ENERGY, ENVIRONMENT & GREEN AUDIT REPORT: FOLLOW UP REPORT

DETAILS OF THE CLIENT

P. A. COLLEGE OF ENGINEERING AND TECHNOLOGY

(AUTONOMOUS)

SH 19, Puliyampatti, Pollachi, Tamil Nadu 642 002, India

DATE OF AUDIT

06 JUNE 2022

(Audited and Accounted for the period of June-2021 to May-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 **P.A. COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS),** Pollachi, Tamil Nadu 642 002, India for providing an opportunity to conduct a **Follow-up Energy, Environment and Green Audit** process for the college premises.

It is our great pleasure which must be recorded here that the management of **P.A. COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS)** 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 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 and office members who were directly and indirectly involved with us during collection of data and conducting field measurements.

Management Team Members	
Dr. P. APPUKUTTY	Chairman
Dr. LAKSHMI APPUKUTTY	Vice-Chairperson
Mrs. A. POONGOTHAI ARULRAMESH	Secretary
Mr. N. ARULRAMESH	CEO
Dr. T. MANIGANDAN	Principal

Audit Team Member	
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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1. INTRODUCTION TO

ENERGY-ENVIRONMENT-GREEN AUDIT

1.1: Preface about the Institution:

→ **Arul Jothi Charitable Educational trust** is a public Charitable Educational trust established in the year 2005 with an objective to achieve **"Higher Education to All"** by running various educational institutions and program for the welfare of the society. The **P. A. College of Engineering and Technology** has been successfully functioning since 2008 in the cluster of Educational institutions run by Arul Jothi Charitable trust for which **Dr. Thiru P. Appukutty** is the Chairman of long standing experience for 34 years in Technical Education.

→ **P.A. College of Engineering and Technology (PACET)** is located in serene surrounding amidst the cluster of coconut groves on the state Highway (SH-19) about 2 Km from Pollachi which is situated at the foot hills of Anaimalai and Valparai hills. Pollachi town is 40 Km from the south of Coimbatore. Pollachi is a leading commercial centre having a big market for agricultural products. Tender coconuts, coconuts, coconut oil and other by-products are being transported to all parts of the country and exported all over the world. PACET is in the reach of about 40 minute's drive from Coimbatore airport or railway station and one hour from Tirupur. The college enjoys a congenial atmosphere essential for a cozy and vibrant scholastic learning process.

→ **PACET** provides engineering education for Life. The beautiful and spacious buildings have been designed well by the chairman – renowned civil engineer- with architectural marvels of various blocks accommodating the needs of administration computer centre, academic block, lecture halls, library, laboratories, conference halls, hostel and students common rooms. In PACET students are given every opportunity to gain optimal advantage in terms of advanced technical knowledge, skills and research by intrinsic motivation through special training modules. The approach offers distinct aspects of intellectual growth and development of individual students as future engineers to suit the growing needs and aspirations of the nation in future. The campus also has a clinic to attend emergency and to check the general health of students. The college has provided bus transport facilities covering the nearby parts of Tirupur and Coimbatore districts.

1.2: Vision:

✓ "To progress to become a center of excellence in Engineering and Technology through creative and innovative practices in teaching-learning and promoting research and development to produce globally competitive and employable professionals who are psychologically strong and emotionally balanced with social perception and professional ethics."

1.3: Mission Statement:

➢ "To offer academic programmes in the emerging areas of Engineering and Technology, provide training and research facilities and opportunities to promote student and faculty research in collaboration with Industry and Government for sustainable growth."

1.4: Quality Policy:

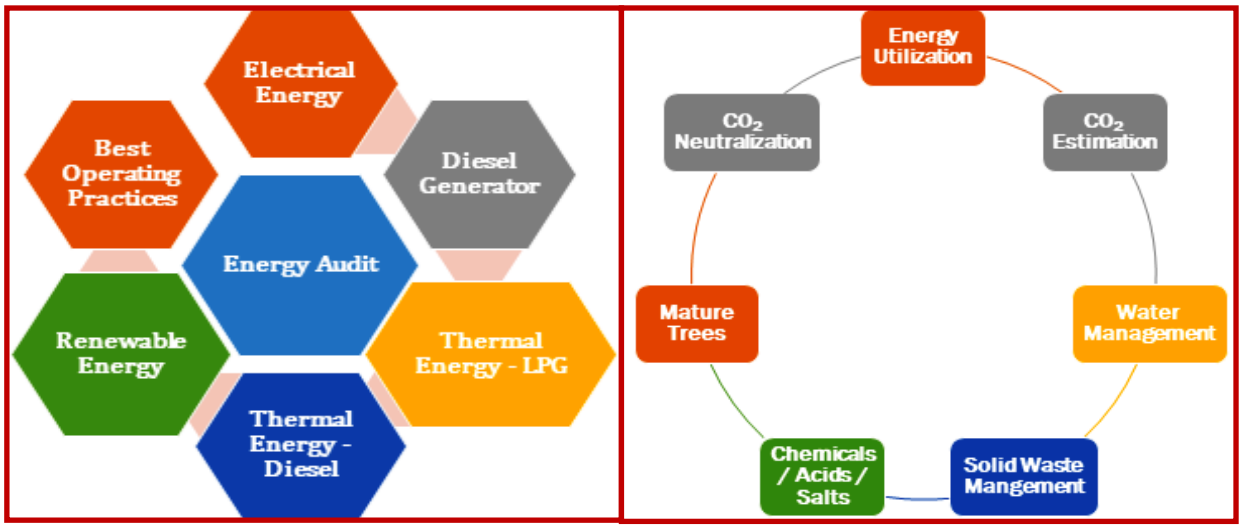
❖ The College strives providing World Class, Holistic Engineering Technology and Management Education of Highest Quality particularly to Rural Students stressing on the understanding of Societal and National Commitments.

1.5: Major Activities in the Institution:

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).
- **Environmental Audit:** Identification of history of activities, present environmental practices followed, monitoring records and known sources of environmental issues inside the college.
- **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_2 due to green energy system and identification of possible implementation and enhancement of current greenery practices.

1.7: Coverage in Energy, Environment & Green Audit Process:



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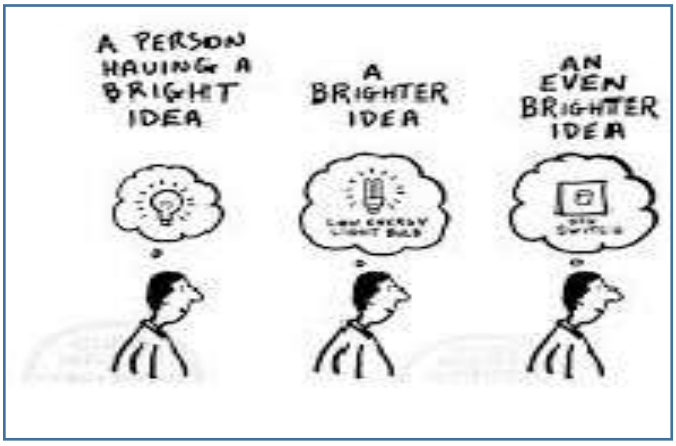
2. EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

Electrical and Thermal Energy Analysis:

A follow-up audit was conducted in **P.A. COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS),** Pollachi, Tamil Nadu 642 002, India; the summary of all the ENCONs are given below:

Summary of Energy Conversion (ENCON) Proposals		
S. No.	**Description**	**Parameters**
1.	Present Annual Energy Consumption	1,15,723 kWh + 2,090 kg of LPG
2.	**Proposed % of Energy Savings**	**5.0 % Electrical + 10.0 % LPG**
3.	**Proposed Annual Energy Savings**	**5,786 kWh + 209 kg of LPG**
4.	**Proposed Financial Savings**	**0.7 Lakhs**
5.	Initial Investment Required	1.2 Lakhs
6.	Simple Payback Period	Nearly 1.7 Years

Equipment's/Systems Audited:

Electrical System	**Thermal System**
• All major Electrical Equipment's	• Inverter, UPS and Battery System
• Electrical Distribution System	• Diesel generator, Pumps and Motors
• Lightings, Fans & AC System	• Energy Efficiency in Application
• Roof top solar Thermal System	• LPG for cooking application

Note:

- Audited and Accounted from June-2021 to May-2022

Audit Conducted and Verified by,

(Dr. S.R. SIVARASU)

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3. STUDY ON ENERGY CONSUMPTION & GENERATION PATTERN

3.1: Energy Consumption Pattern (Electrical and Thermal):

S. No.	Description	Details	
Electrical Energy (Consumption & Generation)			
1.	Name of the customer (As per the utility bill)	**M/s. ARULJOTHI CHARITABLE TRUST (P.A COLLAGE OF ENGINEERING TECHNOLOGY)**	
2.	Type of Utility Supply, Service No.& Tariff	LT SC. No: : 03-390-006-1066; 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) + 20 kW Roof Top Solar PV Plant	
5.	Permitted Demand (PD)	**111.5 kW**	
6.	Details of Diesel Generator (DG)	125 kVA–**1 No.** Air-cooling. Internal fuel tank & separate earthing done	
Annual Electrical Energy Consumption & Generation (kWh)			
TANGEDCO	**Solar PV Plant**	**DG**	**Total**
1,15,723	935	36,000	1,52,658
Thermal Energy (Consumption)			
7.	Types of Thermal Energy Used	Liquefied Petroleum Gas (LPG)	Cooking
		Diesel (Ordinary)	Transport + DG
Annual Thermal Energy Consumption & Generation (kWh)			
LPG	**Diesel (DG)**	**Diesel (Transport)**	
2,090 kg	7,200 Litres	7,477 Litres	
General Loads (Both Electrical and Thermal)			
8.	Lighting System	**Indoor lighting**: Conversion of Florescent Tube Light (FTL) into LED in a phased manner	
		Outdoor lighting: Solar street lighting with LED fittings.	
9.	Fan Loads (Ceiling)	• All the ceiling fans are conventional ones.	
10.	HVAC System	• Unitary air conditioning system is provided 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^{0}C as room temperature as per BEE norms.
11.	Motors and Pump loads	• Mainly used for water distribution, purification, waste water treatment. • Small motors used in kitchen equipment's.
12.	Uninterrupted Power System (UPS)	• All the computers, server, surveillance system, projectors, telephonic units are connected with UPS with nominal back up time of **15-30 min.** • Total of **195 kVA** with **230 Nos** of battery

Table-2: Annual Consumption of Electrical & Thermal Energy Parameters (2021-22)

S. No.	Month	Units Consumed (kWh)	Energy Generated (kWh)		LPG Consumed[1] (kg)	Diesel Consumed (Litres)	
			DG	Solar PV Plant		DG [2]	Transport
1.	Jun-21	11,482	3,000	78	0	600	0
2.	Jul-21	7,518	3,000	78	0	600	0
3.	Aug-21	7,612	3,000	75	0	600	0
4.	Sep-21	9,258	3,000	76	0	600	0
5.	Oct-21	7,853	3,000	78	0	600	0
6.	Nov-21	7,824	3,000	78	570	600	0
7.	Dec-21	9,362	3,000	79	0	600	0
8.	Jan-22	5,994	3,000	78	0	600	0
9.	Feb-22	10,003	3,000	78	0	600	0
10.	Mar-22	14,326	3,000	79	342	600	0
11.	Apr-22	11,761	3,000	79	456	600	4,069
12.	May-22	127,30	3,000	79	722	600	3,408
Average		9,643.6	3,000.0	77.9	174.2	600.0	623.1
Total		1,15,723	36,000.0	935.0	2,090.0	7,200.0	7,477.0

- [1] 19 kg of commercial cylinders are used
- [2] Normal diesel used (not HSD)
- The cost of electricity is Rs.7.91/kWh.
- The cost of the LPG is Rs. 119.9 /kg.

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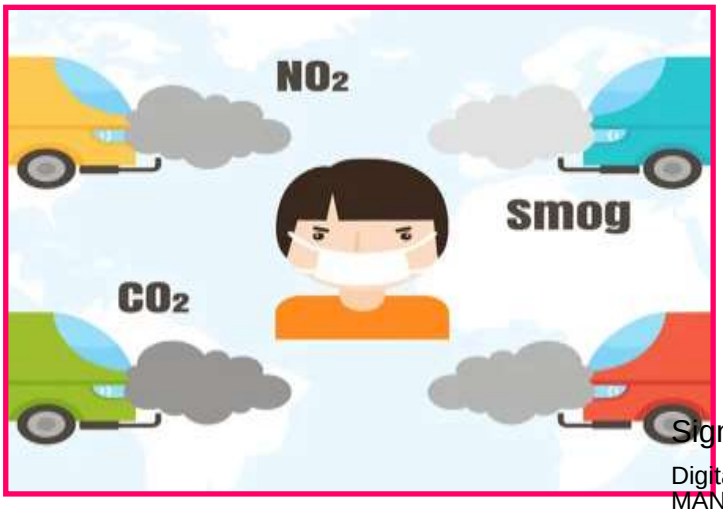
4. ESTIMATION OF

CO_2 EMISSION AND NEUTRALIZATION

(ELECTRICITY, DIESEL, LPG, SOLAR PV & MATURE TREE)



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 (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	Used only for cooking	
4.	Roof Top Solar PV Plant	20 kW connected to main building SSB feeding power generation	
5.	Mature Trees	The college has nearly **516** mature trees of different varieties which are more than 10 years old.	

4.2: Environmental System: CO_2 Balance Sheet (2021-22):

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 (2021-22)

S. No.	Annual Energy Consumption & CO_2 Emission (Tons/Annum)			Annual CO_2 Neutralization (Tons/Annum)		
	Description	Energy Usage	CO_2 Emission	Description	Energy Usage	CO_2 Neutralized
1.	Diesel	14,677 Litres	38.7	Solar PV	935 kWh	0.8
2.	Electrical Energy	1,15,723 kWh	94.9			
3.	LPG	2,090 kg	6.3	Mature Trees	516 Nos	11.2
4.	Total Emission		139.9	Total-Neutralized		20.0
Balance CO_2 to be Neutralized = 127.9 Tons/Annum						

4.3: Calculation Table:

For Electricity $= \left[\text{kWh x } \frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}\right]$
For Diesel $= \left[\text{Diesel Consumption (Litre)x } \frac{2.64 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}\right]$
For LPG $= \left[\text{LPG Consumption (kg)x } \frac{3.0 \text{ kg of CO2 emission}}{\text{kg of LPG Consumption}}\right]$
A matured tree can 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 $\frac{(21.8\ x\ 516\ )}{1{,}000} = 11.2\ \frac{\text{Tons}}{\text{Annum}}$

4.4: References:

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

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

5. RECOMMENDATIONS

5.1: Recommendations: Way Forward towards Energy & Environmental Sustainability:

- For internal transportation; try to use Electric Vehicle; since it reduces the local pollution
- In future, for any new building establishment; try to use High Volume Low Speed (HVLS) fans. These fans are more energy efficient and provides good air delivery.
- In order to reduce the water consumption; try to install vessel cleaning machine (in hostel and mess). This step also provides less detergent and good hygiene environment.
- Measure the building wise energy and water consumption and prepare a comprehensive plan to reduce the parameter without affecting the comfort level.
- **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
- The college is now established a MoU with a third party to dispose the solid and E-waste generated inside the college campus safely. It is a welcome step and must be continued.
- 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 need to achieve the same, vi) Roles and responsibilities of all stake holders, vii) Interim and final review mechanism, viii) Corrective measures if the results deviates from the committed value and ix) Benchmarking, Case study preparation, Knowledge sharing and rewards.
- 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 report is prepared as a part of the **Follow-up Energy, Environment and Green Audit** process conducted at **P.A. COLLEGE OF ENGINEERING AND TECHNOLOGY (AUTONOMOUS),** Pollachi, Tamil Nadu 642 002, India **RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING,** Coimbatore – 641 062.

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