NANDHA ENGINEERING COLLEGE

(AUTONOMOUS)

(Approved by AICTE, New Delhi and Affiliated to Anna University, Chennai) Perundurai, Erode - 638012, Tamil Nadu, India. Email: principal@nandhaengg.org

Website:www.nandhaengg.org Phone: 04294-225595

7.1 Institutional Values and Social Responsibilities	
7.1.6	Quality audits on environment and energy

Audit Reports

S.No	Description	Year	Page No
1.	Energy, Environment & Green Audit Report	2020-2021	44
2. Action Taken Report (ATR) Link		https://nandhaengg.org/wp-content/uploads/2022/03/Action-taken-report-ATR.pdf	
3. Green Campus- Video Link		https://youtu.be/dp7Yrorn_Zo	

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2020-2021

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

DETAILS OF THE CLIENT

NANDHA ENGINEERING COLLEGE (AUTONOMOUS)

Erode – Perundurai Main Road, Vaikkaalmedu,

Erode – 638052, Tamil Nadu, India

DATE OF AUDIT

25 MARCH 2021

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 **NANDHA ENGINEERING COLLEGE (AUTONOMOUS)**, Erode – Perundurai Main Road, Vaikkaalmedu, Erode – 638052, 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 **NANDHA ENGINEERING 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.

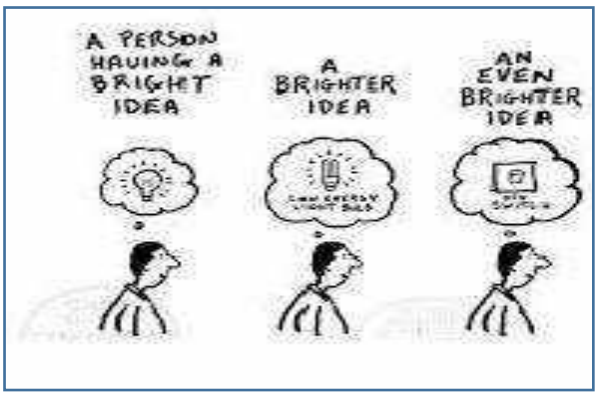
Finally, we offer our sincere thanks to all the members in the engineering division/ technical/non-technical divisions and office members who were directly and indirectly involved with us during collection of data and while conducting field measurements.

Management Team Members	
Thiru. V. SHANMUGAN	**Chairman, Sri Nandha Educational Trust**
Thiru. S. NANDHAKUMAR PRADEEP	**Secretary, Sri Nandha Educational Trust**
Thiru. S. THIRUMOORTHY	**Secretary, Nandha Educational Institutions**
Dr. N. RENGARAJAN	**Principal, Nandha Engineering College (Autonomous)**
Dr. J. SENTHIL	**Director, Nandha Engineering College, Autonomous**

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**
Er. P. MALLIGARJUN, M.E	**Audit Associate**
Er. N. PRETHIVIK, B.E	**Audit Associate**

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

1. INTRODUCTION TO ENERGY-ENVIRONMENT-GREEN AUDIT



1.1 : Preface about the Institution:

- **Sri Nandha Educational Trust** was established in **1992.** The trust functions with **Thiru. V. Shanmugan** as Chairman cum Managing Trustee and his family members as trustees. Nandha Educational Institutions has successfully crossed many milestones and presently functioning with **19 Institutions with 16,200 students.**
- **Nandha Engineering College** was established in **2001** with 3 branches. Presently it is functioning with **10 UG** branches and **6 PG** branches with 720 and 162 student's intake respectively.
- **Nandha Engineering College was conferred Autonomous in the year 2013**. The college is having NBA accreditation for programmes like, Computer Science Engineering, Electronics and Communication Engineering and Information Technology. It has been approved as Research Centres for the departments such as CSE, Mechanical and ECE by Anna University.
- The College has received 1.02 Crores as Grants from various funding agencies such as AICTE, TNSCST, ISRO, CSIR, NHRC, etc. MHRD Institute Innovation Council has rated the Institution with 5 Star Ranking based on the distinct activities of the college.

1.2 : Vision:

- To be a world class Engineering and Management Institution in leading technological and socio-economic development of the country by enhancing the global competitiveness of technical manpower and by ensuring high quality technical education through dissemination of knowledge, insights and intellectual contributions.

1.3 : Mission Statement:

- ✓ To provide value-based technical education and mould the character of younger generation.

1.4 : Quality Policy:

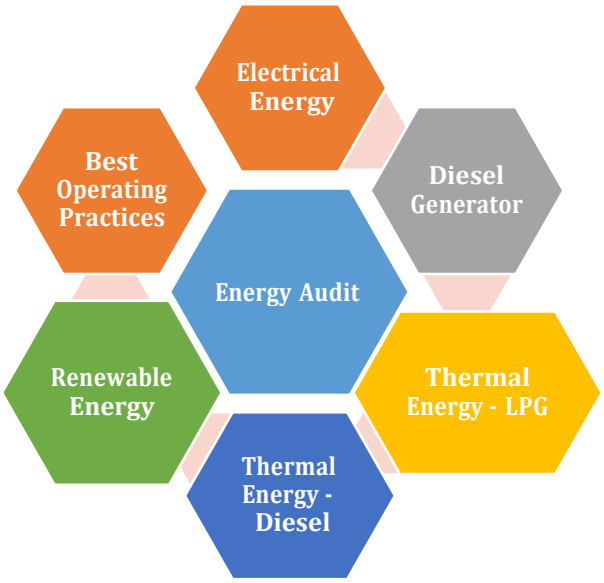
- We, at **NANDHA ENGINEERING COLLEGE**, as a dedicated team are committed to constantly, and consistently work for the students' continual improvement in terms of quality in education, updated technical knowledge, personality development and career advancement to meet the challenges in the world.

1.5 : Major Activities in the Institution:

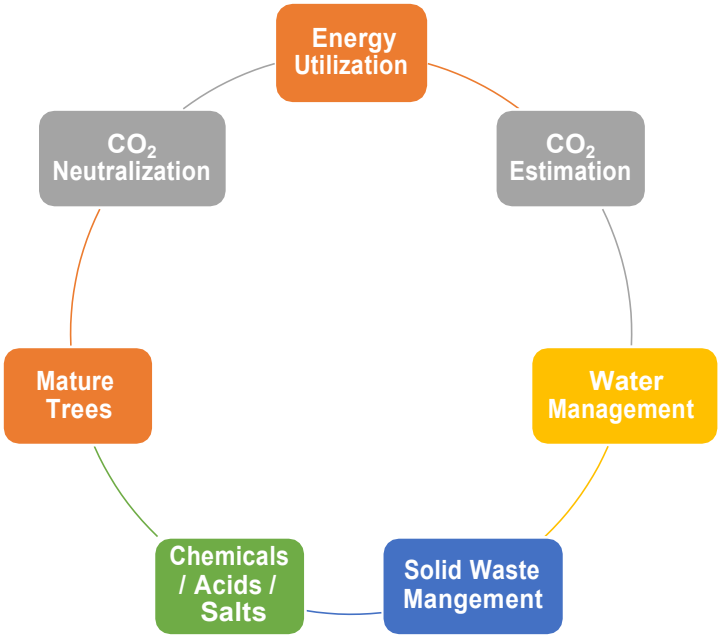
1.6 : Scope of the Audit Process:

- **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).
- **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 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.

1.7 : Coverage in Energy Audit Process:



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

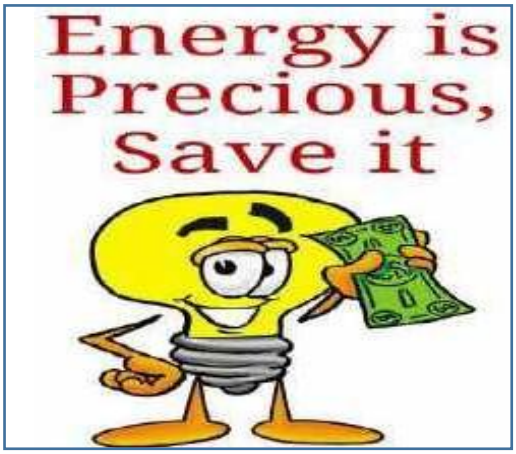


1.9 : List of Members Involved in Audit Process & Data Collection:

S. NO.	NAME	DESIGNATION
1.	Dr.C. SIVA	HoD/ Information Technology
2.	Mr. R. THIRUNEELAKKANDAN	HoD/ Science and Humanities
3.	Mr. S. PRABHARKARAN	Associate Professor/ EEE
4.	Mr. S. GNANA VENKATESH	Assistant Professor/ Civil
5.	Mr. M.C. JAWAHAR	Assistant Professor/Chemical
6.	Mr. MUKILAN	Assistant Professor/Agriculture Engineering
7.	Mr. R. KARTHIKEYAN	Estate Manager
8.	Mr. K. BALASUBRAMANIAM	Electrical Supervisor
9.	Mr. N. SENTHILNATHAN	Maintenance Incharge- RO & STTP
10.	Mr. M. DHANABALAN	Mess Manager
11.	Mr. R. GUNASEKARAN	System Administrator & UPS
12.	Mr. R. KARTHI	Transport Incharge

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

2. EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

Electrical and Thermal Energy Analysis:

A detailed audit was conducted in **NANDHA ENGINEERING COLLEGE (AUTONOMOUS)**, Erode – Perundurai Main Road, Vaikkaalmedu, Erode – 638 052, Tamil Nadu, India. The audit team has come out with ***11 Energy Conservation Proposals (ENCONs)*** and the summary of all the ENCONs are given below:

Description/Year	2016-17	2017-18	2018-19	2019-20	2020-21
Annual Electricity Consumption (kWh)	3,48,025	3,15,685	3,05,261	3,05,376	1,37,008
Annual LPG Consumption (kg)	39,780	37,468	42,466	34,901	13,889
Annual Wood Consumption (Tons)	131.2	110.0	118.8	113.3	41.3

Summary of Energy Conversion (ENCON) Proposals

S. No.	Description	Parameters		
		Present	After	Savings
1.	Annual Energy Consumption	3,05,261 kWh + 42,466 kg of LPG + 119 Tons of Wood	27,0,138 kWh + 36,971 kg of LPG + 86.1 Tons of Wood	35,123 kWh + 5,495.0 kg of LPG + 32.9 Tons of Wood
2.	Annual Energy Cost	Rs. 56.0 Lakhs	Rs. 48.6 Lakhs	Rs. 7.4 Lakhs
3.	Initial Investment Required	–	–	Rs. 13.0 Lakhs
4.	Simple Payback Period	–	–	Nearly 1.8 Years

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, LPG and Fire wood for regular applications are taken into account.

Audit Conducted and Verified by

S.R. Sivarasu

(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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E-Mail: ramkalamcect@gmail.com

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	2 % of Solar PV Energy	1,280 kWh	10,752	Zero Cost	Immediate	1.0
2.	Reduction of Cable Losses and Active Power Consumption using Load End Capacitor Compensation (At DB Level)	1.0 % (Electrical)	3,053 kWh	25,645	12,000	0.5 Years	2.5
3.	Reduction of Belt & Pulley Transmission Losses from Motor to Machine in STP Aerator Motor.	8 % on STP Motor	3,360 kWh	28,224	6,000	0.2 Years	2.8
4.	Reduction of Energy Consumption through retrofitting VFD in One of the Aerator Blower Motor	25 % on STP Motor	5,460 kWh	45,864	70,000	1.5 Years	4.5
5.	Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps)	50 % on Lighting	6,250 kWh	52,500	1,00,800	1.9 Years	5.1
6.	Replacement of Existing Convention Ceiling Fans into EC BLDC Fans	50 % on Fans Load	15,720 kWh	1,32,048	5,40,000	4.1 Years	12.9
ENCONs for Thermal Energy Savings							
7.	Reduction of LPG Consumption using Regular Burner Cleaning and Swapping of Active Burners	5 % of LPG used for Stove	850 kg	52,700	10,000	0.2 Years	2.6
8.	Reduction of LPG Consumption by converting the conventional Vapour Off-Take (VOT) system in to Liquid Off-Take System	System Change	1,248 kg	77,376	1,20,000	1.6 Years	3.7
9.	Reduction of LPG Consumption in Dosa making Stove with Radiant Burners	20 % of LPG for Dosa Stove	3,397 kg	2,10,614	2,00,000	0.9 Years	10.2
10.	Reduction of Heat Energy Exposed in the Boiler Outer Side + Steam Pipes Lines (Especially in Pipe Joints) using TCC	10 % on Wood Consumption	11.9 Tons	38,080	40,000	1.1 Years	22.6
11.	Reduction of LPG Consumption in Boiler Feed Water Pre-heating using Solar Thermal Energy System	Fuel Substitution	21.0 Tons	67,200	2,10,000	3.1 Years	39.9
Total			**35,123 kWh + 5,495.0 kg of LPG + 32.9 Tons of Wood**	7,41,003	13,08,800	–	107.8

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-A: ENERGY AUDIT REPORT

3. STUDY ON ENERGY CONSUMPTION & GENERATION PATTERN

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)	Thiru. V. SHANMUGAN (In the name of chairman)				
		The Secretary, Sri Nandha Educational Trust				
2.	Type of Utility Supply, Service No.& Tariff	LT SC. No: 04-052-009-251; Tariff-LM-II-B-2				
		LT SC. No: 04-052-009-150; 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 (installed in the year 2020)				
5.	Permitted Demand (PD)	SC. No: 04-052-009-251 = **112.0 kW**				
		SC. No: 04-052-009-150 = **112.0 kW**				
6.	Capacity of APFC	In both the service No APFC; only fixed capacitors of nearly 40 kVAr of different stages				
7.	Capacity of Diesel Generator (DG) Sets	180 kVA– 1 No's				
		All are air-cooling. Internal fuel tank (250 L) & separate earthing done				
8.	Annual Electricity Consumption (kWh)	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
		3,48,025	**3,15,685**	**3,05,261**	**3,05,376**	**1,37,008**
9.	Annual Electricity Generation from DG (kWh)	**3,493**	**3,493**	**4,055**	**3,558**	**3,608**
10.	Annual Diesel Consumption for DG (L)	**1,092**	**1,959**	**1,267**	**1,112**	**1,127**
Electrical Energy (Generation)						
11.	Nature & Capacity of Energy Generation	Roof Top SPV Plant – **50 kW MB (2020)** feeding to MV panel in SC. No: 04-052-009-150				
12.	Annual Energy Generation (kWh)	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
		NIL	**NIL**	**NIL**	**NIL**	**47,211**
13.	Overall Energy Generation (Last 5-Years)	**4,51,096 kWh**				
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)	2016-17	2017-18	2018-19	2019-20	2020-21
		39,780	37,468	42,466	34,901	13,889
17.	Annual Wood Consumption (Tons)	131.2	110.0	118.8	113.3	41.3
18.	Annual Diesel Consumption for Transport (L)	2,01,186	2,52,164	2,41,390	2,21,909	44,576
General Loads (Both Electrical and Thermal)						
19.	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				
20.	Lighting Feeder	Lighting loads are separated from raw power and are supplied through lighting distribution board				
21.	Fan Loads (Ceiling)	All the indoor ceiling fans are conventional fans.				
22.	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 ^{0}C as room temperature as per BEE norms • AC filters, condenser & evaporator coils are cleaned at regular intervals				
23.	Motors and Pump loads	• Mainly used for water distribution, purification, waste water treatment. • Necessary sensors are placed to on/off to motor; when the overhead tanks filled with water. • Small motors are used in kitchen equipment's.				
24.	Uninterrupted Power System (UPS)	• All the computers, servers, surveillance systems, projectors, telephonic units are connected with UPS with nominal back up time of 15-30 min.				

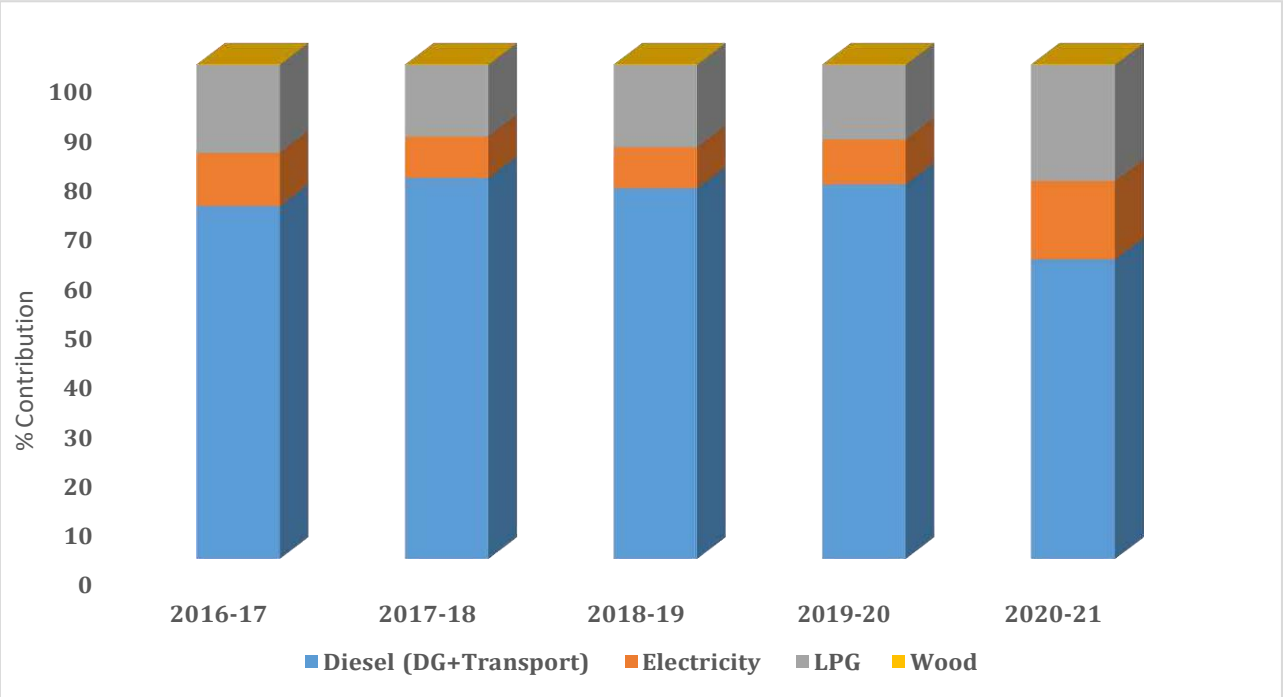
3.2 : Energy Contribution:

Table-2: Contribution of Energy Consumption & Energy Conversion

% Contribution	2016-17	2017-18	2018-19	2019-20	2020-21
Diesel (DG+Transport)	71.3	77.0	74.9	75.7	60.5
Electricity	10.8	8.4	8.3	9.1	15.9
LPG	17.8	14.5	16.7	15.1	23.5
Wood	0.1	0.1	0.1	0.1	0.1

(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

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 & MATURE TREES)

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	From authorised distributor
4.	Seasonal Wood	Used only for cooking	From local vendor
5.	Solar PV System (2020) (Self-Generation)	Powering to all electrical / electronic / HVAC equipments	Installed on the roof top of the Block-4
6.	Solar Thermal System	Hot producing hot water for bathing application	Installed in Boys hostel with 2,000 LPD capacity
7.	Mature Trees	The college has nearly **324** mature trees of different varieties which are more than 10 years old.	

4.2 : Environmental System: CO_2 Balance Sheet (2016-17):

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. The following tables provide the balance sheet indicating various energy carriers associated with the regular activities and their CO_2 mapping.

Table-4: Environmental System: CO_2 Balance Sheet (2016-17)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Annual Usage	CO_2 Emission (Tons/Annum)	Description	Annual Usage	CO_2 Neutralized (Tons/Annum)
1.	Diesel	2,02,278 Litres	534.0	Solar Thermal System	14,470 kWh	11.9
2.	Electrical Energy	3,48,025 kWh	285.4			
3.	LPG Consumption	39,780 kg	119.3	Mature Trees	324 Nos	7.1
4.	Wood	131 Tons	249.3			
5.	Total Emission		1,188.0	Total-Neutralized		19.0
Balance CO_2 to be Neutralized = 1,168.0 Tons/Annum						

(Note: Amount of energy utilized from the solar thermal (2,000 LPD) is being converted into its electrical equivalent. The diesel consumption includes both for DG and Transport application)

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

Table-5: Environmental System: CO_2 Balance Sheet (2017-18)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Annual Usage	CO_2 Emission (Tons/Annum)	Description	Annual Usage	CO_2 Neutralized (Tons/Annum)
1.	Diesel	2,54,123 Litres	670.9	Solar Thermal System	14,470 kWh	11.9
2.	Electrical Energy	3,15,685 kWh	258.9			
3.	LPG Consumption	37,468 kg	112.4	Mature Trees	324 Nos	7.1
4.	Wood	110 Tons	209.0			
5.	Total Emission		1,251.2	Total-Neutralized		19.0
Balance CO_2 to be Neutralized = 1,232.2 Tons/Annum						

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

Table-6: Environmental System: CO_2 Balance Sheet (2018-19)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Annual Usage	CO_2 Emission (Tons/Annum)	Description	Annual Usage	CO_2 Neutralized (Tons/Annum)
1.	Diesel	2,42,657 Litres	640.6	Solar Thermal System	14,470 kWh	11.9
2.	Electrical Energy	3,05,261 kWh	250.3			
3.	LPG Consumption	42,466 kg	127.4	Mature Trees	324 Nos	7.1
4.	Wood	119 Tons	225.7			
5.	Total Emission		1,244.0	Total-Neutralized		19.0
Balance CO_2 to be Neutralized = 1,225.0 Tons/Annum						

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

Table-7: Environmental System: CO_2 Balance Sheet (2019-20)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Annual Usage	CO_2 Emission (Tons/Annum)	Description	Annual Usage	CO_2 Neutralized (Tons/Annum)
1.	Diesel	2,23,021 Litres	588.8	Solar Thermal System	14,470 kWh	11.9
2.	Electrical Energy	3,05,376 kWh	250.4			
3.	LPG Consumption	34,901 kg	104.7	Mature Trees	324 Nos	7.1
4.	Wood	113 Tons	215.3			
5.	Total Emission		1,159.2	Total-Neutralized		19.0
Balance CO_2 to be Neutralized = 1,140.2 Tons/Annum						

4.6 : Environmental System: CO_2 Balance Sheet (2020-21):

Table-8: Environmental System: CO_2 Balance Sheet (2020-21)

S. No.	Energy Consumption & CO_2 Emission			CO_2 Neutralization		
	Description	Annual Usage	CO_2 Emission (Tons/Annum)	Description	Annual Usage	CO_2 Neutralized (Tons/Annum)
1.	Diesel	45,703 Litres	120.7	Solar PV System	47,211 kWh	38.7
2.	Electrical Energy	1,37,008 kWh	112.3	Solar Thermal System	14,470 kWh	11.9
3.	LPG Consumption	13,889 kg	41.7	Mature Trees	324 Nos	7.1
4.	Wood	41 Tons	78.5			
5.	Total Emission		353.1	Total-Neutralized		57.7
Balance CO_2 to be Neutralized = 295.4 Tons/Annum						

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 Wood pellets which reduces considerable amount of amount of CO_2. The management has to think and go for fuel substitution

4.8 : Calculation Table:

For Electricity $= [\text{kWh} \times \frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}]$
For Diesel $= [\text{Diesel Consumption (Litre)} \times \frac{2.64 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}]$
For LPG $= [\text{LPG Consumption (kg)} \times \frac{3.0 \text{ kg of CO2 emission}}{\text{kg of LPG Consumption}}]$
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 $\frac{(21.8 \quad 324)}{1{,}000} =$. _____

4.9 : 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

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

5. TRANSPORT & REFRIGERANT GASES IN AIR CONDITIONING SYSTEM

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	Quantity	Purpose
1.	Bus	50	Transporting students + staff
2.	Car	02	General Applications
Total No. of Vehicles		52	

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

Split A/C		
1.5 Ton	2 Ton	1 Ton
23	36	3
Window A/C		
1.5 Ton	2 Ton	1 Ton
5	Nil	1
Cassette A/C		
3 Ton	2	--

(Note: Most of the AC system has R-22 as refrigerant which has Global Warning Potential (GWP) of 1,810 and Ozone Depletion Potential (ODP) is 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).

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

6. USAGE OF CHEMICALS, SALTS & ACIDS

(STORAGE, HANDLING, AND BEST OPERATING PRACTICES)

6.1 ; 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 preventaccidents
- 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

6.2 ; Recommendations:

Practice-1	Storage and Handling of Chemicals
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 • Submit a detailed audit report based on the specified metric (may be developed internally) to the approved committee annually to 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 • 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	

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

In order to maintain hygiene in the College campus; the administration regularly clean 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-11 shows the cleaning agents used to clean the above mentioned area;

Table-11: 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

6.4 : 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 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. 1 shows the sample eco-friendly Green Pro certified cleaning agents

Fig.1: Green Pro Certified Eco Friendly Cleaning Agents (ZERODER)

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART- C: GREEN AUDIT REPORT

7. WATER UTILIZATION, CONSERVATION & WATER MANAGEMENT

7.1 : Source of Water, Storage and Distribution:

Water is one of the main consumables in the college campus. **NANDHA ENGINEERING COLLEGE** 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-12 shows the source of water, location of storage along with their application.

Table-12: Source of Water, Location of Storage and Application

Type of Water	Source	Location of Storage	Application
Fresh Water	Well water (Excellent facility to tap the rain water from all areas)		Drinking & Cooking (After treatment)
			Utensil Cleaning, Bathing, Cloth Washing
Rain Water	Rain Water collected through i) buildings run off and ii) road run-offs	Routed to pits located in all the buildings	Used to increase the ground water level
		Excess water is then routed to open bund	
Treated Water from RO & STP	Final output treated water from RO & STP plant	Used only for Gardening application	
Daily RO water requirement is nearly **10,000 liter**			

7.2 : 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.
- The overhead tanks storing the drinking water are cleaned at regular intervals and the water management team has been maintaining a cleaning schedule
- The specifications of RO Plant and distribution of potable water to the entire campus is given in Table-13.

Table-13: Specifications of RO Plant and Potable Water Distribution System

S. No.	Parameters	Description
1.	Total no. of RO Plant	• 04 No's (Total – 7,250 Litres/day)
2.	Capacity of each RO Plant	• Civil Block – 1,000 Litre/hour – 1 No
		• Block-2 - 2,000 Litre/hour – 1 No
		• Block-3 – 1,000 Litre/hour – 1 No
		• Nano Park - 2,000 Litre/hour – 1 No
3.	Source of raw water	• Well Water
4.	% of RO & grey water output	• 50 RO water : 50 % grey water
5.	Usage of grey water	• Used for gardening application
6.	Cleaning schedule of carbon & sand filter	• Weekly twice
7.	Cleaning schedule of membrane	• Yearly twice

8.	Back washing duration & Frequency	• 30 min for every day
9.	Functioning of RO Plant	• Floating sensor based water level automatic control of RO Plant
10.	Quality of RO water	• Maintained less than 70-100 TDS
11.	Addition treatments	• Carbon and sand filter
12.	RO water storage	• Stored in HDPE tanks and then pumped to top floor water tanks
13.	Quality of water & testing certificates	• Monthly once the quality of the RO water was tested in a chemistry laboratory • Recommended to test both RO & Grey water at NABL accredited laboratory
14.	Cost of RO Water	• Not Available. Recommend to calculate
15.	Best Operating Procedures to be done	• Recommended to backwash based on the colour of the water • Paste the Dos and Don'ts Chart • Also paste the plant operating sequence

7.3 : 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.

Fig.2: Water Control Taps for General Applicatin

7.4 : Sewage Treatment Plant (STP):

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

Table-14: Specifications of Sewage Treatment Plant (STP)

Collection Tank Capacity	65 KLD
Aeration Tank Capacity	100 KLD
Clarifier Tank	100 KLD
Sludge Sump	100 KLD

Intermittent & Treated Water Sump	100 KLD
Sludge Drying Bed	4 Nos
Filtering Types	Carbon and Sand Filters
Usage of Treated Water & Sludge	Gardening Application

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

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

- The audit team appreciates the effects taken by the management of **NANDHA ENGINEERING 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.
- The number of RWH pits along with their location and specifications are represented in the Table-15;

Table-15: Specifications of the RWH pits available in the College

S. NO.	LOCATION OF THE PIT	AREA OF THE PIT	DEPTH
1	Backside of Block – 4	7.5 sq. ft.	5 feet
2	Backside of Block – 4	7.5 sq. ft.	5 feet
3	Backside of Block – 4	7.5 sq. ft.	5 feet
4	Backside of Block – 4f	7.5 sq. ft.	5 feet
5	Backside of Block – 3	7.5 sq. ft.	5 feet
6	Backside of Block – 3	7.5 sq. ft.	5 feet
7	Backside of Block – 3	7.5 sq. ft.	5 feet
8	Backside of Block – 9	9 sq. ft.	6 feet
9	In front of Estate Office	84 sq. ft.	10 feet

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

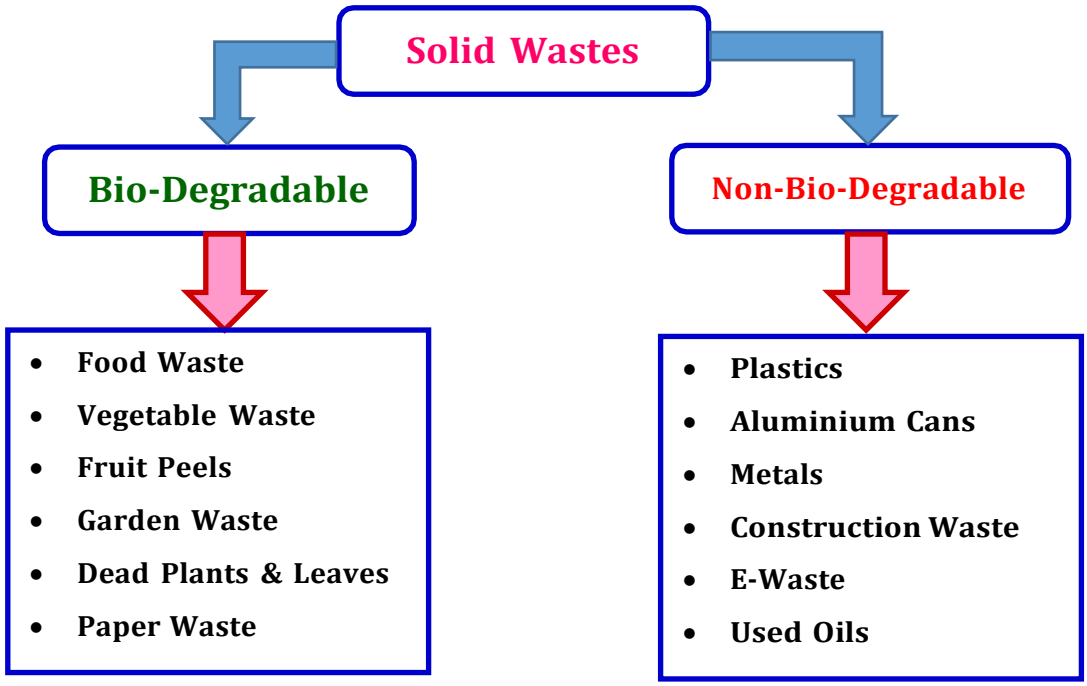
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART- C: GREEN AUDIT REPORT

8. WASTE HANDLING & MANAGEMENT

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-16 shows the process of treating the solid waste generated inside the college campus.

Table-16: Process of Waste Management

S. No.	Waste Type	Waste Treatment
Bio-Degradable Waste Management		
1.	Food and Vegetable Waste	Collected and fed to nearby farming
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 third 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	Used for sale to third party for recycling

8.3 : List of Approved E Waste:

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 Equipments • 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 • Audio & Video Equipments/Remote Controls, Projectors • Printed Circuit Boards • Barcode/QR scanners

Fig.5: Snap shots of Solid Waste Management (SWM)

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-C: GREEN AUDIT REPORT

9. ASSESSMENT ON MATURE TREES, GREEN ENERGY GENERATION & BIO-DIVERSITY

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 ***324 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 **324** which contributes for reduction of **7.1 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, 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 ***47,211.40 kWh*** which reduces **38.7 Tons 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 (2000 LPD in Boy's Hostel) 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 ***14,470 kWh*** which reduces ***11.9*** **Tons of CO_2 Emission/Annum.**

9.4 : Availability of Landscaping & 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.6: Indoor Plants and Green Coverage in the College Campus

9.5 : Recommendations for Miyawaki Forest:

Miyawaki is a technique (also called *Potted Seedling Method*) as that helps build dense, native, multi-layered forests. The approach is supposed to ensure that plant growth is 10 times faster and the resulting plantation is 30 times denser than usual. It involves planting dozens of native species in the same area, and becomes maintenance-free after the first three years. The overall density of the forest is beneficial in lowering temperature, making soil nutritious, supporting local wildlife and sequestration of carbon.

9.6 : Recommendations to maintain Bio-Diversity:

- **Bird Sighting and Survey:** Conduct a dedicated bird sighting and identify the list of birds both residing birds and migratory birds available in the college campus
- Prepare the list of birds with their local name, scientific name, their average life time, nesting facility created by the bird and photo of the bird. Show case the result to all the stake holder and inculcate a habit of friendly environment
- Discuss with the ornithologists and facilitate the environment with more birds coming to the campus and especially migratory birds.
- **Reptile & Amphibian survey:** Similar to bird survey; conduct a survey to list the amphibians available in the campus
- Amphibian and reptile surveys are often performed as part of the Green Audit process or terrestrial survey. These surveys are effective at detecting the presence of even the most elusive species.
- Since NANDHA ENGINEERING COLLEGE **campus has an excellent well; it is highly recommend to conduct the frog and toad survey around the pond and identify the species.**

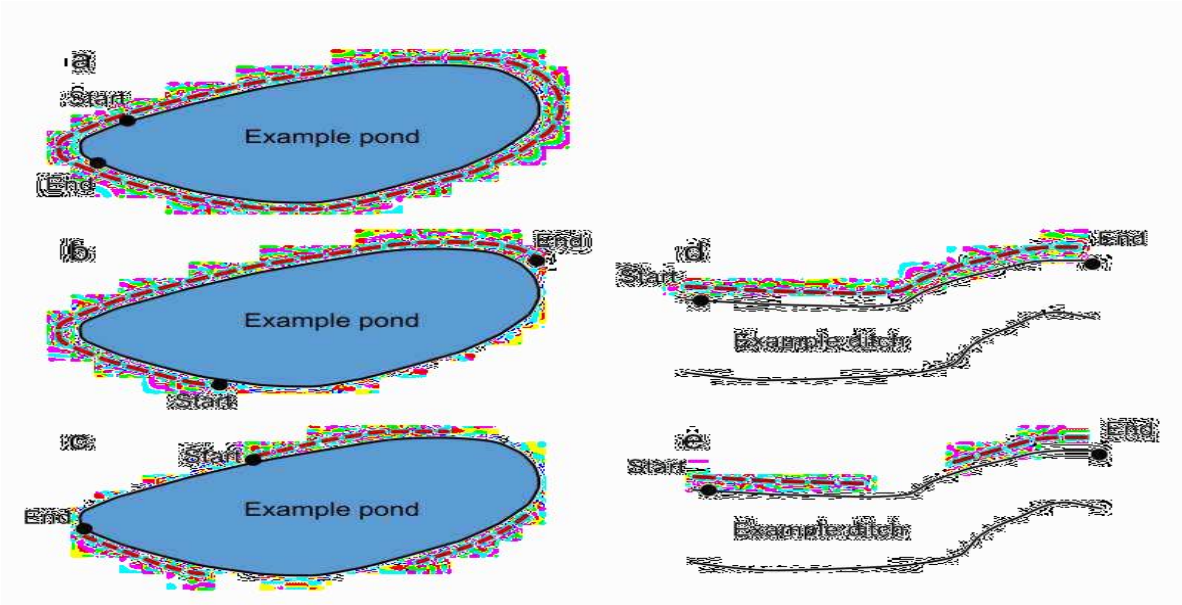


Fig.7: Diagram illustrating approaches to conduct the survey at a water body

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

10. AUDIT SUMMARY & CONCLUSION

SUMMARY OF THE AUDIT PROCESS:

In order to make the **NANDHA ENGINEERING 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 20-25 % 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. it is optimized to design the power capacity of the solar plant based on the day time consumption
- 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

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
- 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) 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
- 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 **NANDHA ENGINEERING COLLEGE (AUTONOMOUS)**, Erode – Perundurai Main Road, Vaikkaalmedu, Erode – 638052, Tamil Nadu, India by **RAM KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING**, Coimbatore – 641 062.

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

ANNEXURE:

AUTHORISED CERTIFICATES OF THE AUDITOR

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 16:22:42 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 2982 02

Delegate No. 71988

for TÜV NORD CERT GmbH

Essen, 2018-01-11

Course 18125 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 www.tuev-nord-cert.com

CQI | IRCA CERTIFIED COURSE

CQI | IRCA APPROVED TRAINING PARTNER

IGBC

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: 18th September 2020

Note : This certification is valid only for GRIHA version 2015.

Chief Executive Officer
GRIHA Council


CII
Confederation of Indian Industry
This is to certify that
SIVARASU S R
is a
CII Certified Professional in Sustainable Waste Management
K S Venkatagiri
Executive Director
CII - Godrej GBC
Pradeep Bhargava
Chairman
CII GreenCo Council
IGBC
E-Learning