A SYNOPSIS OF

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

DETAILS OF THE CLIENT

KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)

Nanjanapuram, Erode – 638 107, Tamil Nadu, India

DATE OF AUDIT

25 & 26 NOVEMBER 2021

(Audited and Accounted for the period of 2017-18, 2018-19, 2019-20, 2020-21 & 2021-22)

AUDIT CONDUCTED AND SUBMITTED BY

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING

(Chennai ♦ Coimbatore ♦ Erode)

Mobile: +91- 80567 19372, 99420 14544 (Whatsapp) E-mail: ramkalamcect@gmail.com

ACKNOWLEDGEMENT

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING, Coimbatore – 641 062 is thankful to the Management, Principal, Faculty and Technical team members of **KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)** Nanjanapuram, Erode – 638 107, Tamil Nadu, India for providing an opportunity to conduct a detailed Energy, Environment and Green Audit process in the college premises.

It is our great pleasure which must be recorded here that the Management of **KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)** extended all possible support and assistance resulting in through completion of the audit process. The audit team appreciates the cooperation and guidance extended during the course of site visit and measurements. We are also thankful to 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 engineering division/ technical/non-technical divisions and office members who were directly and indirectly involved with us during collection of data and while conducting field measurements.

Management Team Members	
Thiru . V.K. MUTHUSAMY	President
Thiru. P.C. PALANISAMY	Secretary
Thiru. E.R. KAARTHIKEYAN	Treasurer
Shri. K. PALANISAMY	Correspondent (KASC)
& Patron Members	
Dr. N. RAMAN	Principal

Audit Team Members	
Dr. S.R. SIVARASU, Ph.D	**BEE Certified Energy Auditor (EA-27299)** Lead Auditor-ISO-14001:2015 (EMS), IGBC AP, GRIHA CP, CII CP in SWM Carbon Footprint Auditor & Implementor **Mobile: +91- 80567 19372, 99420 29372**
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KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS) ERODE 638 107

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A SYNOPSIS OF ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

1. INTRODUCTION TO ENERGY-ENVIRONMENT-GREEN AUDIT

A Thing which Burns Never Returns....

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1.1 : Preface about the Institution:

→ **Kongu Arts and Science College**, an **Autonomous Self Financing Co-Educational Institution** affiliated to **Bharathiar University, Coimbatore** is located in a serene atmosphere at Nanjanapuram village, Erode, Tamilnadu. It was established in the year **1994** by the Kongu Vellalar Institute of Technology Trust. The Trust with 41 dedicated Trustees has built a strong foundation for the Institutional development and it is due to their tireless efforts, the Institution has curved a niche for itself in the academic circle. It is an **ISO 9001-2015** certified Institution and it has also been re-accredited by **NAAC** with **B+ grade in 2018**. Enthroning its gracious educational contribution, the Institution had received its **Autonomous status in the year 2015-16.**

→ Since inception, the College has been playing a pivotal role in the great expansion of knowledge of the rural youth coupled with the basic essence of Ethics and Social responsibility.

1.2 : Vision:

- To impart knowledge and skills to rural youth in order to meet their intellectual and social aspirations and cultural and technical needs of the society

1.3 : Mission Statement:

- ✓ To develop an effective curriculum and optimise institutionalized student's activities
- ✓ To involve learners in practical life situations
- ✓ To expose students to rural realities
- ✓ To sensitize learners to National heritage and values

1.4 : Objectives:

- ➢ To mould the rural youth as self-reliant and socially responsible citizens
- ➢ To facilitate the learners to hone their leadership qualities
- ➢ To equip the learners with updated technological knowledge
- ➢ To enhance the research activities of the rural youth and uplift them to serve the educational needs of the society

1.5 : Quality Policy:

We are committed to instil Knowledge and Values to the students by providing quality education to meet the global challenges.

This will be achieved by:

- Well framed Syllabus to satisfy the needs of learners and on par with the global standard and industry requirements
- Committed and Planned teaching
- Continual upgradation of the Facilities and Resources

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1.6 : Major Activities in the Institution:

1.7 : Scope of the Audit Process:

- **Energy Audit:** To 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 gases), transportation of waste from source to yard, reuse and recycling possibilities, storage mechanism and effective disposal.
- Measurement of effectives 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 mature trees, flowering shrubs, bushes, medicinal plants, adoption of green energy generation and utilization, reduction of CO_2 due to green energy system and identification of possible implementation and enhancement of current greenery practices.

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1.8 : 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 systems (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.

1.9 : Coverage in Energy Audit Process:

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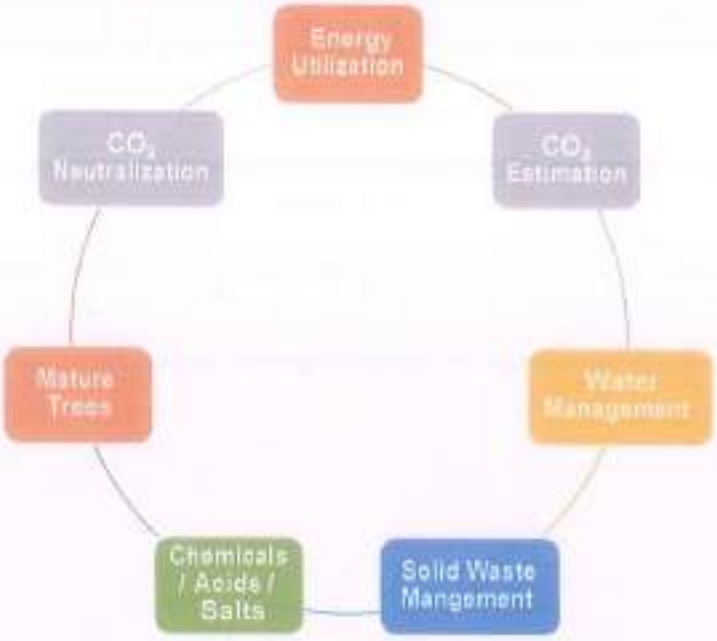
1.10 : Focus Areas in the Environment & Green Audit Process:



1.11 : List of Members Involved in Audit Process & Data Collection:

S. No.	Faculty Details	Contribution
1	**Dr. K.M. Kumaraguru** Associate Professor & Head Department of Commerce	Overall Coordinator for the Energy-Environment and Green Audit Process
2	**Mr. K.P. Karthikeyan** Associate Professor, Department of BBA	Details of the Transport System
3	**Mr. P. Baskaran** Assistant Professor, Department of Commerce	Green Campus Details
4	**Mr. G. Eswaramoorthi** Assistant Professor, Department of Computer Applications	Electrical, UPS, Inverters, AC and Solar PV Data Collection
5	**Mrs. T. Radha** Assistant Professor, Department of Biochemistry	Chemical, Acids and Salts Collection, Details of ECO Club activities
6	**Mr. R. Jaganathan** Administrative Officer, Office	Office, Paper, Solid waste management Data collection

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2. EXECUTIVE SUMMARY

Leaks Make your Future Bleak....

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EXECUTIVE SUMMARY

Electrical and Thermal Energy Analysis:

A detailed audit was conducted in **KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS)**, Nanjanapuram, Erode – 638 107, Tamil Nadu, India. The audit team has come out with ***12 Energy Conservation Proposals (ENCONs)*** and the summary of all the ENCONs are given below:

Description/Year		2017-18	2018-19	2019-20	2020-21	2021-22*
Annual Electricity Consumption (kWh)		5,17,639	5,31,578	4,76,888	2,34,796	1,31,718
Annual LPG Consumption (kg)		12,787	17,442	13,680	4,560	2,375
Summary of Energy Conversion (ENCON) Proposals						
S. No.	Description	Parameters				
		Present	After	Savings		
1.	Annual Energy Consumption	5,31,478 kWh + 17,442 kg of LPG	4,30,046 kWh + 13,949 kg of LPG	1,01,432 kWh + 3,493 kg of LPG		
2.	Annual Energy Cost	Rs. 55.0 Lakhs	Rs. 44.5 Lakhs	Rs. 10.50 Lakhs		
3.	Initial Investment Required	–	–	Rs. 18.40 Lakhs		
4.	Simple Payback Period	–	–	Nearly 1.8 Years		

(* Accounted up to October-2021)

Note:

- The above calculation was performed for the **academic year 2018-19** as all the energy carriers were functioning during that year.
- However all the energy consumption of all the carriers are accounted for the last five years and are presented in the following sections.
- All types of energy carriers like Electricity (of both the services) and LPG used for regular applications are taken into account.

Audit Conducted and Verified by

S.R. Sivarasu

(Dr. S.R. SIVARASU)

KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS) ERODE 638 107

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Table-1: Energy Conservation Proposal (ENCON) along with Annual Energy and Financial Savings

S. No.	Proposed Energy Conservation Measures	% Saving & Source	Estimated Savings		Initial Investment (Rs.)	Payback Period	CO_2 Reduction (Tons/Annum)
			Annual Energy Savings	Monetary Savings (Rs.)			
ENCONs for Electrical Energy Savings							
1.	Increasing the Energy Production from the Roof Top Solar Photovoltaic System using regular Panel Cleaning Schedule	1 % of Solar PV Energy	1,306 kWh	10,822	Zero Cost	Immediate	1.1
2.	Reduction of Belt & Pulley Transmission Losses from Motor to Machine in STP Aerator Motor.	8 % on STP Motor	2,520 kWh	21,168	4,000	0.2 Years	2.1
3.	Reduction of Energy Consumption through retrofitting VFD on one of the Aerator Blower Motor	25 % on STP Motor	3,780 kWh	31,752	60,000	1.9 Years	3.1
4.	Reduction of Cable Losses and Active Power Consumption using Load End Capacitor Compensation (At DB Level)	1.0 % (Electrical)	5,315 kWh	44,109	12,000	0.3 Years	4.4
5.	Replacement of Existing Convention Ceiling Fans into EC BLDC Fans	50 % on Fans Load	12,750 kWh	1,07,100	4,26,600	4.0 Years	10.5
6.	Reduction of Consumption in Electric Geyser used for Hot Water Generation for Bathing Application in Hostel (Both Boys & Girls) Area	Fuel Substitution	18,400 kWh	1,54,560	3,00,000	1.9 Years	15.1
7.	Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps)	50 % on Lighting	21,875 kWh	1,83,750	3,49,200	1.9 Years	17.9
8.	Replacement of Existing UPS with Centralized UPS and Reduction of Battery based Waste Management	2 % of Self Loss of UPS	36,792 kWh	3,09,053	4,00,000	1.3 Years	30.2

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S. No.	Proposed Energy Conservation Measures	% Saving & Source	Estimated Savings		Initial Investment (Rs.)	Payback Period	CO_2 Reduction (Tons/Annum)
			Annual Energy Savings	Monetary Savings (Rs.)			
	ENCONs for Thermal Energy Savings						
9.	Reduction of LPG Consumption using Regular Burner Cleaning and Swapping of Active Burners	5 % of LPG used for Stove	349 kg	20,312	5,000	0.2 Years	1.0
10.	Reduction of Heat Energy Exposed in the Boiler Outer Side + Steam Pipes Lines (Especially in Pipe Joints) using Thermo Ceramic Coating (TCC)	10 % on Boiler LPG Consumption	349 kg	20,312	30,000	1.5 Years	1.0
11.	Reduction of LPG Consumption in Dosa making Stove with Radiant Burners	20 % of LPG for Dosa Stove	1,395 kg	81,189	1,50,000	1.8 Years	4.2
12.	Reduction of LPG Consumption in Boiler Feed Water Pre-heating using Solar Thermal Energy System	Fuel Substitution	1,400 kg	81,480	1,00,000	1.2 Years	4.2
Total			**1,01,432 kWh + 3,493 kg of LPG**	**10,54,784**	**18,36,800**	--	93.7

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A SYNOPSIS OF ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-A: ENERGY AUDIT REPORT

3. STUDY ON ENERGY CONSUMPTION & GENERATION PATTERN

Take Control of your Energy Bills....

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3.1 : Energy Consumption Pattern (Electrical and Thermal):

S. No.	Description	Details				
Electrical Energy (Consumption)						
1.	Name of the customer (As per the utility bill)	THE PRESIDENT, TRUSTEE KONGU VELLALAR COLLEAGE, NANJANAPURAM, THINDAL,ERODE				
2.	Type of Utility Supply, Service No.& Tariff	LT SC. No: 04-022-005-168; Tariff-LM-II-B-2				
		LT SC. No: 04-022-005-169; Tariff-LM-II-B-2				
3.	Tariff Structure	Rs. 7.50/kWh + Rs. 120/kW as demand charges (fixed charges accounted for the sanctioned demand)				
4.	Energy Suppliers	Tamilnadu Generation & Distribution Corporation (TANGEDCO)+ Roof Top Solar PV Plant				
5.	Permitted Demand (PD)	SC. No: 04-022-005-168- **104.1 kW**				
		SC. No: 04-022-005-169- **109.1 kW**				
6.	Capacity of APFC	SC. No: 04-022-005-168- **55 kVAr, 3-CT, 4 Stage**				
		SC. No: 04-022-005-169- **55 kVAr, 3-CT, 4 Stage**				
7.	Capacity of Diesel Generator (DG) Sets	125 kVA- 2 No's				
		All are air-cooling. Internal fuel tank (250 L) & separate earthing done				
8.	Annual Electricity Consumption (kWh)	2017-18	2018-19	2019-20	2020-21	2021-22
		5,17,639	5,31,578	4,76,888	2,34,796	1,31,718
9.	Annual Electricity Generation from DG (kWh)	30,484	29,336	25,792	4,116	1,080
10.	Annual Diesel Consumption for DG (L)	10,200	9,320	8,630	1,770	335
Electrical Energy (Generation)						
11.	Nature & Capacity of Energy Generation	Roof Top SPV Plant - **50 kW MB (2015)** feeding to MV panel in SC. No: 04-022-005-168				
		Roof Top SPV Plant - **40 kW BCA Block (2014)** feeding to MV panel in SC. No: 04-022-005-169				
12.	Annual Energy Generation (kWh)	2017-18	2018-19	2019-20	2020-21	2021-22
		1,20,777	1,30,613	87,650	80,251	31,805
13.	Overall Energy Generation (Last 5-Years)	**4,51,096 kWh**				

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14.	Frequency of panel Cleaning	Monthly Twice				
Thermal Energy (Consumption)						
15.	Types of Thermal Energy Used	Liquified Petroleum Gas (LPG			Cooking	
		Diesel (Ordinary)			Transport + DG	
16.	Annual LPG Consumption (kg)	2017-18	2018-19	2019-20	2020-21	2021-22
		12,787	17,442	13,680	4,560	2,375
17.	Annual Diesel Consumption for Transport (L)	1,56,304	1,68,643	1,70,168	56,385	20,421
General Loads (Both Electrical and Thermal)						
18.	Lighting System	**Indoor lighting**: Conversion of Florescent Tube Light (FTL) into LED in a phased manner				
		Outdoor lighting: All the street lightings are LED based energy efficient lamps				
19.	Lighting Feeder	Lighting loads are separated from raw powerand are supplied through lighting distribution board				
20.	Fan Loads (Ceiling)	All the indoor ceiling fans are conventional fans.				
21.	HVAC System	• Unitary air conditioning system installed in the required places • Most of the AC units are **BEE star rated** and the outdoor units are mostly placed in shade. • 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 • AC filters, condenser & evaporator coils are cleaned at regular intervals				
22.	Motors and Pump loads	• Mainly used for water distribution, purification, waste water treatment • Small motors are used in kitchen equipments				
23.	Uninterrupted Power System (UPS)	• All the computers, server s, surveillance systems, projectors, telephonic units are connected with UPS with nominal back up time of 15-30 min.				

KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS) ERODE 638 107

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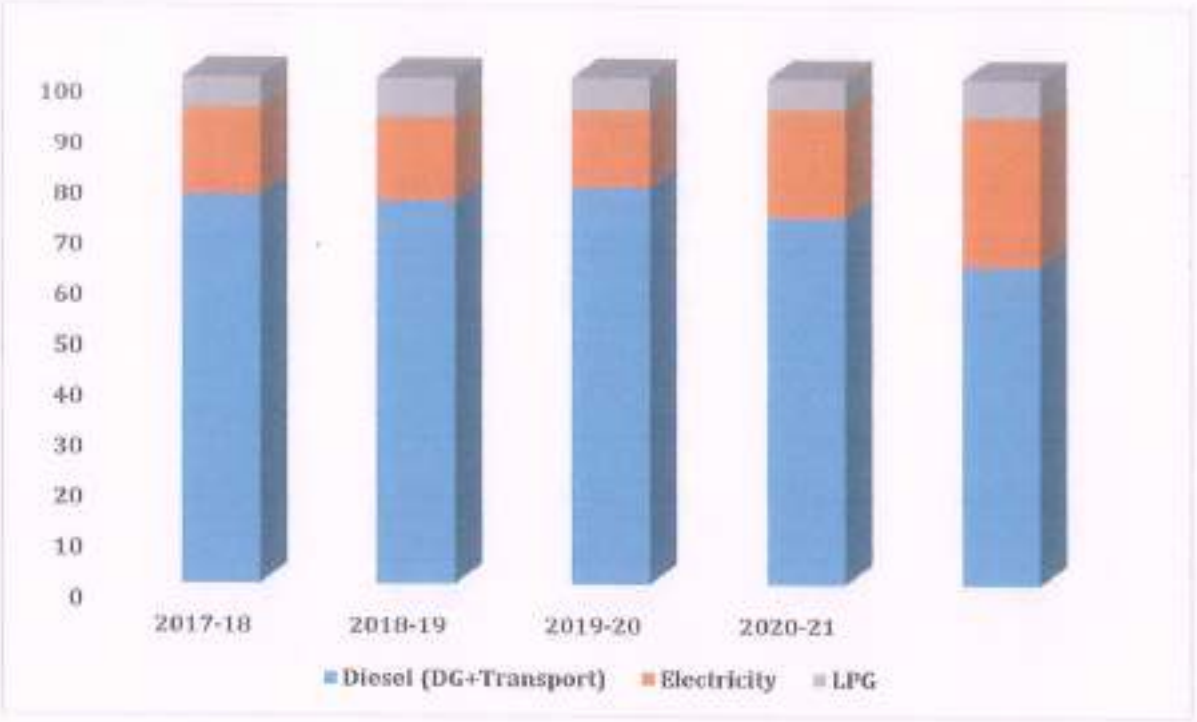
3.2 : Energy Contribution:

Table-2: Contribution of Energy Consumption & Energy Conversion

% Contribution	2017-18	2018-19	2019-20	2020-21	2021-22
Diesel (DG+Transport)	76.8	75.7	78.5	72.6	63.2
Electricity	17.0	16.4	15.2	21.3	29.1
LPG	6.2	7.8	6.3	6.0	7.6

(Note: The percentage values of each energy carriers are converted into its equivalent MTOE using suitable conversion factor. Specific Gravity of diesel is 0.8263 kg/litre)



Graph-1: Contribution of Energy Consumption

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A SYNOPSIS OF
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

4. ESTIMATION OF CO_2 EMISSION AND NEUTRALIZATION

(ELECTRICITY, DIESEL, LPG, SOLAR PV, SOLAR THERMAL BIO-GAS & MATURE TREES)

Reduce, Reuse, Recycle

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4.1 : Assessment of Annual Energy Usage:

Table-3 shows the types of energy carriers used for their regular operation in the college campus along with application area and their source.

Table-3: Energy Carriers, Application area and their sources used for College Operation

S. No.	Type of Energy Carrier	Application Area	Source of Procurement
1.	Electricity (Two LT Service)	Powering to all electrical / electronic / HVAC equipments	From TANGEDCO
2.	Diesel	Transport vehicles and Diesel Generator (Captive Generation)	From authorised distributor
3.	Liquified Petroleum Gas (LPG)	Used only for cooking	
4.	Mature Trees	The college has nearly **786** mature trees of different varieties which are more than 10 years old	

4.2 : Environmental System: CO_2 Balance Sheet (2017-18):

Environment audit is the best tool to assess the CO_2 emission and neutralization and chalk out the plans to reduce it from the present values. Table-4 provides the balance sheet indicating various energy carriers associated with the regular activities of the college and their CO_2 mapping.

Table-4: Environmental System: CO_2 Balance Sheet (2017-18)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Energy Quantity (Annum)	CO_2 Emission (Tons/Annum)	Description	Energy Usage	CO_2 Neutralized (Tons/Annum)
1.	Electrical Energy	5,17,639 kWh	424.5	CO_2 Neutralized due to Solar PV System	1,20,777 kWh	99.04
2.	Diesel (Transport + DG)	1,66,504 Litres	439.6	CO_2 Neutralized due to Mature Trees	786 No's	17.13
3.	LPG Consumption	12,787 kg	38.4	CO_2 Neutralized due to Solar Thermal	7,600 kWh	6.23
				CO_2 Neutralized due to Biogas	3,825 kg	11.48
4.	Total Emission		902.4	Total-Neutralized		133.0
Balance CO_2 to be Neutralized = 768.5 Tons/Annum & & Per Capita CO_2 Consumption = 0.15 Tons/Annum *						

(* Total strength of students: 4,733 + Teaching and technical staff: 251 = 4,984)

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4.3 : Environmental System: CO_2 Balance Sheet (2018-19):

Table-5: Environmental System: CO_2 Balance Sheet (2018-19)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Energy Quantity (Annum)	CO_2 Emission (Tons/Annum)	Description	Energy Usage	CO_2 Neutralized (Tons/Annum)
1.	Electrical Energy	5,31,475 kWh	435.8	CO_2 Neutralized due to Solar PV System	1,30,613 kWh	107.10
2.	Diesel (Transport + DG)	1,77,963 Litres	469.8	CO_2 Neutralized due to Mature Trees	786 No's	17.13
3.	LPG Consumption	17,442 kg	52.3	CO_2 Neutralized due to Solar Thermal	7,600 kWh	6.23
				CO_2 Neutralized due to Biogas	3,825 kg	11.48
4.	Total Emission		958.0	Total-Neutralized		141.9
Balance CO_2 to be Neutralized = 816.0 Tons/Annum & Per Capita CO_2 Consumption = 0.16 Tons/Annum [1]						

([1] Total strength of students: 4,823 + Teaching and technical staff: 254 = 5,077)

4.4 : Environmental System: CO_2 Balance Sheet (2019-20):

Table-6: Environmental System: CO_2 Balance Sheet (2019-20)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Energy Quantity (Annum)	CO_2 Emission (Tons/Annum)	Description	Energy Usage	CO_2 Neutralized (Tons/Annum)
1.	Electrical Energy	4,76,888 kWh	391.0	CO_2 Neutralized due to Solar PV System	87,650 kWh	71.87
2.	Diesel (Transport + DG)	1,78,798 Litres	472.0	CO_2 Neutralized due to Mature Trees	786 No's	17.13
3.	LPG Consumption	13,680 kg	41.0	CO_2 Neutralized due to Solar Thermal	7,600 kWh	6.23
				CO_2 Neutralized due to Biogas	3,825 kg	11.48
4.	Total Emission		904.1	Total-Neutralized		106.7
Balance CO_2 to be Neutralized = 797.4 Tons/Annum & Per Capita CO_2 Consumption = 0.16 Tons/Annum [1]						

([1] Total strength of students: 4,778 + Teaching and technical staff: 255 = 5,033)

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4.5 : *Environmental System: CO_2 Balance Sheet (2020-21):*

Table-7: Environmental System: CO_2 Balance Sheet (2020-21)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Energy Quantity (Annum)	CO_2 Emission (Tons/Annum)	Description	Energy Usage	CO_2 Neutralized (Tons/Annum)
1.	Electrical Energy	2,34,796 kWh	192.5	CO_2 Neutralized due to Solar PV System	80,251 kWh	65.81
2.	Diesel (Transport + DG)	58,155 Litres	153.5	CO_2 Neutralized due to Mature Trees	786 No's	17.13
3.	LPG Consumption	4,560 kg	13.7	CO_2 Neutralized due to Solar Thermal	7,600 kWh	6.23
				CO_2 Neutralized due to Biogas	3,825 kg	11.48
4.	Total Emission		359.7	Total-Neutralized		100.6
Balance CO_2 to be Neutralized = 259.1 Tons/Annum & Per Capita CO_2 Consumption = 0.06 Tons/Annum *						

(* Total strength of students: 4,438 + Teaching and technical staff: 237 = 4,675)

4.6 : *Environmental System: CO_2 Balance Sheet (2021-22):*

Table-8: Environmental System: CO_2 Balance Sheet (2021-22)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Energy Quantity (Annum)	CO_2 Emission (Tons/Annum)	Description	Energy Usage	CO_2 Neutralized (Tons/Annum)
1.	Electrical Energy	1,31,718 kWh	108.0	CO_2 Neutralized due to Solar PV System	31,805 kWh	26.08
2.	Diesel (Transport + DG)	20,756 Litres	54.8	CO_2 Neutralized due to Mature Trees	786 No's	17.13
3.	LPG Consumption	2,375 kg	7.1	CO_2 Neutralized due to Solar Thermal	7,600 kWh	6.23
				CO_2 Neutralized due to Biogas	3,825 kg	11.48
4.	Total Emission		169.9	Total-Neutralized		60.9
Balance CO_2 to be Neutralized = 109.0 Tons/Annum & Per Capita CO2 Consumption = 0.03 Tons/Annum *						

(* Total strength of students: 4,058 + Teaching and technical staff: 250 = 4,308)

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4.7 : Observations:

- **Note: During the year 2019-20 and 20-2121-21; due to COVID lockdown the values of all the energy quantities are less in nature**
- From the above table; it is evident that the college is now trying to neutralize their CO_2 emission through various initiatives like i) Installation of additional roof top solar PV system, ii) Reduction of LPG consumption, iii) Planting more number of trees and iv) implementing various energy conservation measures (FTL to LED conversion, conventional fan to BLDC fans, Energy efficient motor replacement, judicious use of all types of energy etc.,).
- Reduction of LPG consumption by replacing the entire boiler cooking system into biomass Wood pellets reduces considerable amount of amount of CO_2. The management has to think and go for fuel substitution.

4.8 : Calculation Table:

For Electricity = [kWh x $\frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}$]
For Diesel = [Diesel Consumption (Litre) x $\frac{2.64 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}$]
For LPG = [LPG Consumption (kg) x $\frac{3.0 \text{ kg of CO2 emission}}{\text{kg of LPG Consumption}}$]
A mature tree is able to absorb nearly CO_2 at a rate of 48 lbs./year (nearly 21.8 kg); hence total CO_2 to be neutralized is $\frac{(21.8 \times 785)}{1,000} = 17.13 \frac{\text{Tons}}{\text{Annum}}$

4.9 : References:

[1] https://ecoscore.be/en/info/ecoscore/co2

[2]http://www.tenmilliontrees.org/trees/#:~:text=A%20mature%20tree%20absorbs%20carbon,the%20average%20car's%20annual%20mileage

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A SYNOPSIS OF
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

5. TRANSPORT & REFRIGERANT GASES IN AIR CONDITIONING SYSTEM

Air Pollution does not need a Visa to travel across the Border

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5.1 : 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 type of engine are represented in Table-9.

Table-9: List of Transporting Vehicles available in the College

S. No.	Type of Vehicle & YOM	Type of Engine	Fuel Used	No. of Vehicles	Non pollution certificate
1.	BUS&2000	AL-HINO	Diesel	1	Yes
2.	BUS&2001	AL-HINO	Diesel	2	Yes
3.	BUS&2003	AL-HINO	Diesel	1	Yes
4.	BUS&2004	AL-HINO	Diesel	1	Yes
5.	BUS&2005	AL-HINO	Diesel	5	Yes
6.	BUS&2007	AL-BS II	Diesel	2	Yes
7.	BUS&2008	AL-BS II	Diesel	1	Yes
8.	BUS&2009	AL-BS II	Diesel	2	Yes
9.	BUS&2010	AL-BS II	Diesel	4	Yes
10.	BUS&2011	AL-BS II	Diesel	2	Yes
11.	BUS&2012	AL-BS III	Diesel	5	Yes
12.	BUS&2013	AL-BS III	Diesel	4	Yes
13.	BUS&2014	EICHER	Diesel	4	Yes
14.	BUS&2015	EICHER	Diesel	5	Yes
15.	BUS&2016	EICHER	Diesel	5	Yes
16.	BUS&2017	AL-BS IV	Diesel	5	Yes
17.	BUS&2019	AL-BS IV	Diesel	3	Yes
18.	VAN&2007	MARUTI OMNI	Petrol	1	Yes
19.	CAR&2015	HONDA MOBILIO	Diesel	1	Yes
Total No. of Vehicles				**54**	

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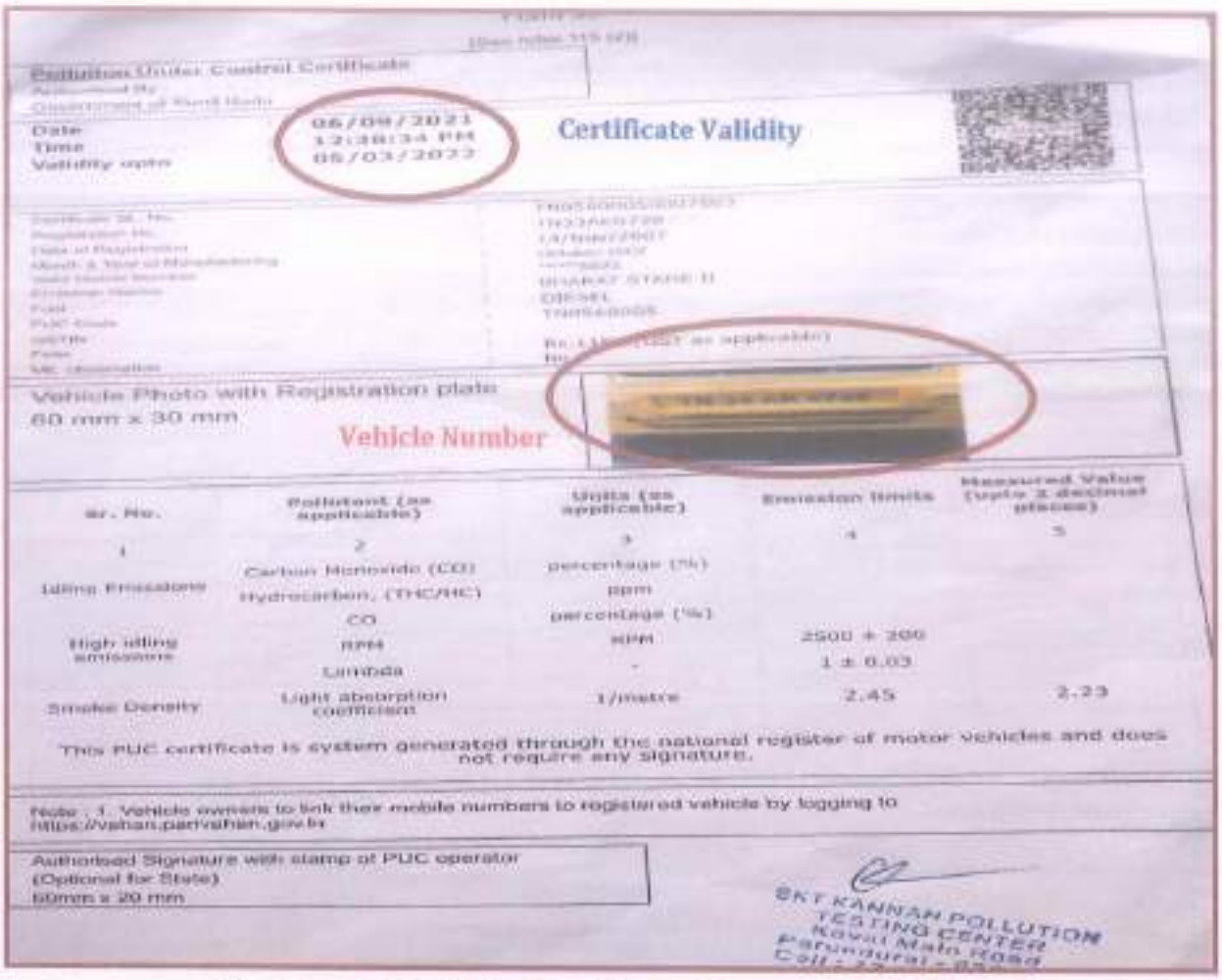

Fig.1: Sample Pollution Certificate of a Transport Vehicle

5.2 : List of Air Conditioning System along with its Refrigerant:

The list of AC available is shown in Table-10: indicating their quantity, tonnage, type of refrigerant, GWP and ODP.

Table-10: List of Multi-variant AC System, Type of Refrigerant, GWP and ODP Values

S. No.	Location	Star & TR Capacity	Quantity	Refrigerant Used	Global Warming Potential (GWP)	Ozone Depletion Potential (ODP)
1.	BCA Block	Nil & 2 TR	1	R22	1,810	Medium
2.	BCA Block	Duct & 11 TR	6	R22	1,810	Medium
3.	BCA Block	Duct & 4 TR	4	R22	1,810	Medium
4.	Guest House	Nil & 1.5 TR	1	R22	1,810	Medium
5.	Guest House	Nil & 2 TR	1	R22	1,810	Medium
6.	Library Block	2 Star & 1.5 TR	2	R22	1,810	Medium
7.	Library Block	2 Star & 2 TR	1	R22	1,810	Medium
8.	Library Block	3 Star & 1.5 TR	1	R22	1,810	Medium
9.	Library Block	2 Star & 1.5 TR	1	R22	1,810	Medium
10.	Library Block	Nil & 2 TR	4	R22	1,810	Medium
11.	Library Block	Nil & 1.5 TR	1	R22	1,810	Medium

12.	Main Block	3 Star & 5 TR	2	R22	1,810	Medium
13.	Main Block	2 Star & 3 TR	1	R22	1,810	Medium
14.	Main Block	Nil & 3 TR	3	R22	1,810	Medium
15.	Main Block	3 Star & 2 TR	1	R22	1,810	Medium
16.	Main Block	Nil & 2 TR	1	R22	1,810	Medium
17.	Main Block	Nil & 3 TR	2	R22	1,810	Medium
18.	Main Block	Nil & 2 TR	4	R22	1,810	Medium
19.	Main Block	Duct & 11 TR	1	R22	1,810	Medium
20.	Main Block	Duct & 11 TR	1	R22	1,810	Medium
21.	PG Block	3 Start & 16.5 TR	1	R22	1,810	Medium
22.	PG Block	Nil & 3 TR	2	R22	1,810	Medium
23.	PG Block	Nil & 4 TR	1	R22	1,810	Medium
24.	PG Block	2 Star * 22 TR (Duct)	2	R22	1,810	Medium
25.	PG Block	Nil & 2 TR	7	R22	1,810	Medium
26.	Principal Quarters	Nil & 1.5 TR	1	R22	1,810	Medium
27.	Principal Quarters	5 Star & 1 TR	1	R22	1,810	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. (Kindly refer: https://www.bijlibachao.com/air-conditioners/comparison-of-various-refrigerants-r-410a-r-22-r-290-r-134a-used-for-air-conditioners-and-refrigerators.html).

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A SYNOPSIS OF
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

6. WATER UTILIZATION, CONSERVATION & WATER MANAGEMENT

Our Earth, Our Habitat, Our Home

6.1 : Source of Water, Storage and Distribution:

Water is one of the main consumables in the college campus. **KONGU ARTS AND SCIENCE COLLEGE** gets the water from four different sources i) Treated RO water from an RO plant located outside the college ii) Fresh water from the bore well, iii) Rain Water Harvesting (RWH) and iv) Treated water from STP. Table-11 shows the source of water, location of storage along with their application.

Table-11: Source of Water, Location of Storage and Application

Type of Water	Source	Location of Storage	Application
Fresh Water	Bore water (7 Nos)	Stored in separate tanks located in each buildings. All the tanks are interconnected. The water requirement/day is **2.0-2.5 Lakh Litre**	Cooking, Utensil Cleaning, Bathing, Clothing and Washing
	Principal Quarters – 1 No.		
	Main Gate – 1 No.		
	Boys Hostel – 2 Nos		
	Library – 1 No.		
	Open Auditorium – 1 No.		
	PD Room – 1 No.		
Rain Water	Rain Water collected through i) buildings run-offs, ii) road run-offs and iii) collected in small ponds	Collected and stored in front of each building	Used to increase the ground water level
		Percolated to underground	
Treated Water from TP	Final output treated water from STP plant	Used only for Gardening application	

6.2 : Reverse Osmosis (RO) Plant and Treated Water for Drinking Application:

- The college management is keen on providing uninterrupted, safe and healthy drinking water to all; throughout the year. This water is checked in the chemistry laboratory as per the standard and ensures that the water is potable.
- The treated water (RO) is taken from the Kongu Engineering College (KEC) through transportation and then stored in **separate tanks (only used to store RO)** located in roof top of the each buildings. The capacity of the tanks are of different types designed based on the utilization.
- These tanks are cleaned at regular intervals and the water management team has been maintaining a cleaning schedule.

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KONGU ARTS AND SCIENCE COLLEGE

(An Autonomous Institution Affiliated to Bharathiar University, Coimbatore)

ERODE - 638 107.

Office : 0424 - 2242668, 2242999, 98427 26267

QUALITY CRITERIA OF DRINKING WATER

Date: 26.07.2021

Water Sample source: Kongu Arts and Science College (Main Block- 1st floor)

Microbiological Analysis - Report

S. No	Parameter	Result	ISI Permissible limits
1	*E.coli*	No colony detected	Agreeable
2	*Coliform*	Not detected	Agreeable
3	Aerobes	11 colonies detected (Normal - should not exceed 20 colonies/ml sample)	Agreeable
4	Anaerobes (*Clostridia*)	No colony detected	Agreeable
5	*Pseudomonas aeruginosa*	Absent	Agreeable
6	Yeast and Molds	Absent	Agreeable

Staff in Charge

HOD/Biotechnology

Copy to:
1. Principal, KASC
2. Office
3. File

E-mail : konguarts@kasc.ac.in Website : www.kasc.ac.in

KONGU

Fig.2: Drinking Water Testing Certificate (Internal Testing)

6.3 : Water Control Taps for General Application:

In the college, the Openable taps (Only metal) are employed for all water distribution and utilization application and hence the user can utilize only the required quantity of water.

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6.4 : Sewage Treatment Plant (STP):

- The Institution has implemented conventional wastewater treatment plant with a total capacity of **2,00,000 Liters/day).**

Table-12: Specifications of Sewage Treatment Plant (STP)

Collection Tank Capacity	65 KLD
Aeration Tank Capacity	100 KLD
Settling Tank Capacity	100 KLD
Bar Screen Chamber Capacity	2' x 2'
Treated Water Tank	Available (Three layer design)
Filtering Types	Carbon and Sand Filters
No. of Sludge Bed	8 No's
Duration & Quantity of Sludge removed	Yearly once and nearly 100 kg
Usage of Treated Water	**Only for gardening**
Usage of sludge	**Bio Fertilizer & Manure for gardening**

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Fig.3: Snap shots of Sewage Treatment Plant (STP)

6.5 : Rain Water Harvesting (RWH) - from Building Roof Area & Run-off Area:

- The audit team appreciates the effects taken by the management of **KONGU ARTS AND SCIENCE COLLEGE** for harvesting the rain water almost in all buildings.
- The roof area is so arranged to collect the rainwater and then passed through proper piping system and then bring back to the RWH pits, which are located close to each pits.

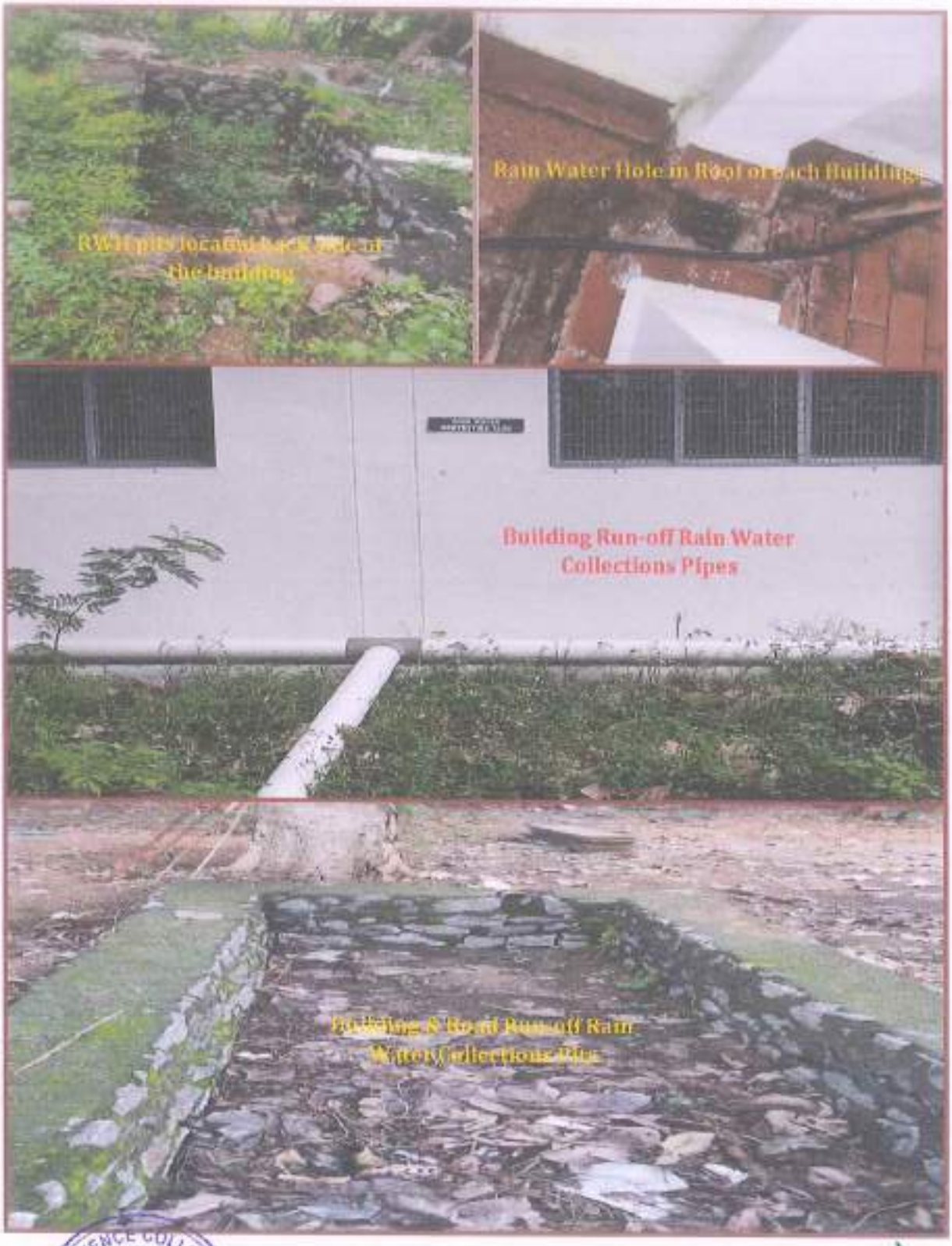

Fig.4: Rain Water Harvesting (RWH) system implemented in the College

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A SYNOPSIS OF
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

7. USAGE OF CHEMICALS, SALTS & ACIDS

(STORAGE, HANDLING, AND BEST OPERATING PRACTICES)

Say no to pollution & Yes to Recycle

7.1 : Policy of Chemicals/Salts/Acids used in the Laboratories:

The science departments uses chemicals for experimental applications and are having strict safety rules for handling and storage as follows.

- Well trained faculty and lab assistants who have knowledge have knowledge about the hazardous nature of each and every chemical are only allowed to handle the chemicals safely
- Strictly follow the manufacturer's instruction on the container in order to prevent accidents
- Volatile or highly odorous chemicals, fuming acids are stored in a ventilatedarea
- 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. 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

7.2 : 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 in Fig. 5 & 6.

Fig.5: Chemicals, Salts and Agents are separately placed for laboratory application

Fig.6: Concentrated acids are stored in sand bed (Best Practice)

Practice-1	Storage and Handling of Chemicals

Best Practices Adopted

- Most of the chemicals, salts and acids used in the science departments are inorganic in nature and no harmful effects are created during the experiment process.
- However after completion of each experiment, the wastes are washed in the water sink and are rooted to common STP.
- Only trained teaching and non-teaching staffs are handling the chemicals and also they are well trained to handle any abnormal situations.
- Laboratories with chemicals are well ventilated with proper emergency exits. Adequate and correct sequence of fire extinguishers are placed near all the laboratories.
- LPG used for laboratory application is properly distributed through manifold necessary safety precautions. After completion of the day; the technical staffs are instructed to close the main valve and avoid unnecessary flow of gas during non-working period of the college.
- One more best practice; the chemical/acid outcome of some of the experiments is used as input for other experiments which also reduces the annual requirement of the chemicals/acids.

Best Practices to be Adopted

- After completion of each experiment, the wastes are washed in the water sink and are rooted to sewage treatment plant which is designed to handle only sewage; not the effluent.
- It is recommended to create a **separate policy for Chemical handling and usage** indicating various measures involved starting from **procurement of chemical to disposal (Cradle to Grave approach)**. Ascertain that the chemicals/salts/acids used in the college campus for their academic/research application do not pollute the mother earth.
- The policy must be approved by any regularly convened apex committee (may be Governing Council) and must be disseminated to all stakeholders. Also paste the content of the policy in vulnerable points inside the college campus.
- Though the quantity of the chemical wastes generated in an annum is small, it is appropriate to divert and treat this effluent to some other means.
- One of the best ways to treat this is;

  Design a dedicated system and collect the chemical wastes in a separate tank with suitable backup facility. Once the tank fills; then transfer the effluent to nearby authorised Effluent Treatment Plant (ETP). An agreement may be made between the college and the ETP authorities over a certain period of time

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7.3 : Cleaning Agents (Soap & Powders) used for Vessels & Floor Cleaning:

In order to maintain hygiene in the College campus; the administration regularly cleans the floors and restrooms. In addition to this; the hostel management has to monitor i) the cleaning of vessels, kitchen floor, dining hall, store room and gas station. Table-13 shows the cleaning agents used to clean the above area;

Table-13: Cleaning Agents used for Floor and Vessel Cleaning

S. No.	Cleaning Agent	Application
1.	Cleaning Powder & Vessel Cleaning Soap	Vessel Cleaning
2.	Soap Oil & Bleaching Powder	Floor Cleaning

7.4 : Recommendations: Eco Friendly - Green Cleaning Agents:

- On an average; the cleaning agents used today have about 62 harmful chemicals like Paraben, Phosphates or Chlorides. A lot of them are present multi-purpose cleaners.
- It is recommended to use natural ingredients like orange peel extract & vinegar. It leaves a mild and pleasant fragrance after use. The formula is free from all harmful chemicals & toxins. It is pH-neutral, gentle on the skin as well as on the surface where it is used.
- Also these products are **IGBC GreenPro** certified. GreenPro is a mark of guarantee that the product is environment friendly throughout its life cycle.
- Fig. 7 shows the sample eco-friendly Green Pro certified cleaning agents.

Fig.7: Green Pro Certified Eco Friendly Cleaning Agents (ZERODER)

A SYNOPSIS OF ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

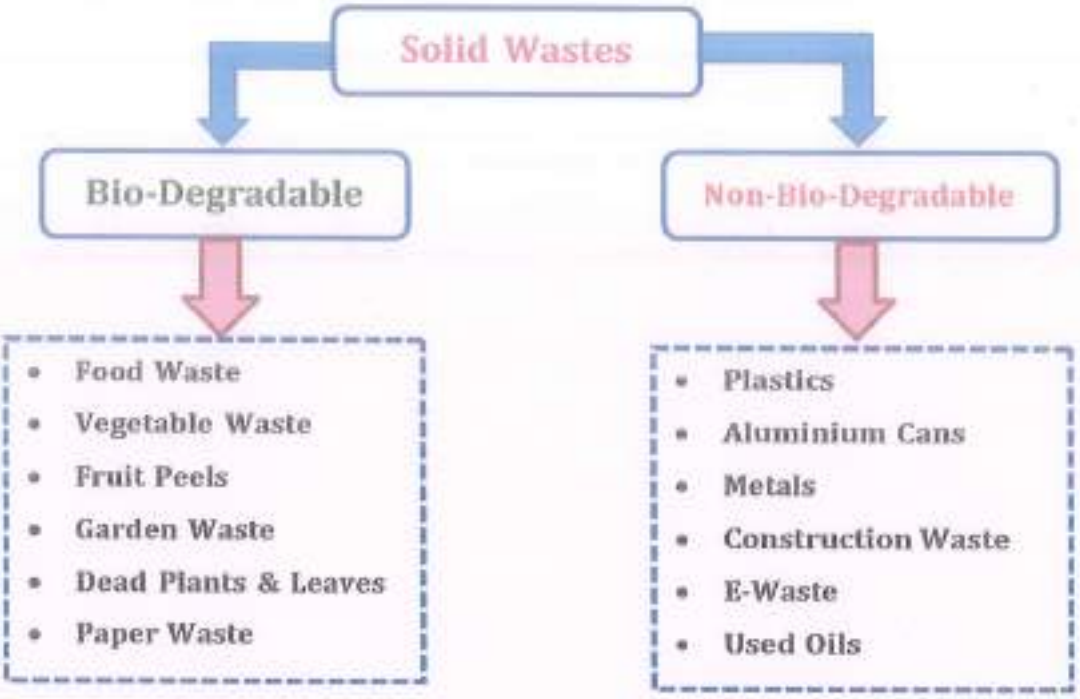
PART-B: ENVIRONMENT AUDIT REPORT

8. WASTE HANDLING & MANAGEMENT

Save the environment in present for better life in future

8.1 : Solid Waste Management System:

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



8.2 : Process of Waste Management:

The college management practised some methods to treat the waste generated and Table-14 shows the process of treating the solid waste generated inside the college campus.

Table-14: Process of Waste Management

S. No.	Waste Type	Waste Treatment
Bio-Degradable Waste Management		
1.	Food and Vegetable Waste	Collected and fed to digester for bio-gas generation
2.	Garden Wastes and Plant Leaves	Daily collected and dumped in a yard
3.	Paper Waste	Collected and stored in a separate place.
		Sold to third party for recycling
Non-Bio-Degradable Waste Management		
4.	Plastics	Banned in the college campus (Welcome step). The chemical/salt storage plastic containers are disposed to third party
5.	Construction Waste	Mostly used by their own construction and used for internal land filling
6.	Metals	Construction metals or metals from any other sources are stored in a separate place
		Used for sale to third party for recycling

7.	Transport Oil + Tyres	Stored in a separate place and used for sale to 3rd party.
8.	Transport Vehicle and Computer Batteries	Procuring new batteries with buyback offer (old battery replacement)
9.	Used edible oil	Almost zero waste. Mostly used for internal cooking and frying.
10.	E-Waste Management	Separately given below. Used for sale to third party for recycling

- Most of the furniture items are repaired and reused.
- Waste collection procedure: A common circular is given to all the Heads of the Department stating to identify and quantify the amount of waste generated.
- As against the circular, all the departments collect the waste and hand over them to the Waste Management Committee.
- Based on the highest quotation (among the three quotation) the party is authorized to take the waste in the vehicle. Empty vehicle weight is checked first and then the wastes are loaded in the vehicle. The weight of the fully loaded vehicle is also noted in order to quantify the amount of waste being disposed.
- Equipment, meters and measuring instruments if found to be waste; it would be approved by supplier/service persons/trust people.

8.3 : List of Approved E Waste:

E-Waste – Electrical	E-Waste – IT & Communication
• Motors and Starters	• Copier/Printers & Fax Machines
• Fans, Lamps and Luminaries	• Power Stripes & Power Supplies
• Electrical Drives	• UPS/Servo Stabilizers/Inverters
• Heater Coils	• Batteries
• Broken/Fired Cables	• Wi-fi-Modems, Routers, Toggle
• Air Conditioning System	• Network Cables, Switches, Hubs
• Power Distribution Panels	• Phone, Intercom & PBX
• Electronic Music Instruments	• Audio & Video Equipments/Remote Controls, Projectors
• Electronic GYM Equipments	
• Electronic Attendance System	• Printed Circuit Boards
• Analog & Digital Measuring Instruments	• Barcode/QR scanners

8.4 : General Note:

- Prepare a flow chart for collection of E-waste from Generation to Disposal and paste it on appropriate places
- An electronic weighing scale (with suitable capacity) must be installed in the storage yard and should be properly calibrated
- One emergency lamp (with UPS supply) must be installed along with suitable fire extinguisher. Ensure proper ventilation in the yard

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- Form rule for declaring the waste as E-Waste & Assign the singing authorities
- Identify a third party vendor to procure the E-waste from the college
- Establish MoU with that party. Disseminate the following information at appropriate places i) E-Waste Policy, ii) Process Methodology, iii) Copy of MoU with third party vendor, iv) Contact persons mobile number and E-mail
- Identify certain vehicle to carry the waste from generation to storage yard
- Provide training to the man power who are handling the waste
- Maintain separate Delivery Challan, Billing, Weighing mechanism for handling the E-Waste.
- Update the status of E-waste (through digital circular) to all the concerned management representatives, faculty members and staff at regular intervals (month wise is good)

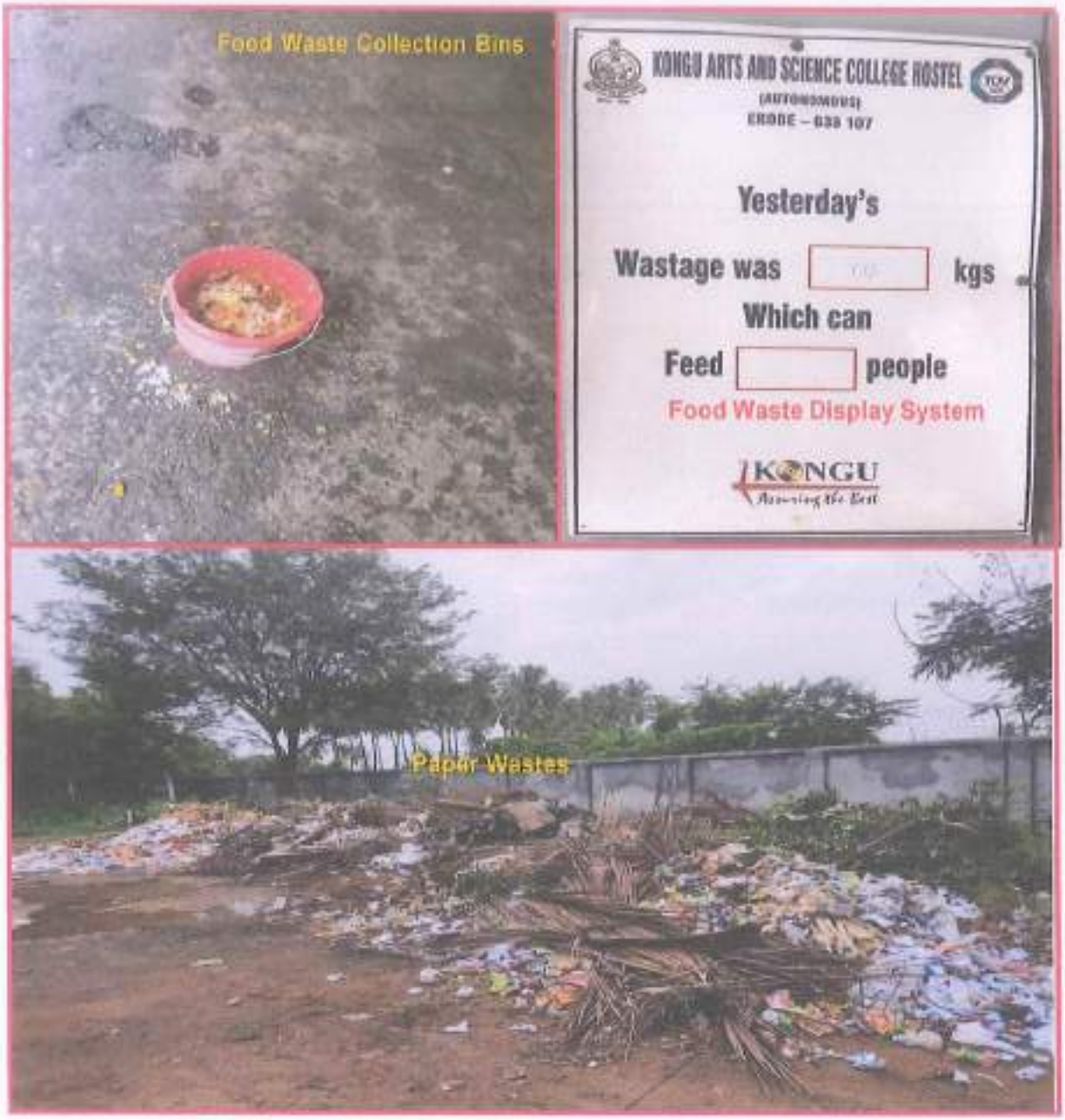

Fig.8: Snap shots of Solid Waste Management (SWM)

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A SYNOPSIS OF ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-C: GREEN AUDIT REPORT

9. ASSESSMENT ON MATURE TREES & GREEN ENERGY GENERATION

Trees are life, don't cut them

9.1 : Campus Greenery:

The college is completely covered with mature trees grown for more than 10 years. The total number of mature trees available in the college campus is ***786 with 20 varieties of trees.*** Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowering shrubs and bushes.

Total No. of Mature Trees available in the college campus is **786** which contributes for reduction of **17.1 Tons of CO_2 emission/Annum**

9.2 : Roof Top Solar Photovoltaic System:

- The college has installed solar PV plants with a capacity of 50 kW + 40 kW = **90 kW** in total, generate and feed power to the respective LT services and are utilized by the campus load.
- All the conductive parts are properly earthed at respective buildings and ensures safety.

.

Overall energy saving from solar PV system is ***4,51,096 kWh*** which reduces **369.9 ons of CO_2 Emission/Annum.**

9.3 : Hot Water Generation using Solar Thermal System:

- In order to promote more green generation; the management has installed Solar Thermal system in the staff quarter's roof top and generates hot waters for bathing application.
- It is a good practice to use renewable energy based system for hot water generation by avoiding conventional heating methods (electricity or wood based).

Annual energy saved from the solar hot water system used for bathing is ***7,600 kWh*** which reduces **6.2** **Tons of CO_2 Emission/Annum.**

9.4 : Bio-gas Plant Generating Cooking Gas

- **KONGU ARTS AND SCIENCE COLLEGE** has implemented a Bio-gas (natural fuel) plant generating energy from food, vegetable wastes and toilet solids daily generated in mess and canteen.
- Production of biogas obtained from **"anaerobic digestion"** which contains micro-organisms breaking down complex organic substances (lipids, protides, and glucides), that are present in plants, sludge and by-products of animal origin.

KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS) ERODE 638 107

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- Biogas is primarily methane (CH_4) and carbon dioxide (CO_2) and may have small amounts of hydrogen sulphide (H_2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen.
- Food waste generated from cooked rice, cut portions of vegetables and non-used vegetables.

Annual savings of LPG is around ***3,825 kg*** which reduces ***11.5 Tons*** of CO_2 Emission / Annum.

9.5 : Availability of Indoor Plants:

- Indoor plants not only looks beautiful, but also brings life to our living space. They also help purify the air. According to a study of NASA even a small plant inside the workspace can help remove at least three household toxins (think benzene, formaldehyde, and trichloroethylene, which are carcinogenic chemicals commonly found in stagnant indoor environments)
- Here are the list of the indoor plants which acts as a natural air purifier that one can try with indoor area to remove toxins and improve air quality. The variety of indoor plants are i) Snake Plant, ii) Spider Plant, iii) Aloe Vera, iv) Money Plant (Devil IVY), v) Bosten Fern, vi) Chrysanthemum and vii) Kimberly Queen Fern

Fig.9: Indoor Plants and Green Coverage in the College Campus

A SYNOPSIS OF ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

10. AUDIT SUMMARY & CONCLUSION

Save Energy: Save Future Generation....

SUMMARY OF THE AUDIT PROCESS:

In order to make the **KONGU ARTS AND SCIENCE COLLEGE** campus 100 % energy efficient; Environmental sustainability and lush Greenery; the audit team recommends to implement the following measures:

I. Energy Conservation & Management - Electrical Energy:

- Monitor the health of the APFC & FC. Fine tune reactive power based on the load condition
- At present, the solar PV system (90 kW) contributes nearly 18-20% of the annual electricity consumption which is more than the Solar Purchase Obligations (SPO) as the Tamil Nadu Solar Policy-2019. However, in order to make greener energy & environment; the management may try to install another 50 kW roof top plant and reduce the dependency of EB utility power. However; it is optimized to design the power capacity of the solar plant based on the day time consumption
- Recommended to convert the existing EB meter into Bi-direction meter (Net metering) and allow the excess power (during low load condition) to be exported to the utility grid. This option is now available to all types of consumers. Rectify the hurdles and work on this plan
- Calculate the payback period of solar PV system. Compare with the recommended payback by the system integrator. Determine the possible reasons and take necessary actions if it deviates. Discuss with the OEM for better return on investment
- Regularly clean the solar PV panel as per the prepared schedule and improve the power generation
- Optimize the STP blower operation and conserve the energy
- Check the belt tension and slippage by measuring the speed at regular intervals
- In a phased manner, ceiling fans must be changed from conventional fans into BLDC fans. Also change FTL into LED with adequate illumination levels
- Implement Energy Management System (EMS) to accurately measure & monitor energy flow
- Prepare a policy plan to convert the distributed UPS layout into centralized UPS and save energy. This step also saves the maintenance time due to reduction in number of batteries
- Implement automatic street light controller to turn on and off based on different time in a day. Use astrological timer for better results and energy savings
- Diesel flow meter must be fitted with each DG and calculate the UPL accurately
- Prepare suitable formats for all energy consumption and regularly follow the records. At regular intervals; 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, and Boiler, iv) Water quality assessment (for all type of water utilized) and v) Indoor and ambient air quality study

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II. Energy Conservation & Management - Thermal Energy:

- Regularly clean the stove burners and ensure that the flame should be in light bluish colour
- Use TCC painting on hot surfaces and reduce the exposed energy
- Try with radiant burner in dosa making machines and save energy. This provides more convenience to the human working on the stove (reduction of exposure to heat radiation)
- In future; plan to replace the existing Vapour Off Take (VoT) LPG layout into Liquid Off Take (LoT) system which saves good amount of LPG by reducing the left over LPG in the cylinder
- Efficiency of the boiler can be improved by regularly adopting the blow down process
- Blow down has to be done daily; so that the conductivity of the water increases (since it reduces the hardness of the water) which improves the heating efficiency. Daily blow down has following advantages:
    - Reduced operating costs (less feed water consumption, chemical treatment, and higher heating efficiency).
    - Reduced maintenance and repair costs (minimized carryover and deposits).
    - Cleaner and more efficient steam.
- Replace the conventional insulated (ceramic wool) steam pipes into vacuum insulated pipes. The steam loss in the convention insulated pipe is 50 W/m where as in vacuum insulated pipe; it is 15 W/m (reduced heat loss)

III. Water Conservation & Management:

- Utilize more amount of treated water from STP plant since most of the approving agencies like AICTE, UGC etc., are now requesting to utilize the treated water
- To check the quantity the amount of water utilized by each buildings by connecting digital water flow meter and optimize the water usage
- Similar to raw water measurement; water inlet to the STP & treated STP water pipe line must be fitted with flow meter and check the exact quantity of inlet and outlet
- Prepare and maintain a Single Line Diagram (SLD) for water distribution network
- Try to reduce water tapped from the ground water source since it is not environmental friendly
- Paste water and energy saving slogans at appropriate places
- Generate your own power and water for regular activities and move towards Net Zero Energy and Net Zero Water Building
- Retrofit aerator based water taps for good water savings. For hand washing applications, all the pipes must be fitted with aerators
- In future; install Bio-Sewage Treatment Plant as it reduces the amount of energy required to operate the plant and environmental friendly operation
- Capture almost 100 % rain water harvesting through i) Recharging pits and ii) Open well type storage pits

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- Properly follow scientific method of handling chemicals/Acids/Salts and safe disposal through 3rd party
- Water treatment log must be maintained indicating the water inlet, treated and outlet water quantity
- Install sensor based water controller in each Over Head Tanks and reduce the water waste and power required to operate the pump
- Energy required to process the water treatment must be calculated
- Overall cost of treated water by accounting i) consumables, ii) manpower iii) energy and iv) other conventional expenses
- Also it is highly recommended to use the treated STP water for toilet flushing system as this is much essential for the AICTE, UGC norms of treated water usage
- Display the specifications of the STP (Like RWH display)
- Use the treated water at the maximum in whatever possible areas and try to minimize the fresh water intake (from any source)
- Set a policy and fix a target for usage of treated water; ensure that the plan is being executed without any deviation. Increase the % of usage of treated water year by year.
- With the advent of smart technologies, it is possible to have centralized monitoring in real-time using Internet of Things (IoT), Geographic Information System (GIS) software, etc. as per **Jal Jeevan Mission,** Department of Drinking Water & Sanitation Ministry of Jal Shakti.
- In hostel building; try to introduce **"Emergency Water Line"** during day time (usually from 9.00 AM t0 4.00 PM). The gate valve of the common line is closed during that time and hence water wastage is avoided in the knowingly or unknowingly opened taps
- Introduce **Power Wash** floor cleaning mechanism which removes the stains easily with reduced water usage
- Awareness campus 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 faculty members

IV. Waste Management:

- Cotton, Syringe, Needles are to be kept separately as these are treated as Bio-Medical wastes
- **Yellow dust bins** must be placed to collect these bio-medical wastes.
- After COVID; mask, sanitizer bottles, gloves and other medical items must be trashed only through the yellow bins
- This must be informed to all the students and stakeholders. Suitable steps have to be taken to disseminate this information
- All the solid wastes are to be properly stored in a separate place and should be maintained as a record mentioning its quantity
- Fix flow meter in bio-gas output and continuously measure the gas output

- The food waste must be weighted and marked in a record before keeping into the digester unit. This must be checked with the amount of gas generated using suitable calculation and check with the designed output
- Any waste items given to trust office or to the 3rd party must have a record of the respective department.
- **Reduction of Paper:** Workout a policy to move towards paperless office. Present system of paper usage may be reviewed and wherever possible; digitalize the activities and reduce the paper
- Use bar code scanning to identify the location, row and seat number of a candidates during examination and avoid paper information pasted in the notice board.
- Publish the internal marks, model examination marks through student ERP
- Make attendance report, feedback, payments, salary slip in digital platform and if necessary take prints (only office copy)
- Adopt College Management System (CMS) and try to automate
- Automation saves energy, saves man power, saves paper, leads to better transparency, efficient man power utilization and thus saves cost

V. Impart Training to Faculty and Technical Staffs:

- **Energy Conservation and Management**
- **Environmental impact and assessment**
- **Fire and Safety (Operation and Handling)**
- **Electrical maintenance, AC, Battery Maintenance & Safety**
- **Emergency Preparedness**
- **E-Waste, Chemicals Handling & Solid Waste Management**
- **Training for Transport employees** (Improvement in fuel economy, reduce accidents, vehicle cleanliness, 100 % attendance, student friendly approach and overall maintenance of the vehicle)
- **Training for Faculty and Students on Vehicle Operation** (Preferably by PCRA or any other authorised service providers)
- **Training for Kitchen Employees** (LPG savings, improvement in productivity, equipment operation and best practices to be followed)
- **General Medical Camps for Employees**
- **Training on Stress management and Yoga**

VI. Way Forward towards Energy & Environmental Sustainability:

- Prepare an exclusive **Energy and Environment Policy** based on the energy and environment practices followed in the campus. This must reflect the i) Present energy consumption & generation, ii) Projection of energy need, iii) Commitment by the college to conserve energy (in terms of percentage), iv) Road map to achieve the commitment, v) Facilities needed to achieve the same, vi) Roles and responsibilities of all stake holders, vii) Internal and final review mechanism, viii) Corrective measures, ix) Time lines

from the committed value and ix) Benchmarking, Case study preparation, Knowledge sharing and rewards

- 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)
- Practice appropriate ISO standards for System Management. The audit team highly recommend to follow i) ISO-9001 (Quality Management System), ISO-14001 (Environmental Management System) and ISO-50001 (Energy Management System)
- Working towards Net Zero Energy and Net Zero Water Campus and achieve **Platinum rated Global Leadership campus (as per IGBC rating)** and/or **5-star rated campus** (as per GRIHA rating) and/or **GEM-5 rated campus** (as per ASSOCHEM GEM rating)

COMPLETION OF THE REPORT

This synopsis report is prepared as a part of the Energy, Environment and Green Audit process conducted at **KONGU ARTS AND SCIENCE COLLEGE (AUTONOMOUS),** Nanjanapuram, Erode – 638 107, Tamil Nadu, India by **RAM KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING,** Coimbatore – 641 062.

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ANNEXURE:

AUTHORISED CERTIFICATES OF THE AUDITOR

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Reg No.: EA-27299

Certificate No.: 9645/19

National Productivity Council

(National Certifying Agency)

PROVISIONAL CERTIFICATE

This is to certify that Mr./ Mrs./ Ms. SIVARASU SULUR RATHINAVELU

son / daughter of Mr. P RATHINAVELU *has passed the National certification Examination for Energy Auditors held in September 2018, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India. He / She is qualified as* ***Certified Energy Manager*** *as well as* ***Certified Energy Auditor.***

He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for Accredited Energy Auditor and issuance of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.

This certificate is valid till the Bureau of Energy Efficiency issues an official certificate.

Digitally Signed by K V R RAJU
Mon Apr 22 16:12:43 IST 2019
Controller of Examination, NPC AIP Chennai

Place : Chennai, India
Date : 22nd April, 2019

Controller of Examination

TÜV NORD

ISO 14001:2015 Lead Auditor
(Environmental Management Systems)
Training course

It is hereby certified that

Dr. S. R. Sivarasu

has successfully completed the above mentioned course and examination

08th - 12th December 2017

Coimbatore, India

Certificate No. 3521 3902 02

Delegate No. 71988

for TÜV NORD CERT GmbH

Essen, 2018-01-11

Course 18128 is certified by CQI/IRCA and meets the training requirements for those seeking certification under the IRCA EMS auditor certification scheme

TÜV NORD CERT GmbH Langemarckstraße 20 45141 Essen

CQI | IRCA CERTIFICATED COURSE

CQI | IRCA APPROVED TRAINING PARTNER

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IGBC

CII
Confederation of Indian Industry

The Indian Green Building Council

hereby certifies that

Sivarasu S R

has successfully demonstrated knowledge on the Green Building Design & Construction, Building Standards & Codes, IGBC Resources & Processes and Green Design Strategies & their Impacts, required to be awarded the title of

IGBC Accredited Professional

K S Venkatagiri
Executive Director
CII-Godrej GBC

V Suresh
Chairman
Indian Green Building Council

Gurmit Singh Arora
Vice Chairman
Indian Green Building Council

200239

20 June 2020

GRIHA

GREEN RATING FOR INTEGRATED HABITAT ASSESSMENT

GRIHA CERTIFIED PROFESSIONAL CERTIFICATE

This is to certify that

Sivarasu sr

has qualified as a **GRIHA** Certified Professional For V. 2015

Date of issue: 16th September 2020

This certification is valid only for GRIHA version 2015.

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Chief Executive Officer
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