CRITERIA NO :7 **INSTITUTIONAL VALUES AND SOCIAL RESPONSIBILITIES**

METRIC NO. 7.1.10 **QUALITY AUDITS ON ENVIRONMENT AND ENERGY ARE REGULARLY UNDERTAKEN BY THE INSTITUTION**

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GREEN AUDIT REPORT

A SYNOPSIS OF

GREEN AUDIT REPORT

(Covering Energy, Environment & Campus Greenery)

Details of the Client

M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

PERIOD OF AUDIT

10 MARCH 2020

(Audited and Accounted from March-2019 to Feb-2020)

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

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GREEN AUDIT REPORT

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M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

1. ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING (RK-CECT), Coimbatore – 641 062 is thankful to the Management, Faculty and Technical team members of **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET),** Kinathukadavu, Coimbatore, Tamilnadu, India - 642 109 for providing an opportunity to conduct a detailed Green Audit (Including Energy, Environment and Campus Greenery) for college promises.

It is our great pleasure which must be recorded here that the management of **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET)** 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 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	
Shri. A. NAGARASAN	Managing Trustee, ACET
Shri. T. SUBRAMANIYAN	Chairman, ACET
Shri. K. PAVITHRAN	Secretary, ACET

Audit Team Member	
Dr. S.R. SIVARASU	**BEE Certified Energy Auditor (EA-27299)** Lead Auditor-ISO-14001:2015 (EMS), IGBC AP, GRIHA CP Managing Partner: RK-CECT, Email: ramkalamcect@gmail.com **Mobile: +91- 80567 19372, 99420 29372**
Shri. B. SATHISH	Audit Associate, RK-CECT

A SYNOPSIS OF

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Details of the Client

M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

2. INTRODUCTION

TO

ENERGY-ENVIRONMENT-GREEN AUDIT PROCESS

2.1: Preface about the Institution:

M/s. Akshaya College of Engineering Technology (ACET) was established by Akshaya Charitable Trust in the year 2009. The Trust was founded by professionals with more than 25 years of industrial experience to impart quality technical education and ethical as well as societal values to the students. The institution offers five UG and three PG programmes. The institution has earned acclaim for its excellent infra-structure, well equipped laboratories and highly qualified dedicated faculty members. **The institution is recognized under section 2(f) of the UGC Act 1956. It is an ISO 9001:2015 Certified Institution.** Within a decade of its existence, the institution has earned laurels for its academic, placement, sports and co-curricular achievements. Institution of Engineers (India) has granted Life Membership to our Institution under the code IM000623-5. ACET is now offering Under Graduate (UG), PG and Ph.D Programmes namely;

UG Programme	PG Programme
• Civil Engineering	• Structural Engineering
• Computer Science and Engineering	• VLSI Design
• Electronics & Communication Engineering	• Computer Science and Engineering
• Mechanical Engineering	**Research Programme**
• Mechatronics Engineering	• Electronics & Communication Engineering

2.2: Vision Statement:

- To develop into a premier institution for disseminating high quality technical education by establishing best practices in teaching, learning and research, capable of making significant contribution to individual and societal empowerment.

2.3: Mission Statement:

- To achieve academic diligence through effective teaching-learning process.
- To foster cooperation between industry and academia.
- To prepare the graduates for lifelong learning by adopting ethical and responsible engineering practices.
- To encourage entrepreneurship and develop sustainable technologies for the benefit of global society.
- To establish State-of-the-art facilities and techniques to facilitate quality education.

2.4: Mission Statement:

- Akshaya is committed to provide quality education and inculcate ethical values in students and faculty to achieve Global Standards in Academics and Research through self-evaluation and continuous improvement.

2.5: Major Activities in the Institution:

2.6: Foreword about Energy-Environment-Campus Greenery Audit Activity:

- Energy-Environment-Green audit is an inspection survey and is a major tool for analysing the present utilization of all types of energy, assessment of environmental condition and development of Campus greenery mapping with CO_2 emission.
- The primary objective of the green audit is to reduce the amount of energy utilization, reduction of water consumption, improve the green coverage without negatively affecting the productivity or comfort level.
- The vision of the green audit with a focus on energy consumption to assess the viability to upgrade the energy efficiency measures prior to investing extensive resources in electrical and thermal energy systems.

2.7: Scope of the Audit:

- Detailed audit process in the college campus with a main focus to identify judicious usage of energy and sustainable environment.
- Identification of possible reduction of present energy consumption and thereby reduce the Carbon foot print. Also ensures to focus on Green energy generation in the college campus.
- Best practices to be followed in energy conservation, environmental management, recommended safety measures and continuous energy monitoring system.
- Providing constant awareness for both faculty and students in Energy, Environment and Ecology.

2.8: Outcomes of the Audit Process:

- Recommendations based on objective and subjective measurements with achievable **En**ergy **Con**servation (ENCON) proposals with Low cost and Cost investments.

- Minimization of present energy cost by adjusting and optimizing energy usage and reduction of energy wastage without affecting the regular activities.
- Development of rule based system for safety measures to be followed and formation of best practicing guidelines for major energy consuming system.
- Providing a pathway to become a sustainable environment inside the college campus and nurture the importance of less energy with more productivity.
- Formation of methodology for long term road map for maintaining green environment within the campus and encourage the stakeholders for continuous improvements.

2.9: Period of Audit:

2.10: Coverage in Green Audit Process:

2.11: Standards Adopted:

- BEE – Bureau of Energy Efficiency – Guidelines to conduct the Energy Audit.
- The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard (Revised Edition) released by World Resources Institute & World Business Council for Sustainable Development – 2014.
- ISHRAE-10001:2016 – Indoor Environmental Quality Standard, Ist Version: 2016-17.
- IS-3646-Part-1 - Recommended Values of Illuminance as per National Building Code (NBC): 2005.

2.12: Audit Schedule:

S. No.	Activity	Focused Area and Location of Audit
1.	Introduction Meetings	Meeting with core committee members
2.	Electrical Energy	Assessment on Power House, APFC/Fixed capacitors, Switch rooms, Electrical distribution boards, Diesel generator, Diesel Storage of diesel
3.	Solar PV System (Renewable)	Assessment on PV System, Mounting, Orientation, Cleaning schedule, Integration at MV panel, AJB, AC distribution and Inverter systems
4.	Water Pumping System	Water storage, Pumps location, Water distribution, Dimensions of sump, tank and well capacity.
5.	Water Distribution System	Assessment on water distribution, Water inlet & outlet and Layout analysis, RO plant
6.	Sewage Treatment Plant (STP)	Collection of waste water, Main tank storage, Chemical dosing, Water agitator and separation, Treated water outlet and distribution and Treatment/usage of sludge.
7.	HVAC System	Assessment on indoor and outdoor units, Capacity/Star rating, Make & Model, Gas used, Assessment on maintenance record.
8.	Un-interrupted Power Supply (UPS)	Assessment on capacity, Location, Condition monitoring of battery voltage and UPS earthing.
9.	Interior Lighting System	Assessment on both Interior and Exterior lighting used in college and other areas.
10.	Green Coverage	Assessment on matured trees, location/coverage, Flowing shrubs and bushes.
11.	Transport System	Assessment of total no. of vehicles, Fuel used, Fitness certification and Assessment of pollution certificates
12.	Hostel Cooking System	Assessment on Boiler and allied system, Feed water, Fuel usage, Steam consumption, and Ash removal.
		Consumption of LPG, Gas yard with distribution system and Safety precautions.
13.	Closing Meeting	Concluding meeting with faculty representatives at conference hall

2.13: List of Faculty Members Involved in Audit Process & Data Collection:

S. No.	Faculty Details	Contribution
1.	**Dr. S. KAPILAN** HoD/Department of Civil Engineering & PRO, ACET	Collection of Transport Details
2.	**Shri. S. JEEVANANDHAM** Assistant Professor, Department of CSE, ACET	
3.	**Shri. P.A. EDWIN FERNANDO** Assistant Professor, Department of Civil Engineering, ACET	Green Audit Facilitator
4.	**Smt. NIRMALA** Head of the Department, S&H, ACET	Collection of Chemicals / Acids / Salts
5.	**Smt. D. GUNAPRIYA** HoD/Department of EEE, ACET	Collection of electrical energy consumption, Diesel consumption for DG, List of Lightings and Fans, Collection of E-waste data, Fire extinguishers, Water pumping Water distribution system
6.	**Shri. R. MANOHARAN** System Admin, ACET	
7.	**Shri. K. SAKTHIVEL** Lab Assistant, Department of EEE, ACET	
8.	**Shri. B. SHANMUGHAM** Electrician & Plumber, ACET	
9.	**Shri. K. ANANDAN** Supervisor, Maintenance, ACET	Collection of LPG Consumption for cooking application, Water Taps, Basin and Distribution

2.14: List of Measuring Equipment's used:

S. No.	Name of the Equipment	Model/Range
1.	Power Quality Analyser (Three Phase)	Fluke 434 –Series II
2.	Power Quality Analyser (Single Phase)	ALM-10
3.	Multifunction Electrical Installation Meter	Sonel-MPI 540
4.	Infrared (IR) Thermal Imager	Fluke TiS-20
5.	Digital Clamp & Multi Meter (True RMS)	Fluke – 317 & 115
6.	Digital Anemometer & Photo Tachometer (Laser)	Extech-AN-100 & Extech-RPM-33
7.	Other general electrical/mechanical measuring instruments.	

A SYNOPSIS OF

GREEN AUDIT REPORT

Details of the Client

M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

3. EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

2.1: Electrical and LPG Energy Analysis:

After conducting a detailed audit in M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET), Kinathukadavu, Coimbatore, Tamilnadu, India-642 109; the audit team has come out with 8 Energy Conservation Proposals (ENCONs) and the summary of all the ENCONs are given below:

S. No.	Description	Parameters		
		Present	After	Savings
1.	Annual Energy Consumption (Electricity only)	2,40,980 kWh + 5,946 kg of LPG	1,49,933 kWh + 5,768 kg of LPG	91,047 kWh + 178 kg of LPG
2.	Annual Energy Cost	Rs. 23.7 Lakhs	Rs. 16.0 Lakhs	Rs. 7.7 Lakhs
3.	Initial Investment Required	–	Rs. 27.0 Lakhs	–
4.	Simple Payback Period	–	Nearly 3.5 Years	
5.	% Reduction of Energy Consumption	–	38 % of Electrical + 3 % of LPG	

3.2: Environmental Analysis (CO_2 Neutralization):

S. No.	Description		Type of Fuel and their CO_2 Conversion Process				
			Electricity	Diesel	Petrol	LPG	Wood
1.	Total Annual Consumption		2,40,980.2 KWh	63,411.8 Litre (Vehicle + DG)	2,241 Litre (Vehicle)	5,946.4 kg	39.8 kg
2.	CO_2 Emission (Tons/Annum)	A	197.6	167.4	5.4	17.8	59.7
3.	Total CO_2 Emission	B	447.9 Tons/Annum (↑)				
4.	No. of Matured Trees Available	D	458				
5.	CO_2 Neutralized due to Trees	E	10.0 Tons/Annum (↓)				
6.	CO_2 Neutralized due to SPV Plant	G	27.1 Tons/Annum (↓)				
7.	CO_2 Neutralized after implementing ENCON	I	75.0 Tons/Annum (↓)				
8.	Amount of CO_2 to be Neutralized (Final)	J	335.8 Tons/Annum				
9.	Per Capita CO_2 Emission (Considering Students +Staffs)		0.38 Tons / Person (↔)				

Apart from the Energy Conservation and Environmental analysis, the audit team proposes nearly 11 technical recommendations focusing on energy, water, environment, safety and best operating practices to be followed.

Audit Conduced & Complied by,

S.R. Sivarasu

Dr. S.R. SIVARASU

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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.)	Simple Payback Period	CO_2 Reduction (Tons/Annum)	Ref. Page. No.
			Annual Energy Savings (kWh)	Monetary Savings (Rs.)				
Zero Cost Investment								
1.	Increasing the Energy Production from the Roof Top SPV using regular Panel Cleaning Schedule	1 % (SPV)	1,270	10,541	Zero Cost	Immediate	1.0	19
Low Cost Investment (Less than 2.0 Lakhs)								
2.	Astronomical Timer Based Street Lighting Automation System	50 % (Street Light)	931	7,727	10,000	1.3 Years	0.8	21
3.	Reduction of Cable Losses and Active Power Consumption using PCC level Compensation	1% (Electrical)	2,410	20,003	17,500	0.9 Years	2.0	22
4.	Replacement of Existing UPS with Centralized UPS & reduction of E-Waste Management	2 % (UPS)	9,636	79,979	1,60,000	2.0 Years	7.9	24
Medium Cost Investment (2.0 Lakhs to 5 Lakhs)								
5.	Retrofit of AIRCON Energy Saver, AC House Keeping & Optimization of AC Operation	10 % (AC)	10,000	83,000	2,00,000	2.4 Years	8.2	27
6.	Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps)	50 % (Lamps)	12,480	1,03,584	1,78,000	1.7 Years	10.2	30
High Cost Investment (Above 5.0 Lakhs)								
7.	Performance Enhancement & Reduction of Energy in AC Circuits using Mist Pre-Cooler	10 % (AC)	23,800	1,97,540	6,90,000	3.5 Years	19.5	34
8.	Replacement of Existing Convention Ceiling Fans into EC-BLDC Fans	50 % (Fan)	30,520	2,53,316	14,35,000	5.7 Years	25.0	36
9.	Reduction of LPG Consumption using Regular Burner Cleaning and Burners Swapping	3 % (LPG)	178 kg	10,377	5,000	0.5 Years	0.3	38
Total			**91,047 kWh + 178 kg of LPG**	**Rs. 7,66,067**	**Rs. 26,95,500**	–	**75.0**	–

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PART-A

ENERGY AUDIT REPORT

4. ENERGY CONSERVATION PROPOSALS (ENCONs)

ENCON-1	Increasing the Energy Production from the Roof Top Solar Photovoltaic System using regular Panel Cleaning Schedule
Assessment Area	Energy generation from Roof Top Solar Photovoltaic System
Observations	• 94.08 kW roof top solar PV plant was installed in the IET academic block; generating electricity to feeding to MV panel (located back side of the mechanical block). • However; the solar panels must be cleaned at regular interval as the dust accumulation must reduce the expected power output and hence it is a loss of generation. • In general; a minimum of 1 % power generation may be improved by regularly cleaning the panels. Most of the bulk power generating solar PV plant has separate panel cleaning schedule (pipes, cleaning detergents and man power) to operate the same.
Recommendation (Target)	• It is highly recommend to clean the solar panel (ordinary water cleaning is enough) once in 15 days ensures a minimum1 % higher productivity for the same installed capacity. • Prepare a separate cleaning schedule; assign a team of members with higher degree of supervision. Ensure the power output before and after cleaning. Visually inspect the panels for any damage, cracks, stains and other abnormalities. • Even conduct an IR thermography study on the solar panels, solar DC and AC connectors, AJB and Inverter once in a year.

Energy & Financial Saving Calculation:

Parameters	Description	
Installed capacity of SPV Plant	130 kW (Grid Tied connected in MV Panel)	
Location	Roof Top of Academic Block	
Energy Calculation	**Before**	**After**
Expected % of Energy Saving	–	**1 % Improvement**
Expected Energy Generation	1,27,008 kWh	1,28,278 kWh
(Considering 94.08 kW x 4.5 sunshine hours/day x 300 days/annum)		
Annual Energy Saving	–	**1,270 kWh**
Annual Financial Saving	–	**Rs. 10,541 /-**
(1,270 kWh x Rs.8.30/kWh) = Rs. 10,541 /-		
Initial Investment	-	**Zero Cost**
Simple Payback	**–**	**Immediate**
CO_2 Reduction	**–**	**1.0 Tons/Annum**

ENCON-2	Astronomical Timer Based Street Lighting Automation System
Assessment Area	Street lighting automation for the entire campus
Observations	• The college now has nearly 47 no's of street lights (9 W CFL each and the total power capacity is around 0.43 kW) located throughout the entire campus. • All the lamps are controlled in two control switches and are operated mostly between 6.00 PM to 6.00 AM (12 hours/day) and this may vary depends on the season.
Recommendation (Target)	• For street lighting system, Astrological timer must be the best choice for lighting automation as this will definitely saves considerable amount of energy by preventing the lights to turn on during the availability of enough natural lighting. • Also it also recommended to automate the ON/OFF strategies of the lighting circuit based on the required like; all the lamps on during evening 6.00 PM to 8.00 PM and then alternate lamps will only in on condition up to 10.00 PM. (50 % reduction of energy for 2 hours of operation). • After 10.00 PM to early morning 6.00 AM; lamps located in the vulnerable places must be in ON condition. (Further 25 % reduction of energy for 8 hours)

Energy & Financial Saving Calculation:

Parameters	Description	
Total no. of street lights	47 No's of 9 W each	
Energy Calculation	**Before**	**After**
Expected % of Energy Saving	–	**50 %**
Expected Energy Generation	1,862 KWh	931 kWh
(5.1 kWh/day considered for all 365 days)		
Annual Energy Saving	–	**931 kWh**
Annual Financial Saving	–	**Rs. 7,727 /-**
Initial Investment	-	**Rs. 10,000 /=**
(Since ACET is an technical institution; this automatic circuit may be taken as a project and makes this ENCON at zero initial investment)		
Simple Payback	–	**1.3 Yeas**
CO_2 Reduction	–	**0.8 Tons/Annum**

ENCON-3	Reduction of Cable Losses and Active Power Consumption using Load End Capacitor Compensation (PCC Level)
Assessment Area	Electrical Distribution System
Observations	• LT electrical system from power house is distributed through various electrical distribution panel board conveniently located in each building (with a total of 5 distribution rooms) all over the college campus. • Supply side power factor is being maintained; whereas the load end PF is to be corrected by connecting suitable values of FC, mostly at the distribution panels.
Assessments	• In any electrical distribution network, the distribution losses may account for nearly 2 % and this can be reduced by i) Selecting proper cable size (class 1 or 2 cables) with reduced resistance and ii) Compensate the distribution losses by connecting load end capacitors at the load point and/or at DB level. • This method has many advantages like i) reduction of kVA demand (applicable for HT consumer), ii) reduction of distribution losses and iii) maintaining the terminal voltage from source to load end.
Recommendation (Target)	• Connect suitable value of FCs (Nearly 10 kVAr, 3-Phase, 440/400 V, Heavy Duty) at the PCC input and try to reduce the line loss.

Energy & Financial Saving Calculation:

Parameters	Description	
No. of DBs (Approx. Value)	5 No's. (at the entry of each block)	
kVAr required to connected	10 kVAr (3-Phase, 400 V, Heavy Duty FC with a total of 30 kVAr for all 3 DBs)	
Energy Calculation	**Before**	**After**
Expected % of Energy Saving	–	**1%**
Annual Energy Consumed	2,40,980 kWh	2,38,570 kWh
Annual Energy Saving	–	**2,410 kWh**
Annual Financial Saving	–	**Rs. 20,003 /-**
Initial Investment	-	**Rs. 17,500 /-**
(Heavy duty, box type capacitor cost around Rs.350/kVAr and for 10 kVAr; the initial cost is 3,500/-. Installing for 5 DBs; the overall initial investment is Rs. 17,500 /-		
Simple Payback	–	**0.9 Years**
CO_2 Reduction	–	**2.0 Tons/Annum**

ENCON-4	Replacement of Existing UPS with Centralized UPS and reduction of Battery based E-Waste Management
Assessment Area	Energy Conservation and E-Waste reduction in UPS System
Assessments	• The college has 9 no's of UPS with a total capacity of 167.5 kVA (with different individual power rating and back up capacity). • Each UPS operates at different loading factors (mostly with less than 50 %) and 128 no's of batteries of different Ah was connected in line. • All the UPS were used to supply i) computers in the department labs and ii) sophisticated equipment's.
Recommendation (Target)	• It is highly recommended to revamp and replace all the UPS into equivalent **2 no's of 50 kVA** centralized UPS powering all the entire loads. • New UPS system may be designed with 30 No's of 50 Ah (VRLA batteries) each and hence the total no. of batteries now is **60 no's.** • **Nearly 53 % of reduction of battery quantity achieved and hence reduces the E-waste.**

Energy and Financial Saving Calculation:

S. No.	Description	Parameters	
		Old System	New System
1.	Power rating of UPS	167.5 kVA/134 kW	2 x 50 kVA = 100 kVA/80 kW
(Mostly at 0.8 operating PF)			
2.	Self-power consumption at rated capacity of operation (kW)	2.7 kW	1.6 kW
3.	Energy Power Savings	–	1.1 kW
4.	Annual Energy savings (kWh)[2]	–	**9,636 kWh**
5.	Financial Savings	–	**Rs. 79,979 /-**
6.	Initial Investment	–	**Rs. 1,60,000 / -**
7.	Simple Payback Period	–	**Nearly 2.0 Years**
8.	CO_2 Reduction	–	**7.9 Tons/Annum**
9.	Total no. of batteries	128	**60 (53 % ↓)**

([1] – Assuming self-power loss as 2 % as standard.

[2] – Considering 8,760 running hours per annum)

ENCON-5	Retrofit of AIRCON Energy Saver, AC House Keeping and Optimization of Air Conditioning Operation
Assessment Area	Energy Conservation in Air Conditioning Systems having lesser value of EER & older installation (2010)
Observations	• There are about 25 No's of air conditioning units are available and are located in various places inside the college.
Assessments	• The running hour of each AC units differ and purely depends on the availability of the human beings in the respective rooms/laboratories. • The detailed list of AC available is shown in Table-3: indicating their star rating, tonnage and their power capacity.
Recommendation (Target)	• Install AIRCON energy saver gadget which works on dynamic un-saturation principle in conjunction with the sensor algorithms so that the air conditioners run hours are cut by 20 to 25 %.

Energy and Financial Saving Calculation:

Parameters	Description	
Proposed AIRCON fittings	25 No's	
Energy Calculation	**Before**	**After**
Power Consumption	50.1 kW	45.1 kW
(Power Consumption is based on $EER = \frac{3.516}{kw/_{Ton}}$ and assuming 80 % of loading condition)		
Expected Reduction of Power	–	5.0 kW
(AIRCON provides a minimum savings of 10 % from the present power consumption)		
(Considering 2,000 hours per annum)		
Annual Energy Savings	–	**10,000 kWh**
Annual Financial Saving	–	**Rs. 83,000 /-**
Initial Investment	-	**Rs. 2,00,000 /-**
(The Initial cost of the AIRCON unit is about Rs. 8,000 per piece)		
Simple Payback	–	**Nearly 2.4 Years**
CO_2 Reduction	–	**8.2 Tons/Annum**

ENCON-6	Performance Enhancement and Reduction of Energy Consumption in AC Compressor using Mist Pre-Cooler
Assessment Area	Energy Conservation in Air Conditioning Systems inside the Campus
Observations	• Mist pre-cooler is one successful retrofit system to be implemented to any of the AC outdoor units. Table-4 shows the list of Multi-variant Air Conditioning Available in the College Campus. • It saves the compressor running time (and also power) by reducing the condenser temperature and there by saves the life of the compressor.
Assessments	• Mist cooling is based on the concept of evaporative cooling. Evaporative cooling is the process of removing heat from the air by using water vapour. The misting system converts ordinary water into billions of micron sized water particles by using spray nozzles.
Recommendation (Target)	• It is recommended to install the mist cooling system in higher power and continuous running ACs & ascertain the performance. • Implement the mist pre-cooler system and coupling of water mist with condenser reduces the compressor power up to 25%. The application of water mist condenser, inlet air pre-cooling could decrease the Specific Energy Consumption (SEC).

Energy and Financial Saving Calculation:

Parameters	Description	
Proposed AIRCON fittings	69 No's	
Energy Calculation	**Before**	**After**
Power Consumption	119.4 kW	107.5 kW
(Power Consumption is based on $EER = \frac{3.516}{kW/Ton}$ and assuming 80 % of loading condition)		
Expected Reduction of Power	–	11.9 kW
(Mist cooler provides a minimum savings of 10 % from the present power consumption)		
(Considering 2,000 hours per annum)		
Annual Energy Savings	–	**23,800 kWh**
Annual Financial Saving	–	**Rs. 1,97,540 /-**
Initial Investment	-	**Rs. 6,90,000 /-**
(The Initial cost of the MIST cooler setup is about Rs. 10,000 per unit of installation)		
Simple Payback	–	**Nearly 3.5 Years**
CO_2 Reduction	–	**19.5 Tons/Annum**

ENCON-7	Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps)	
Assessment Area	Compact Fluorescent Lighting System located both in college and hostel area with magnetic/electronic choke fitting.	
Observations	College Area – Main Building (Including Class, Lab and Others) – Kindly refer the Annexure-I	FTL-40 W & 36 W lamps with other power capacity
Assessments	• The college is now replacing FTL into LED and this step must bring considerable amount of energy saving. • In general 40 W FTL consumes 44 W and 36 W FTL consumes 40 W including power consumption of the Choke. • In order to reduce the lighting bulb failures, it is necessary to supply a safe working voltage (say about 210 V) through a dedicated Servo Stabilizer (SS) connected at the output of the lighting DB.	
Recommendation (Target)	• College administration has to replace the FTL to LED (20 W with choke) of branded round LED tube fitting without Blue Tinge.	

Energy and Financial Saving Calculation:

Parameters	Description	
Total No. of FTL Available	FTL 40 W – 356 No's (44 W including choke) : 15.7 kW	
	FTL 36 W – 89 No's (40 W including choke) : 3.6 kW	
Considering only hostel (boys +girls) buildings with a total of 445 No's contributes 19.3 kW		
Power rating of new lamps	LED-18 W (One to One – 20 W including choke) with the total power consumption of (20 x 445) = 8.9 kW	
Approx. Operating Hours (Average assumed value)	**4 hours/day & 300 days/Annum = 1,200 Hours/Annum** (The actual operating hours may change depends on the applications)	
Energy Calculation	**Before**	**After**
Power Consumed (Approx.)	19.3 kW	8.9 kW
Expected Power Savings	–	10.4 kW
Annual Energy Saving	–	**12,480 kWh**
Annual Financial Saving	–	**Rs. 1,03,584 /-**
Initial Investment	-	**Rs. 1,78,000 /-**
(Considering Rs.400/Lamp fittings of branded LED Day Cool Light)		
Simple Payback	**–**	**Nearly 1.7 Years**
CO_2 Reduction	**–**	**10.2 Tons/Annum**

ENCON-8	Replacement of Existing Convention Ceiling Fans into Electronically Commutated BLDC Fans	
Assessment Area	Energy Conservation Ceiling fans located in the College Area	
Observations	College Area including all Building, Class, Lab and Other areas	1,100 No's (77 kW)
Assessments	• BLDC fans operate in less energy with same air delivery. Similarly these fans generates lesser noise, runs with inverter supply, remote control based speed control, Aesthetic look and better lifespan. • Conventional fans consume 1 unit of electricity for approximately 12-13 hours of running period, whereas the BLDC fans consume the same 1 unit of electricity for nearly 28-29 hours.	
Recommendation (Target)	• Recommended to replace the existing conventional fans into EC BLDC fans in a phased manner and ensure good energy saving.	

Energy and Financial Saving Calculation:

Parameters	Description	
Total No. of Fans available	Considering only college buildings with a total of 624 No's (Assuming 70 W power consumption for conventional fans)	
Approx. Operating Hours (Average assumed value)	4 hours/day & 350 days/Annum = 1,400 hours/annum (The actual operating hours may change depends on the applications)	
Energy Calculation	**Before**	**After**
Power Consumed (Approx.)	43.7 kW	21.8 kW
Expected Reduction of Power	–	21.8 kW (**50 % ↓**)
Annual Energy Saving	–	**30,520 kWh**
Annual Financial Saving	–	**Rs. 2,53,316 /-**
Initial Investment	-	Rs. 14.35 Lakhs
(Considering Rs.2,500/fan - Salvage value of Rs. 200/fan for old fan = Rs. 2,300/- per fan)		
Simple Payback	**–**	**Nearly 5.6 Years**
CO_2 Reduction	**–**	**25.0 Tons/Annum**

(Note: BLDC fans consume **less power when it operates at low speeds** which further saves energy. Further a conventional fan draws nearly about **100 VA**, whereas the EE fan draws only **30 VA.** This will be more beneficial for HT consumer as direct reduction of kVA rating).

ENCON-9	Reduction of LPG Consumption using Regular Burner Cleaning and Swapping of Active Burners.
Assessment Area	LPG Consumption (Cooking System in Hostel Mess)
Assessment	• Cooking system in the college mess mainly uses LPG as energy carrier and utilize Gas stoves as a medium to cook the food. • Gas stoves are easy to maintain. However, when the flow of gas gets blocked, the burner heads can't burn efficiently. • The best indicator for the efficiency of LPG system is the irregular flame patterns and yellow flames. • Formation of soot in both side of the burners, cleaning methods and interval improves the efficiency and reduce the LPG consumption.
Recommendation (Target)	• LPG commercial burners are made up of cast iron in which smoke formation is high and frequently able to crack due to aging. • It is recommended to clean the burner every week with solvent rinsed and gently clean the holes with ordinary fine cloth. Also it is highly encouraged to swap with active spare burners. The investment on spare burners are less expensive and let us make it a practice to swap the burner every week. • Also look for an alternative with Stainless Steel (SS) burners (slightly costlier compared with existing one). But the lifespan is longer and replace cost is much reduced.

Energy and Financial Saving Calculation:

Parameters	Description	
Swapping of new burners every week and cleaning of existing burner with natural ingredients (Ex: Dishwashing detergent, Non-abrasive scrub pad, Microfiber towels)		
Energy Calculation	**Before**	**After**
Expected Savings on LPG	**–**	**3 %**
(From overall LPG consumption; nearly 50 % consumption goes to burner based cooking)		
LPG Consumption/Annum	**5,946** [1]	**5,768 kg**
LPG Savings/Annum	–	**178 kg**
Equivalent to 9 no's of 19.6 kg cylinders with a financial savings of 178 kg x Rs.58.30/kg = **Rs. 10,377 / Annum**		
Initial Investment	-	**Rs. 5,000 /-**
However purchasing of cleaning ingredients for Rs. 5,000 with a payback of 0.50 Years		
CO_2 Reduction – 0.3 Tons/Annum		

([1]: 50 % is being accounted from overall LPG consumption of 5,946/annum)

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PART-B

ENVIRONMENTAL AUDIT REPORT

5. ANALYSIS OF WATER CONSUMPTION

5.1: Source of Water, Storage and Distribution:

Water is one of the main consumable in the college campus. ACET gets the fresh water from three sources namely i) Bore well ii) Outsourced water and iii) Rain Water Harvesting (RWH). Table-2 shows the source of water, location of storage along with their application.

Table-2: Source of Water, Location of Storage and Application

Type of Water	Source	Location of Storage	Application
Fresh Water	3 no's of pumps (Bore Water)	• In front of the hostel Building • Near Main Block • Near girls hostel	• Cooking • Utensil Cleaning • Bathing • Clothing washing
	17 no's of Rain Water Harvesting (RWH) pits are located throughout the entire college campus		
Treated Water from STP	From STP plant	Stored in a separate tank located at the top of the R-Block	For entire campus gardening

5.2: 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 being checked in an accredited laboratory and ensures that the water is potable.
- Separate RO plant of 1,200 LPH capacity is being installed in the R-Block (at the rooftop). Raw water is being fed as an input. Output RO water is being stored in a 3,000 litre water tank and then distributed for drinking application. The specifications of RO Plant and distribution of potable water to the entire campus is given in Table-3.

Table-3: Specification of RO Plant and Potable Water Distribution

S. No.	Parameters	Description
1.	Capacity of the RO Plant	• 1,200 Litre per hour
2.	Location	• R-Block Building (Top)
3.	Source of raw water	• Bore water + Outside water
4.	% of RO & grey water output	• 25 & 75 % respectively
5.	Usage of grey water	• Gardening and toiler flushing for the academic block
6.	Cleaning schedule of carbon & sand filter	• Yearly twice
7.	Cleaning schedule of membrane	• Every Month
8.	Back washing duration	• 10 min/day
9.	Functioning of RO Plant	• Manual (operated based on the students strength)
10.	Provision for automatic controller	• Not available (To be implemented)

11.	Tank capacity of the RO Water	• 3,000 Litre (Heavy Plastic)
12.	Tank capacity of the raw Water	• 50,00 Litre (Cement)
13.	Water flow control	• Butterfly valve (kept at maximum position)

5.3: Recommendations for RO Plant:

- Operate the RO plant in automatic mode of operation; as this step saves energy required by reducing the running hours of i) feed water pump, ii) main RO motor, iii) outlet water pump and iv) dozing pump. Further converting the plant operation from manual to automatic reduces the man-power, maintenance scheduling and also reduces the water overflow.
- Output pressure of the water distribution line must be reduced (now it is in maximum position and may at 4-5 bar) by adjusting the butterfly value and set the pressure to 2.5 – 3 bar.
- Install the water flow meter at each of the main line (distributed to each building and floor), so that the usage of water must be measured and monitored.
- With 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.

5.8: Rain Water Harvesting (RWH) Pit:

- Water is an important natural resource and is the very basis of our life. Water is a cyclic resource which can be used again and again after cleaning. The best way to conserve water is its judicious use. RWH is an option which has been adopted to collect and storage of rain water and also other activities aimed at harvesting surface water, prevention of loss through evaporation and seepage.
- The college has a suitable recharge structure (recharge pit) for rain water harvesting located on the left side of the mechanical block. The overall rain water collected in all the blocks are properly rooted to reside in this pit and assist to increase the ground water table.
- 17 no's of Rain Water Harvesting (RWH) pits are located throughout the entire college campus. Materials used are; 6 feet depth with 3 feet dia, filled with 8 layers of sand and coal.

RWH Collection Pit Located in R-Block as a sample

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PART-B

ENVIRONMENTAL AUDIT REPORT

6. ESTIMATION OF CO_2 EMISSION AND NEUTRALIZATION

(ELECTRICITY, TRANSPORT & LPG)

6.1: Assessment of Annual Energy Usage:

Table-4 shows the types of energy carriers used for their regular operation in the college campus along with application area and their source.

Table-4: 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)	All electrical/electronic equipment's	From TANGEDCO
2.	Roof Top Solar PV Plant (94.08 kW)		Roof top captive power plant
3.	Diesel	For transport vehicles and DG	From authorised distributor
4.	LPG	Cooking	
5.	Fire Wood	Hot Water generation for bathing	From local vendor

Table-5 represents the annual energy consumption of all type of fuels used in the college & power generation from SPV Plant during April-2019 to March-2020.

Table-5: Annual Energy Consumption of all types of Fuels, Power & LPG Generation

S. No.	Month	Units Consumed (kWh)	Diesel Consumption (Litre)		Vehicle Petrol Consumption (Litre)	LPG Consumption (kg)	Wood Consumption (kg)	Electricity Generation from SPV (kWh)
			Vehicles	DG				
1.	Mar-19	25,016.0	2,784.5	5.8	131.1	314.0	2.8	2,250.0
2.	Apr-19	26,232.8	5,316.9	330.2	293.4	843.9	4.7	2,600.0
3.	May-19	24,185.6	2,530.7	457.6	148.6	785.0	4.3	3,200.0
4.	Jun-19	18,708.0	4,641.8	1,045.6	205.9	0.0	0.0	1,700.0
5.	Jul-19	19,352.8	6,686.9	1,483.0	172.5	745.8	4.2	2,400.0
6.	Aug-19	22,119.8	6,039.5	278.0	194.5	255.1	2.7	0.0
7.	Sep-19	22,652.0	5,992.6	694.0	178.6	765.4	4.5	2,500.0
8.	Oct-19	18,089.6	5,373.4	301.1	105.7	608.4	4.3	2,600.0
9.	Nov-19	17,713.2	4,511.4	193.7	261.5	588.8	4.2	2,250.0
10.	Dec-19	17,215.6	3,397.2	36.0	119.4	392.5	3.4	700.0
11.	Jan-20	13,953.6	4,866.9	139.7	223.5	98.1	1.1	2,900.0

12.	Feb-20	15,741.2	6,273.3	32.0	206.3	549.5	3.6	9,900.0
Average		20,081.7	4,867.9	416.4	186.8	495.5	3.3	2.8
Total		2,40,980.2	58,415.1	4,996.7	2,241	5,946.4	39.8	33,000.0
			63,411.8					

6.2: Estimation of CO_2 for Transport Vehicles:

The college is committed to 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-6;

Table-6: List of Transporting Vehicles used in the College

S. No.	Type of Vehicle	Make, Model & YoM	Fuel Used	No. of Vehicles	Date of FC & Due Date	Non Pollution Certified (Y/N)
1.	Mini Bus - 5	Eicher, Feb 2010	Diesel	1	04.08.2020	Yes
2.	Mini Bus - 6	Eicher,Apr 2010	Diesel	1	04.08.2020	Yes
3.	Mini Bus - 15	Tata Star bus, Oct 2012	Diesel	1	07.02.2021	Yes
4.	Mini Bus - 16	Tata Star bus, Sep 2012	Diesel	1	09.11.2021	Yes
5.	Mini Bus - 25	Tata, Jul 2015	Diesel	1	04.03.2023	Yes
6.	Mini Bus - 27	Force, Jun 2015	Diesel	1	04.03.2023	Yes
7.	Bus - 10	Ashok Leyland, Apr 2012	Diesel	1	12.09.2020	Yes
8.	Bus - 12	Ashok Leyland, Apr 2012	Diesel	1	09.10.2020	Yes
9.	Bus - 14	Ashok Leyland, Apr 2012	Diesel	1	02.06.2020	Yes
10.	Bus - 22	Tata, May 2014	Diesel	1	02.06.2020	Yes
11.	Bus - 23	Tata, Aug 2014	Diesel	1	18.02.2023	Yes
12.	Bus - 24	Tata, May 2014	Diesel	1	13.08.2020	Yes

13.	Car - Innova	Toyota, Oct 2013	Diesel	1	22.10.2028	Yes
14.	Car - Bolero	Mahendra, Feb 2010	Diesel	1	21.02.2025	Yes
15.	Car - Omni	Maruthi Suzuki, Jul 2015	Petrol	1	20.07.2030	Yes
16.	Bike - Star City	TVS, Oct 2011	Petrol	1	11.10.2026	Yes

Annual fuel consumption for transport is *58,415.1 litre of Diesel* which contributes CO_2 emission of *154.2 Tons/Annum* + 2,241 litre of Petrol which contributes CO_2 emission of *5.4 Tons/Annum* and cumulative CO_2 emission is *159.6 Tons/Annum*

6.3: Estimation of CO_2 Emitted by Annual Fuel Consumption:

S. No.	Description		Type of Fuel and their CO_2 Conversion Process				
			Electricity	Diesel	Petrol	LPG	Wood
10.	Total Annual Consumption		2,40,980.2 KWh	63,411.8 Litre (Vehicle + DG)	2,241 Litre (Vehicle)	5,946.4 kg	39.8 kg
11.	CO_2 Emission (Tons/Annum)	A	197.6	167.4	5.4	17.8	59.7
12.	**Total CO_2 Emission**	**B**	**447.9 Tons/Annum (↑)**				
13.	No. of Matured Trees Available	D	**458**				
14.	**CO_2 Neutralized due to Trees**	**E**	**10.0 Tons/Annum (↓)**				
15.	Annual Energy Generated from SPV Plant	F	33, 000 kWh				
16.	**CO_2 Neutralized due to SPV Plant**	**G**	**27.1 Tons/Annum (↓)**				
17.	Expected Reduction of Annual Electricity Consumption	H	91,047 kWh				
18.	**CO_2 Neutralized after implementing ENCON**	**I**	**75.0 Tons/Annum (↓)**				
19.	Amount of CO_2 to be Neutralized (Final)	J	**335.8 Tons/Annum**				
20.	**Per Capita CO_2 Emission (Considering Students +Staffs)**		**0.38 Tons / Person (↔)**				

(Note: Student strength of 784 + Teaching and technical staff strength of 92 = Total 876 persons)

H	Expected energy savings by implementing the ENCONs proposed in the audit
I	For electrical energy saved= $\left[\text{kWh saved x } \frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}\right]$.
J	$= [C - (E + G + I)]$

References:

*https://ecoscore.be/en/info/ecoscore/co2

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

CO_2 Emission:

447.9 Tons/Annum

CO_2 Neutralized:

37.1 Tons/Annum

CO_2 to be Neutralized

410.8 Tons/Annum

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PART-B

ENVIRONMENTAL AUDIT REPORT

7. USAGE OF CHEMICALS, SALTS & ACIDS

(HANDLING, STORAGE AND BEST OPERATING PRACTICES)

7.1: List of Chemicals Used, Storage Method and their Application:

Table-7 shows the list of various chemicals/salts/acids used in the Department of Science and Humanities (S&H) laboratories indicating method of storage, dilution and their application area.

Table-7: List of Chemicals Used, Storage Method and Application

Name of the Department	Chemistry	**Name of the Laboratory**	Chemical Analysis Laboratory

S. No.	Chemicals/Salts/Acids Used	Method of Storage	Method of Dilution	Application
1	Hydrochloric Acid	Acid cabinet	Adding the acid to water slowly and with constant stirring.	Volumetric, Conduct metric and PH metric analysis.
2	Sulphuric Acid		Adding the acid to water slowly and with constant stirring.	Volumetric, Conduct metric, potentiometric and PH metric analysis.
3	Nitric Acid(Nice)	Stored in acid cabinets, but it is kept isolated from all other acids.	Adding the acid to water slowly and with constant stirring.	Volumetric, Conduct metric analysis.
4	Acetic Acid Glacial(Nice)	Acid cabinet	Adding the acid to water slowly and with constant stirring.	Volumetric, Conduct metric analysis.
5	Acetone		Adding the acid to water slowly and with constant stirring.	Volumetric analysis.
6	EDTA Disodium Salt	Stored in medium shelf and below eye level	-	Volumetric analysis.
7	Ammonia Solution		Adding the acid to water slowly and with constant stirring.	Volumetric analysis.
8	Copper Sulphate		-	Volumetric analysis.
9	Zinc Sulphate		-	Volumetric analysis.
10	Sodium Carbonate		-	Volumetric analysis.
11	Potassium Hydroxide		-	Volumetric analysis.
12	Potassium Iodide		-	Volumetric analysis.
13	Sodium Sulphate		-	Volumetric analysis.
14	Magnesium Sulphate		-	Volumetric analysis.
15	Poly Vinyl Alcohol		-	Volumetric analysis.
16	Sodium Thiosulphate		-	Volumetric analysis.
17	Potassium Permanganate		-	Volumetric analysis.
18	Potassium Dichromate	Stored in medium shelf and below eye level	-	Volumetric analysis.
19	Ammonium Ferrous Sulphate		-	Volumetric analysis.
20	Potassium Thiocyanate		-	Volumetric analysis.

21	Ammonium Chloride		-	Volumetric analysis.
22	Phenolphthalein Powder		-	Volumetric analysis.
23	Phenolphthalein Solution		-	Volumetric analysis.
24	Ammonium Purpurate		-	Volumetric analysis.
25	Methyl Orange Powder		-	Volumetric analysis.
26	Methyl Orange Solution		-	Volumetric analysis.
27	Starch Soluble (Nice)		-	Volumetric analysis.
28	Eriochrome Black-T Powder(Nice)		-	Volumetric analysis.
29	Silver Nitrate L.R.(Nice)		-	Volumetric analysis.
30	Potassium Chromate		-	Volumetric analysis.
31	Sodium Hydroxidepellets L.R(Nice)		-	Volumetric analysis.
32	Sodium Chloride L.R.(Nice)		-	Volumetric analysis.
33	Calcium Chloride		-	Volumetric analysis.
34	Barium Chloride		-	Volumetric analysis.
35	Ethanol		-	Volumetric analysis.
36	Sodium Acetate		-	Volumetric analysis.
37	Potassium Chloride		-	Volumetric analysis.
38	1,10,Phenanthroline Hydrate		-	Volumetric analysis.
39	Manganous Sulphate L.R.(Nice)		-	Volumetric analysis.
40	Ferrous Sulphate		-	Volumetric analysis.
41	Ammonium Oxalate		-	Volumetric analysis.
42	Ammonia Buffer Solution		-	Volumetric analysis.
43	Fast Sulphone Black-F		-	Volumetric analysis.
44	Calcium Carbonate		-	Volumetric analysis.

7.2: 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 labelled.
- 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.

7.3: Recommendations:

- Most of the chemical, salts and acids used in the science department are inorganic in nature and no harmful effects were created during the experiment process. However 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 does 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 stake holders. Also paste the content of the policy in vulnerable points inside the college campus.
- Submit a detailed audit report based on the specified metric (may be developed internally) to the approved committee annually ensure the minimization of chemical pollution.
- 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 (not letting out to STP).
- Two best ways are recommended to treat this is;
  1. Design a dedicated system and collect the chemical wastes in a separate tanks 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.
  2. The college itself can construct and operate a Min-ETP exclusively for the chemical wastes. The management has to think and acts as per their convenience and ensure that the effluents released from the college should not pollute i) Soil, ii) Water and iii) Atmospheric air.

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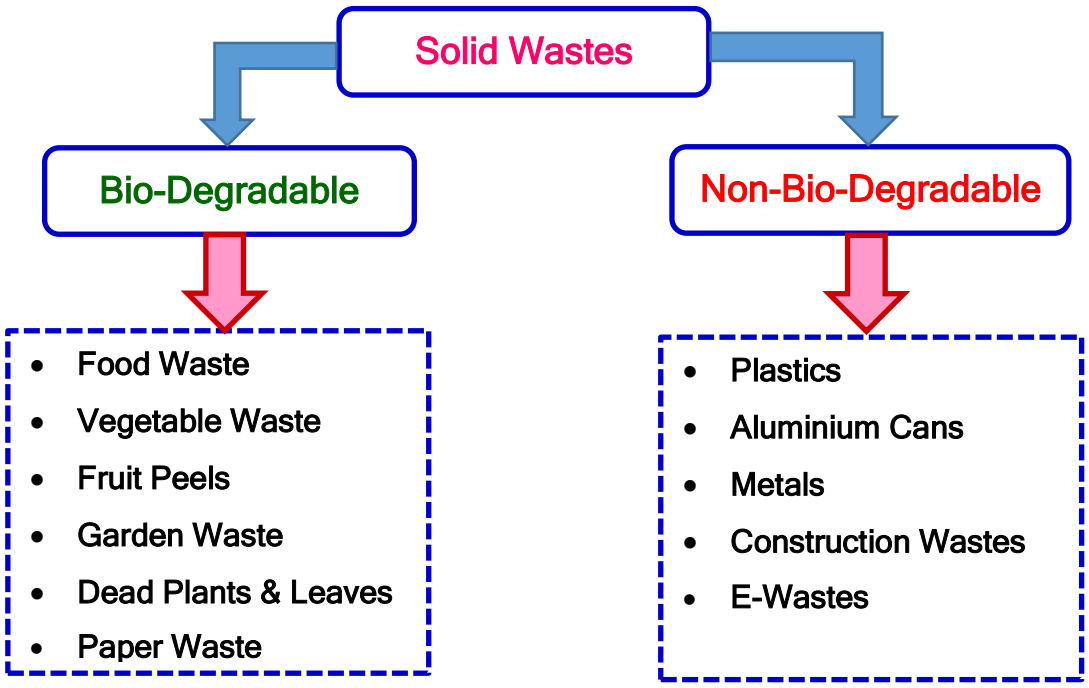
ENVIRONMENTAL AUDIT REPORT

8. SOLID WASTE MANAGEMENT

8.1: Solid Waste Management System:

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



8.2: Process of Waste Management:

The college management practiced some methods to treat the waste generated and Table-8 shows the process of treating the solid waste generated inside the college campus.

Table-8: Process of Waste Management

S. No.	Waste Type	Waste Treatment
Bio-Degradable Waste Management		
1.	Food and Vegetable Waste	Collected & given to nearly by hog forming
2.	Garden Wastes and Plant Leaves	Daily collected and dumped in a yard
3.	Paper Waste	Collected and stored in a separate place.
Non-Bio-Degradable Waste Management		
4.	Plastics	Banned in the college campus (Welcome step)
5.	Construction Wastes	Mostly used by their own construction
6.	Metals	Construction metals or from any other sources are stored in a separate place
7.	Transport Oil + Tyres	Transport oils not covered in ACET scope; as it is being taken by the service authority Vehicle tyres are stored in a separate place and sale to 3rd party
8.	E-Waste Management	Collected and stored in a separate place.

8.3: Identified E-Waste in the College Campus:

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

8.4: E-Waste Management Committee:

S. No	Name and Department	Responsibility
1.	Principal/Director/Dean	Chairperson
2.	Member-1:	Co-ordinator (SPOC)
3.	Member-2:	Member
4.	Member-3: Electronics Department	Member
5.	Member-4: Electrical Maintenance	Member
6.	Member-5: Network Maintenance	Member
7.	Member-6: General Maintenance	Member
8.	Member-7: Administrative Member	Member

8.5: E-Waste Policy:

- All the Electrical, Electronics, IT & ITES wastes (listed above) are considered as E-Waste; either completion of their life cycle or repaired during working condition.
- Once these wastes are identified; the same must be informed to the committee through E-slip (format to be prepared).
- The committee should evaluate the same based on the details submitted before disposing the material (Rule based format to be prepared).
- Once the committee approves; then this must be weighted and taken to storage area. (Separate area must be earmarked to store E-waste with necessary facilities).
- A log book must be maintained for E-waste management (format to be prepared)
- Establish an agreement with E-waste trader (a singed MoU copy must be produced in the audit report). The committee is the responsible to communicate to the trader regarding the amount of waste collected. (This may be fixed either based on weight of the waste or period of collection)

- Dispose the material to the vendor as per the policy and maintain the relevant documents.

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.
- 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 no. and E-mail.
- Identify certain vehicle to carry the waste from generation to storage yard.
- Provide training to the man power those 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 interval (month wise is good).

8.6: Recommendations:

- Except vegetable and food wastes; all other wastes must be measured and monitored on daily basis. Record the values and maintain separate record for each.
- Establish an MOU with 3rd party for selling the waste and document it.
- Like E-waste; develop separate polices for all type of wastes indicating i) Identification of sources of waste generation, ii) Segregation process, iii) Waste handling (from source to storage to disposal), iv) Recycling-Reuse methods and v) Effective disposal.
- Encourage and educate all the stakeholder to reduce the waste generation and reuse the same.

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Details of the Client

M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

PART-C

GREEN AUDIT REPORT

9. ROOF TOP SOLAR PV POWER PLANT
(Green Energy Generation)

9.1: Specifications of the Roof Top Solar PV Plant (SPP):

Table-9: Specifications of Roof Top Solar PV Plant

Total Capacity (kWp)					94.08 KW				
Specifications of Individual Panel									
Panel Make/Model					Trino Solar				
P_{max}	245W	V_{max}	30.2V	I_{max}	8.13A	V_{oc}	37.5V	I_{sc}	8.68
Location of SPV Plant					Top of the R Block and synchronized to MV panel PCC.				
Panel Orientation					North – South				
Availability of Tracking					NIL				
No. of Panels per Inverter					76 No's				
Total No. of Panels					384 No's				
DC Bus Voltage					200-1000V DC				
Inverter Specifications									
No. of Inverters					5 No's				
Make and Model No.					Delta and RPI – M20A				
Power Rating					20 kW				
Output Voltage and Frequency					**3/N/PE, 400 V AC; 50/60 Hz**				
General Specifications									
Number of DC Earthing					1				
Number of Inverter Earthing					AC Earthing - 2				
Frequency of Panel Cleaning					Cleaning at every month; However must make a proper scdule and strickly follow the same.				
Average Units Generated per Day					4 to 5 Units/day				
Year of Installation					2015				
Date and Month of Power Generation					December; 2016				

9.2: Recommendations:

- **Maintain a separate record for i) Daily production of energy (export) and ii) Daily import of energy from TANGDCO. Also maintain the fault/maintenance record of entire PV plant including Panel, Array junction box, Connector, Inverter and Earthing system.**
- **Similarly maintain a record for panel cleaning schedule. Ensure that for each cleaning, the power generation must increase.**
- **Ensure that the solar PV plant has to connect in all the days and the power generation must be fully utilized by the college loads during day time in order to achieve quicker payback for the investment made towards setting up of the plant.**

A SYNOPSIS OF

GREEN AUDIT REPORT

Details of the Client

M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY

Kinathukadavu, Coimbatore, Tamilnadu, India-642 109

PART-C

GREEN AUDIT REPORT

10. LIST OF MATURED TREES IN THE COLLEGE CAMPUS (GREEN COVERAGE)

10.1: Campus Greenery:

The college management planted many native trees inside the campus and is completely covered with matured trees grown for more than 10 years. Total number of matured trees available in the college campus is ***458 with 15 varieties of trees.*** Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowing shrubs and pushes. Table-10 shows the list of matured trees available inside the college campus.

Table-10: List of Matured Tree Available in the College Campus

S. No.	Location (Wing/Block/Area)	Name of the Tree	Botanical Name	Quantity
1.	All around the campus	Coconut Tree	Cocos nucifera L	67
2.		Punga Tree	Millettia pinnata	211
3.		Neem Tree	Azadirachta indica	45
4.		Guava Tree	Psidium guajava	08
5.		Mango Tree	Mangifera indica	04
6.		Almond Tree	Prunus dulcis	03
7.		Nelli Tree	Phyllanthus emblica	03
8.		Bamboo Tree	Bambusoideae	03
9.		May flower tree	Delonix regia	80
10.		Thoongu moonji Tree		23
11.		Lime Tree	Citrus limon	02
12.		Senbaga tree	Magnolia champaca	21
13.		Kathi savukku tree	Acacia auriculiformis	05
14.	In front of B block	Palm tree	Arecaceae	04
15.	Garden	Perunkondrai	Peltophorum pterocarpum	48
Total				527
Total No. of Tree (after omitting Coconut Tree – Since its CO2 contribution is less)				**458**

Total No. of Matured Trees available in the college campus is 458 which contributes for CO_2 reduction of 10.0 Tons/Annum

10.2: List of Shrubs (Bushes):

S. No.	Location (Wing/Block/Area)	Name of the Shrubs	Botanical Name	Quantity
1.	All around the campus	Dwarf Shrubs	--	45
2.		Nithyakalyani	Catharanthus roseus	35
3.		Arali sedi	Nerium oleander	25
4.		Yello Arali	Peltophorum pterocarpum	15
5.	In front of B & D Block	Green plants	--	16
Total				**136**

10.3: List of Flowering Shrubs:

S. No.	Location (Wing/Block/Area)	Name of the Flowing Shrubs	Botanical Name	Quantity
1.	In front of bus stoping	Rose shrub	--	13
2.	In front of B Block	Evergreen Shrub	--	20
3.	In front of portico	Beauty flower	--	04
4.	In front of R Block	Evergreen Shrub	--	24
Total				**61**

END OF THE REPORT

This synopsis report is prepared as a part of the Green Audit (Covering Energy, Environment and College Greenery) conducted at **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY,** Kinathukadavu, Coimbatore, Tamilnadu, India-642 109 **conducted** by **M/s. RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING,** Coimbatore-641 062, Tamilnadu, India.

CERTIFICATE FOR GREEN AUDIT

RAM KALAM -CENTRE FOR ENERGY CONSULTANCY & TRAINING

CHENNAI COIMBATORE ERODE

(Regt. Ofice No. 8, VPK Garden, Coimbatore-641 062,
Mobile: +91-99420 14544, 80567 19372, Email: ramkalamcect@gmail.com)

(GST No. 33AAZFR8890A1ZN)

CERTIFICATE FOR GREEN AUDIT PROCESS

This is to certify that, we have conducted a ***Green Audit*** in **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET),** Kinathukadavu, Coimbatore, Tamilnadu, India - 642 109 on **10 MARCH 2020.** This audit process investigates the following activities;

I) Coverage of matured trees (nearly 458 trees available in the college campus).

II) Implementation of Renewable Energy Systems for regular activities.

III) Assessment of Rooftop Solar PV Plant (94.08 kW Grid Interactive Model).

(Audited and Accounted from March-2019 to February-2020)

Thank You

Yours Truly,

(Dr. S.R. SIVARASU)

Dr. S.R. SIVARASU, Ph.D.,
BEE Certified Energy Auditor (EA-27299)
Lead Auditor - ISO 14001: EMS
IGBC - AP, GRIHA - CP
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CERTIFICATE FOR ENERGY AUDIT

RAM KALAM -CENTRE FOR ENERGY CONSULTANCY & TRAINING

CHENNAI COIMBATORE ERODE

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Mobile: +91-99420 14544, 80567 19372, Email: ramkalamcect@gmail.com)

(GST No. 33AAZFR8890A1ZN)

CERTIFICATE FOR ENERGY AUDIT PROCESS

This is to certify that, we have conducted a detailed ***Energy Audit*** in **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET),** Kinathukadavu, Coimbatore, Tamilnadu, India - 642 109 on **10 MARCH 2020.** The audit team has identified ***08 Energy Conservation Proposals (ENCONs)*** and summary of the Energy Audit Process is given below.

S. No.	Description	Parameters
1.	Present Annual Energy Consumption	2,40,980 kWh + 5,946 kg of LPG
2.	Present Annual Energy Cost	Nearly Rs. 23.7 Lakhs
3.	**Proposed % of Energy Savings (through ENCON)**	**38 % of Electrical + 3 % of LPG**
4.	**Proposed Annual Energy Savings**	**91,047 kWh + 178 kg of LPG**
5.	**Proposed Financial Savings**	**Rs. 7.7 Lakhs**
6.	Initial Investment Required	Rs. 27.0 Lakhs
7.	Simple Payback Period	Nearly 3.5 Years

Equipment's/Systems Audited:

Electrical System	Thermal System
• Electrical System & Network	• Inverter, UPS and Battery System
• Lighting, Fan & Air Conditioners	• Boiler and Steam System
• Solar PV System	• LPG Consumption

(Audited and Accounted from March-2019 to February-2020)

Thank You

Yours Truly,

S.R. Sivarasu

(Dr. S.R. SIVARASU)

Dr. S.R. SIVARASU, Ph.D.,
BEE Certified Energy Auditor (EA-27299)
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CERTIFICATE FOR ENVIRONMENT AUDIT

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(GST No. 33AAZFR8890A1ZN)

CERTIFICATE FOR ENVIRONMENTAL AUDIT PROCESS

This is to certify that, we have conducted an ***Environmental Audit*** in **M/s. AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY (ACET),** Kinathukadavu, Coimbatore, Tamilnadu, India - 642 109 on **10 MARCH 2020**. This audit process highlights the present CO_2 emission and methods adopted to neutralize the same in the college campus.

S. No.	Description		Type of Fuel and their CO_2 Conversion Process				
			Electricity	Diesel	Petrol	LPG	Wood
1.	Total Annual Consumption		2,40,980.2 KWh	63,411.8 Litre (Vehicle + DG)	2,241 Litre (Vehicle)	5,946.4 kg	39.8 kg
2.	CO_2 Emission (Tons/Annum)	A	197.6	167.4	5.4	17.8	59.7
3.	Total CO_2 Emission	B	447.9 Tons/Annum (↑)				
4.	No. of Matured Trees Available	D	458				
5.	CO_2 Neutralized due to Trees	E	10.0 Tons/Annum (↓)				
6.	CO_2 Neutralized due to SPV Plant	G	27.1 Tons/Annum (↓)				
7.	CO_2 Neutralized after implementing ENCON	I	75.0 Tons/Annum (↓)				
8.	Amount of CO_2 to be Neutralized (Final)	J	335.8 Tons/Annum				
9.	Per Capita CO_2 Emission (Considering Students +Staffs)		0.38 Tons / Person (↔)				

System Audited	Systems Inspected
• Electricity Consumption & Generation	• Solid and E-Waste Handling & Management
• Diesel Consumption (Vehicles + DG)	• Usage of Chemical, Salts & Acids
• LPG Consumption	• Water Purifier and Distribution System

(Audited and Accounted from March-2019 to February-2020)

Thank You

Yours Truly,

S.R. Sivarasu

(Dr. S.R. SIVARASU)

Dr. S.R. SIVARASU, Ph.D.,
BEE Certified Energy Auditor (EA-27299)
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BEYOND THE CAMPUS ENVIRONMENTAL PROMOTIONAL ACTIVITIES

Swachh Bharat Mission

2.10Pm No - 4596 13 OCT 2016

ANNA UNIVERSITY
Chennai - 600 025

Phone 2235 7004
Fax 91-44-2235 1856

AKSHAYA COLLEGE OF ENGINEERING AND TECHNOLOGY
KINATHUKADAVU, COIMBATORE-642109

Chairman	
Trustee	Date: 29.09.2016
Director	
Joint Director	13/10/16
Principal	13/10/16

REGISTRAR
Lr.No.19764 /SA 3/2016

To

1. The Principal of all Government / Self-financing Engineering Colleges / Autonomous Colleges affiliated under Anna University.
2. The Dean of all Constituent Colleges of Anna University.

Sir / Madam,

Sub: Anna University – To follow Swachh Bharat Mission – In higher educational Institutions – Quarterly report requested – Reg.

Ref: Lr.No.3903/U2/2016, dated: 23.09.2016 from Principal Secretary to Governor, Governor's Secretariat, Raj Bhavan, Chennai.

****

I am to inform that the University has received a letter from the Principal Secretary to Governor, Governor's Secretariat, Raj Bhavan, and Chennai regarding follow up of "Swachh Bharat Mission" in Educational Institutions.

Based on this, you are advised to follow the objectives of Swachh Bharat Mission, among other things, aim to effect behavioral change regarding healthy sanitation practices and generate awareness about sanitation and its linkage with public health.

The colleges should involve in a greater manner in carrying forward the Swachh Bharat Mission by actively involving the students as well as the Staff of the Colleges. The activities so carried out should be taken beyond the campuses to surrounding/nearby villages.

In this connection, the colleges have to draw up specific programme for your insitution over the next one year involving the participation of students, NSS Volunteers, Faculty and Staff for carrying forward the objectives of Swachh Bharat Mission and send the quarterly report on the activities carried out to the Director, Centre for Student Affairs, Anna University, Chennai.

Yours faithfully,

29/9/16

for REGISTRAR

29.9.16 29/9

AKSHAYA
COLLEGE OF ENGINEERING AND TECHNOLOGY
Kinathukadavu, Coimbatore - 642 109.

25.01.2017

Swachh Bharat mission (Campus Cleaning)

National Service Scheme/YRC unit of Akshaya College of Engineering and Technology organized a **"Swachh Bharat mission (Campus Cleaning)" on 25.01.2017 at our college campus.** The student volunteers participated in the mission by cleaning the surroundings of campus.

"Swachh Bharat Mission (Campus Cleaning)" held at Akshaya College of Engineering and Technology on 25.01.2017

TREE PLANTATION

AKSHAYA
COLLEGE OF ENGINEERING AND TECHNOLOGY
Kinathukadavu, Coimbatore - 642 109.

15.08.2016

Tree Plantation Programme

National Service Scheme/YRC unit of Akshaya College of Engineering and Technology organized a **"Tree Plantation Programme" on 15.08.2016 at our college campus.** Our college **Director Dr. K. Thanushkodi**, inaugurated the Tree Plantation Programme. The NSS student volunteers and faculty members participated in this event and **Planted Around 200Saplings.**

"NSS volunteers on Tree Plantation Programme" held at Akshaya College of Engineering and Technology on 15.08.2016

15/8/16

Dr. J. JANA, M Tech Ph D
PRINCIPAL
Akshaya College of Engineering and Technology
Kinathukadavu, Coimbatore-642 109

VIDAITHELU

PLANTING AND DISTRIBUTION OF SIPLINGS

Rotaract club of Akshaya College of Engineering and Technology Rotaractors conducted **Community Service project "VIDAITHELU" planting** and **distributing saplings** to the **public people held at Akshaya College of Engineering and Technology** on **29.08.2018.**

NURTURE THE NATURE FOR THE FUTURE

awareness to eradicate the plastic Bag

Rotaractors from Akshaya College of Engineering and Technology organized **Nurture the Nature for the Future** event to create awareness to eradicate the plastic bags and use Canvas bags and cotton bags at **Codissia, Coimbatore** on **12.04.2018**.

SPROUT THE SAPLINGS

Rotaractors from Akshaya College of Engineering and Technology organized **SPROUT THE SAPLINGS event** and **planted saplings** with the public people and created awareness about the importance of tree saplings at Pollachi on **09.04.2018.**