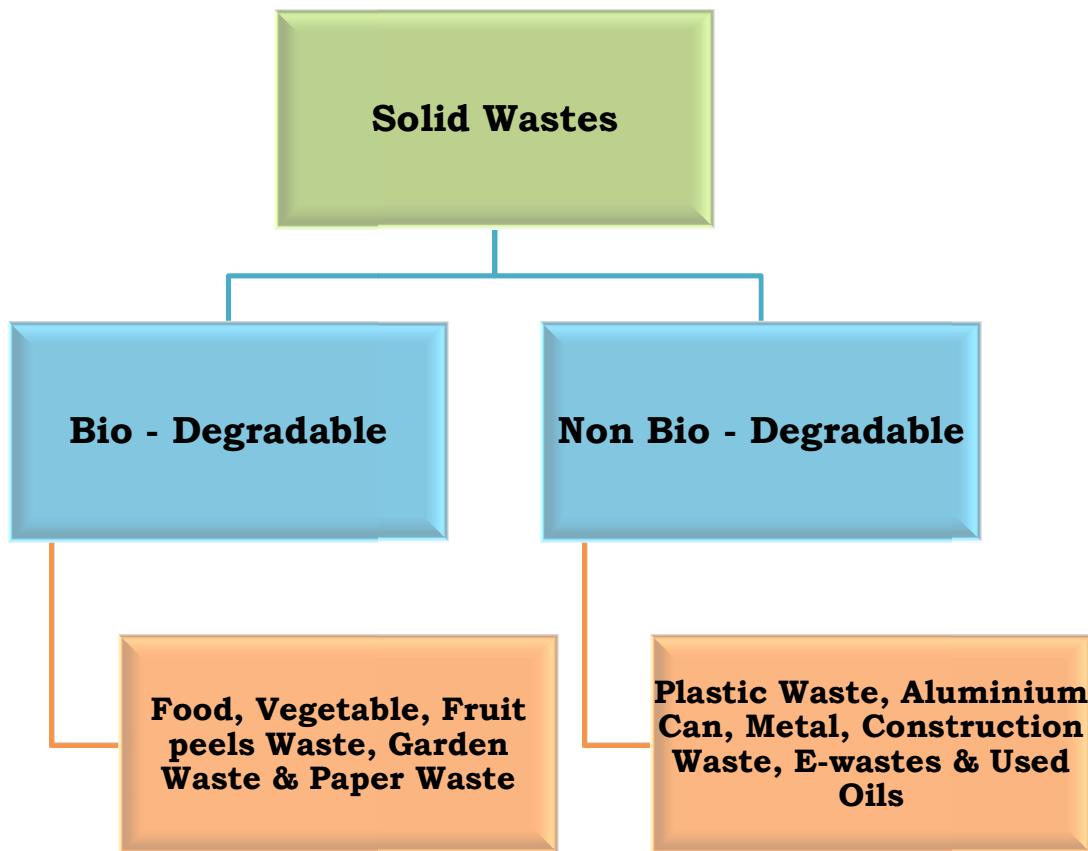
Fig. 13: Concentrated acid Storage

## **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

### **7. WASTE HANDLING & MANAGEMENT**

### **7.1. Solid Waste Management System:**

Different types of wastes generated inside the college promises are represented in the below block diagram.



### **7.2. Process of Waste Management:**

The college management practiced some methods to treat the waste generated and Table-17 shows the process of treating the solid waste generated inside the college campus.

**Table-10: Process of Waste Management**

<b>S. No.</b>	<b>Waste Type</b>	<b>Waste Treatment</b>
<b>Bio Degradable Waste Management</b>		
1.	Food & Vegetable Waste	Collected & given to Farming Plan.

2.	Garden Wastes and Plant Leaves	Daily collected and dumped in a yard
3.	Paper Waste	Collected and stored in a separate place. Sale to third party for recycling.
<b>Non-Bio Degradable Waste Management</b>		
4.	Plastics	Banned in the college campus.
5.	Construction Wastes	Mostly used by their own construction
6.	Metals	Construction metals are stored in a separate place and are sale to thirty parties for recycling.
7.	Transport Oil + Tyres	Stored in a separate place and sale to 3rd party.
8.	Transport Vehicle and Computer Batteries	Procuring new batteries with buyback offer (old battery replacement)
9.	Used edible oil	Used cooking oils are kept in separate place and sold to 3rd party for recycling.
10.	E-Waste Management	Separately given below.

### **7.3. List of Approved E-Wastes:**

<b>E-Waste – Electrical</b>	<b>E-Waste – IT &amp; Communication</b>
<ul style="list-style-type: none"> <li>• Motors and Starters</li> <li>• Fans, Lamps and Luminaries</li> <li>• Electrical Drives</li> <li>• Broken/Fired Cables</li> <li>• Power Distribution Panels</li> <li>• Analog &amp; Digital Measuring Instrument</li> </ul>	<ul style="list-style-type: none"> <li>• Copier/Printers</li> <li>• Power Stripes &amp; Power Supplies</li> <li>• UPS/Servo Stabilizers/Inverters</li> <li>• Batteries</li> <li>• Wi-fi-Modems, Routers, Toggle Network Cables, Switches, Hubs</li> <li>• Audio &amp; Video Equipment's/Remote</li> <li>• Printed Circuits Boards</li> </ul>



**Fig 14: Food waste collected in bucket**



**Fig 15: Collected Food waste is stored in storage tank for farming**



**Fig.16: Metal, Wooden and Carton Box wastes stored in a separate place**



**Fig. 17: Manure preparation from garden waste**

# **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

## **PART -C: GREEN AUDIT REPORT**

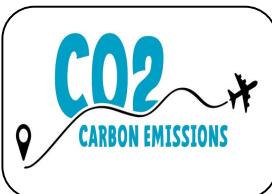
### **8. ASSESSMENT ON LIST OF MATURED TREES AND GREEN ENERGY GENERATION**

### 8.1. Campus Greenery:

The college is completely covered with matured trees grown for more than 10 years. The total number of matured trees available in the college campus is 107 with 9 varieties of trees. Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowing shrubs and pushes. Table-15 shows the list of matured trees available inside the college campus.

**Table-11: List of Matured Trees Available in the College Campus**

S.No.	Location (Wing/Block /Area)	Name of the Tree	Botanical Name	Quantity
1	Right side	Neem tree	Azadirachta Indica	12
2	Backside	Neem tree	Azadirachta Indica	7
3	Left side	Neem tree	Azadirachta Indica	9
4	Front side	Neem tree	Azadirachta Indica	17
5	Right side	Coconut-tree	Cocos Nucifera	6
6	Front side	Coconut-tree	Cocos Nucifera	10
7	Right side	Portia tree	Thespesia Populnea	1
8	Left side	Portia tree	Thespesia Populnea	8
9	Front side	Vatanarayani	Delonix Elata	4
10	Left side	Vatanarayani	Delonix Elata	4
11	Front side	Fig tree	Ficus Carica	5
12	Backside	Teak tree	Tectona Grandis	4
13	Front side	Java plum tree	Syzygium Cumini	4
14	Front side	Casuarina tree	Casuarina Equisetifolia	10
15	Left side	Palmyra palm	Borassus Flabellifer	6
<b>Total</b>				<b>107</b>



**Total No. of Matured Trees available in the college campus is 107 which contributes for reduction of 2.33 Tons of CO<sub>2</sub> emission/Annum**



Fig. 18: Geographical View of the college

## **ENERGY, ENVIRONMENT & GREEN AUDIT REPORT**

### **9. AUDIT SUMMARY & CONCLUSION**

## **SUMMARY OF THE AUDIT PROCESS:**

In order to make the WAVOO WAJEEHA WOMEN'S COLLEGE OF ARTS AND SCIENCE campus 100 % energy efficient, Environmental sustainability and lush Greenery the audit team recommends to implements the following measures:

### **I. Energy Conservation & Management:**

- ❖ It is recommended to install **Solar PV plant** to reduce the electrical demand for the site which also helps to neutralize the carbon emission.
- ❖ Recommended to change the FTL into LED with adequate illumination levels.
- ❖ Prepare suitable formats for all energy consumption and regularly follow to records. At regular interval, conduct internal audits to assess the effectiveness of the practice. Make proper corrections; if it deviates from the standard operating procedure.
- ❖ Regularly conduct i) Illumination study, ii) Thermal comfort study, iii) Flue gas study on DG, iv) Water quality assessment (for all type of water utilized) and v) Indoor and ambient air quality study.

### **II. Water Conservation & Management:**

- ❖ It is highly recommended to install **Sewage Treatment Plant (STP)** for reuse the treated water for toilet flushing system as this is much essential for the AICTE, UGC norms of treated water usage.
- ❖ Paste water and energy savings slogans at appropriate places.
- ❖ Retrofit aerator based water taps for good water savings.
- ❖ Captures almost 100 % rain water harvesting.
- ❖ Awareness camp must be conducted to all the stakeholders at regular interval. Through this initiative; Painting, Photography, Slogan and Poster making contest are conducted to create consciousness among the students and faculties.

### **III. Impart Training to Faculty and Technical Staffs:**

- ❖ Energy Conservation & Management
- ❖ Training on Environmental impact and assessment
- ❖ Fire and Safety (Operation and Handling)
- ❖ Electrical maintenance & Safety
- ❖ E-Waste and Chemicals Handling
- ❖ Training for Transport employees.

**IV. Way Forward towards Energy & Environmental Sustainability:**

- ❖ Prepare an exclusive Energy and Environment Policy based on the energy and environment practices followed in the campus.
- ❖ Implement ENCONs and best operating practices proposed in the audit report and measure the results.
- ❖ Adopt effective waste management policy and reduce the food print of waste generation (Net zero waste campus).