ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

DETAILS OF THE CLIENT

CARE COLLEGE OF ENGINEERING

 # 27, THAYANUR , TRICHY – 620 009, TAMILNADU, INDIA

CARE
COLLEGE OF ENGINEERING

DATE OF AUDIT

07 & 08 APRIL 2021

AUDIT CONDUCTED AND SUBMITTED BY

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING

(Chennai ♦ Coimbatore ♦ Erode)

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ACKNOWLEDGEMENT

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING, Coimbatore – 641 062 is thankful to the Management, Principal, Faculty and Technical team members of **CARE COLLEGE OF ENGINEERING,** # 27, Thayanur , Trichy – 620 009, Tamilnadu, 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 **CARE COLLEGE OF ENGINEERING** extended all possible support and assistance resulting in thorough 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.

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ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

1. INTRODUCTION TO ENERGY-ENVIRONMENT-GREEN AUDIT

1.1: Preface about the Institution:

- **CARE College of Engineering** offers application oriented engineering courses with hands on training in one of the most conducive learning environments in India. It inculcates the value of life beyond curriculum and explores the full potential of the students. With the state of the art facilities and highly experienced and trained faculty members, our focus is on academics as well as holistic development of the students. Join CARE and step out into the real world as a true professional.
- **CARE** believes that the most promising opportunities for discovery exist at the intersections of disciplines, and that the technologies of the next century will grow out of multidisciplinary partnerships. CARE is committed to excellence in all its endeavours. Similarly, the leaders of tomorrow must be able to bridge multiple interests. Our teaching pedagogy ensures that students get exposed to a holistic approach to education, integrating physical, emotional and social development of our students. We complement this with a sound academic base which enables our students to get a head start in an increasingly complex world. Thus preparing them for the global challenges of tomorrow.
- **CARE** believes in partnerships between industry, government, and higher education to yield countless innovations. Our faculty value corporate partnerships for the insights they contribute as much as for the support they provide.

1.2: Vision:

- ✓ Transform lives through Education and Research

1.3: Mission Statement:

- ❖ CARE is dedicated to impart quality education to Students through critical thinking, creativity, leadership and the spirit of entrepreneurship
- ❖ The organization is committed to foster research and development in a conducive learning environment
- ❖ At CARE, we develop in each member, the ability and passion to work effectively for the betterment of humanity with cultural awareness, high ethical and moral values and a sense of social responsibility.

1.4: 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

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

S. No.	Details of the Faculty	Contribution
1.	**Mr. G. Vigneshwaran** Assistant Professor, Department of Civil Engg., **Mr. J. Vijay Anand, Plumber**	Collection of RO and STP system
2.	**Mr. G. Vigneshwaran** Assistant Professor, Department of Civil Engg., **Mr. A. Senthilkumar,** Electrician	Collection of Solar Thermal System
3.	**Ms. B. Sudha Priya** Assistant Professor, Department of Civil Engg., **Mr. J. Vijay Anand,** Plumber	Collection of Water Distribution System
4.	**Mr. K. Vetri Aadithiya** Assistant Professor, Department of Civil Engg.,	Collection of Air Conditioning System
5.	**Mr. M. Vigneshwaran** Assistant Professor, Department of Civil Engg., **Mr. A. Senthilkumar,** Electrician	Collection of UPS/SS/Inverter System
6.	**Mr. C.S. Murali** Assistant Professor, Department of Civil Engg., **Mr. A. Senthilkumar,** Electrician	Collection of Electrical Parameters
7.	**Mr. M. Vigneshwaran** Assistant Professor, Department of Civil Engg., **Mr. P. Raja Prabhu,** Operation Manager	Collection of LPG Consumption
8.	**Mr. S. Shiek Imam** Assistant Professor, Department of Civil Engg., **Mr. K. Mayavan,** Supervisor	Collection of Trees, Shrubs & Bushes
9.	**Mr. C.S. Murali** Assistant Professor, Department of Civil Engg., **Mr. K. Mayavan,** Supervisor	Collection of Transportation System
10.	**Mr. M. Vigneshwaran** Assistant Professor, Department of Civil Engg., **Mr. A. Selvakumar,** Lab Technician	Collection of Chemicals / Salts / Acids

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

2. EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

Electrical and Thermal Energy Analysis:

A detailed audit was conducted in **CARE COLLEGE OF ENGINEERING,** # 27, Thayanur , Trichy - 620 009, Tamilnadu, India. The audit team has come out with ***8 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)		4,49,030	4,49,294	4,57,270	3,84,930	1,89,660
Annual LPG Consumption (kg)		14,062	10,864	12,638	9,898	2,901
Summary of Energy Conversion (ENCON) Proposals						
S. No.	**Description**	**Parameters**				
		Present	**After**	**Savings**		
1.	Annual Energy Consumption	4,57,270 kWh + 12,638 kg LPG	4,03,925 kWh + 11,051 kg LPG	**53,345 kWh + 1,587 kg of LPG**		
2.	Annual Energy Cost	Rs. 47.8 Lakhs	Rs. 42.1 Lakhs	**Rs. 5.7 Lakhs**		
3.	Initial Investment Required	--	--	**Rs. 14.0 Lakhs**		
4.	Simple Payback Period	--	--	**Nearly 2.5 Years**		

Note:

- Apart from the Energy Conservation, the audit team proposes ***18 technical recommendations*** focusing on energy, equipment's life improvement, safety and best operating practices
- The above calculation was performed for the **year 2018-19** as all the energy carriers were fully functional 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 and LPG) used for regular applications are taken into account

Audit Conducted and Verified by

(Dr. S.R. SIVARASU)

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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)	**CARE COLLEGE OF ENGINEERING** (In the name of G. Narayanan Educational Trust)				
2.	Type of Utility Supply, Service No.& Tariff	HT SC. No: 069094420204; Tariff-HT-II—B-2				
3.	Tariff Structure	Rs. 6.35/kWh + Rs. 350/kVA as demand charges accounted for 90 % of the Permitted Demand				
4.	Energy Suppliers	Tamilnadu Generation & Distribution Corporation (TANGEDCO)				
5.	Permitted Demand (PD)	**300 kVA** (Demand Charges accounted for 90 % of PD)				
6.	Capacity of Diesel Generator (DG) Sets	**250 kVA (College) & 63 kVA (Hostel) – 1 Each**				
		All are air-cooling, Internal fuel tank (400 & 100 L capacity each) & separate earthing done				
7.	Annual Electricity Consumption (kWh)	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
		4,49,030	4,49,294	4,57,270	3,84,930	1,89,660
8.	Annual Electricity Generation from DG (kWh)	17,129	4,416	5,240	16,144	3,896
9.	Annual Diesel Consumption for DG (L)	5,305	2,737	2,070	5,260	2.151
Thermal Energy (Consumption)						
10.	Types of Thermal Energy Used	Liquified Petroleum Gas (LPG)			Cooking	
		Diesel (Ordinary)			Transport + DG	
11.	Annual LPG Consumption (kg)	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**
		14,062	10,864	12,638	9,898	2,901
12.	Annual Diesel Consumption for Transport (L)	38,359	33,946	31,873	23,077	18,107
13.	Solar Thermal System (Bathing Application)	**250 LPD x 3 No's = 750 LPD** Located in both Boy's and Girl's Hostel				
General Loads (Both Electrical and Thermal)						
14.	Lighting System	❖ **Indoor lighting**: Mixture of FTL & LED Lights				

		❖ The management is now committed to convert the existing FTL into LED in a phased manner
		❖ **Outdoor lighting:** All the street lightings are LED based energy efficient lamps powered with solar panels
15.	Lighting Feeder	❖ Lighting loads are separated from raw power and are supplied through lighting distribution board
16.	Fan Loads (Ceiling)	❖ Conventional ceiling fans only
17.	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 rood of the respective building
18.	Motors and Pump loads	• Mainly used for water distribution, purification and waste water treatment • Small motors are used in kitchen equipments
19.	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** • Total capacity of the UPS is **160 kVA**

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)	42.8	40.7	37.7	38.0	50.0
Electricity	38.6	43.9	44.4	45.2	41.0
LPG	17.6	15.4	17.9	16.9	9.0

- **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**

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

4. ESTIMATION OF CO_2 EMISSION AND NEUTRALIZATION

(ELECTRICITY, DIESEL, LPG, 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 (HT 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.	Solar Thermal System (Hot Water Generation)	Bathing application	500 LPD in Boy's Hostel
			250 LPD in Girls Hostel
5.	Mature Trees	The college has nearly **1,097** 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.	Electrical Energy	4,49,030 kWh	368.2	Wind	2,67,061 kWh	219.0
2.	Diesel	43,664 Litres	115.3	Mature Trees	1,097 Nos	23.9
3.	LPG	14,061 kg	42.2	Solar Thermal	7,750 kWh	6.4
4.	Total Emission		525.7	Total-Neutralized		249.3
Balance CO_2 to be Neutralized = 276.4 Tons/Annum & Per Capita CO_2 Consumption = 0.32 Tons/Annum [1]						

([1] Total strength of students, teaching and technical staff = 871)

(Note: Quantity of energy utilized from the solar thermal (750 LPD) is 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.	Electrical Energy	4,49,294 kWh	368.4	Wind	1,26,311 kWh	103.6
2.	Diesel	36,683 Litres	96.8	Mature Trees	1,097 Nos	23.9

3.	LPG	10,864 kg	32.6	Solar Thermal	7,750 kWh	6.4
4.	Total Emission		497.9	Total-Neutralized		133.8
Balance CO_2 to be Neutralized = 364.0 Tons/Annum & Per Capita CO_2 Consumption = 0.49 Tons/Annum [2]						

([2] Total strength of students, teaching and technical staff = 738)

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.	Electrical Energy	4,57,270 kWh	375.0	Wind	1,67,051 kWh	137.0
2.	Diesel	33,943 Litres	89.6	Mature Trees	1,097 Nos	23.9
3.	LPG	12,638 kg	37.9	Solar Thermal	7,750 kWh	6.4
4.	Total Emission		502.5	Total-Neutralized		167.3
Balance CO_2 to be Neutralized = 335.2 Tons/Annum & Per Capita CO_2 Consumption = 0.60 Tons/Annum [3]						

([3] Total strength of students, teaching and technical staff = 559)

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.	Electrical Energy	3,84,930 kWh	315.6	Wind	2,10,233 kWh	132.4
2.	Diesel	28,337 Litres	74.8	Mature Trees	1,097 Nos	23.9
3.	LPG	9,898 kg	29.7	Solar Thermal	4,650 kWh	3.8
4.	Total Emission		420.1	Total-Neutralized		200.1
Balance CO_2 to be Neutralized = 220.0 Tons/Annum & Per Capita CO_2 Consumption = 0.60 Tons/Annum [4]						

([4] Total strength of students, teaching and technical staff = 367)

(Note: Electrical equivalent of solar thermal (750 LPD) system is considered for 150 days/annum due to COVID lockdown)

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.	Electrical Energy	1,73,580 kWh	142.3	Wind	1,55,274 kWh	127.3
2.	Diesel	17,816 Litres	47.0	Mature Trees	1,097 Nos	23.9
3.	LPG	2,705 kg	8.7	Solar Thermal	1,550 kWh	1.3
4.	Total Emission		197.5	Total-Neutralized		165.7
Balance CO_2 to be Neutralized = 52.0 Tons/Annum & Per Capita CO_2 Consumption = 0.13 Tons/Annum [5]						

([5] Total strength of students, teaching and technical staff = 415)

(Note: Electrical equivalent of solar thermal (750 LPD) system is considered for 50 days/annum due to COVID lockdown)

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.,)

4.8: Calculation Table:

For Electricity = $\left[\text{kWh x } \frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}\right]$
For Diesel = $\left[\text{Diesel Consumption (Litre)x } \frac{2.64 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}\right]$
For LPG = $\left[\text{LPG Consumption (kg)x } \frac{3.0 \text{ kg of CO2 emission}}{\text{kg of LPG Consumption}}\right]$
A 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 $\frac{(21.8\ x\ 1097)}{1{,}000} = \mathbf{23.9}\ \frac{\textbf{Tons}}{\textbf{Annum}}$

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:

Vehicle pollution level is regularly monitored and are maintained within the prescribed limit since the college is committed to provide green environment for better atmosphere. The list of transporting vehicles along with their type of engine are represented in Table-9.

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

S. No.	Type of Vehicle & YOM	Type of Engine	Fuel Used	No. of Vehicles	Non Pollution Certificate
1.	BUS & AL-2010	AL-BS III	Diesel	1	Available
2.	BUS & AL-2011	AL-BS III	Diesel	1	Available
3.	BUS & AL-2011	AL-BS III	Diesel	1	Available
4.	BUS & AL-2011	AL-BS III	Diesel	1	Available
5.	BUS & AL-2011	AL-BS III	Diesel	1	Available
6.	BUS & AL-2011	AL-BS III	Diesel	1	Available
7.	BUS & AL-2011	AL-BS III	Diesel	1	Available
8.	BUS & AL-2012	AL-BS IV	Diesel	1	Available
9.	Car	Toyota	Diesel	1	Available
10.	Car	Maruthi	Diesel	1	Available
11.	Car	Bolero	Diesel	1	Available
Total No. of Vehicles				**11**	

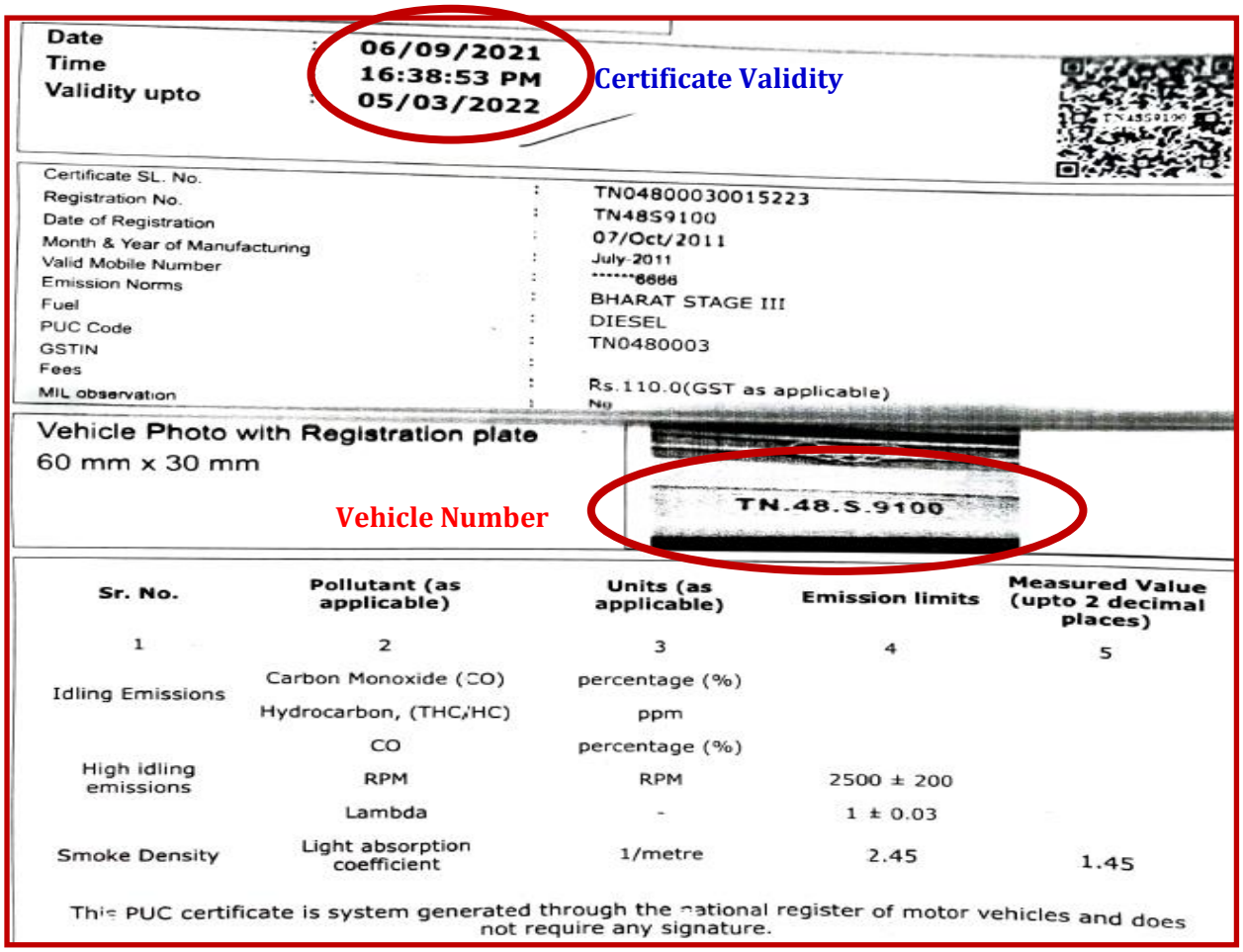


Fig.1: Sample Pollution Certificate of a Transport Vehicle

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

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

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

S. No.	Location	Quantity	Refrigerant Used	Global Warning Potential (GWP)	Ozone Depletion Potential (ODP)
1.	LIBRARY MAIN	1	R-22	1,810	Medium
2.	UPS ROOM	2	R-22	1,810	Medium
3.	MBA	4	R-32	675	Zero
4.	FIIND	2	Unknown	--	--
5.	FIIND	1	Unknown	--	--
6.	CONFERENCE HALL	8	R-22	1,810	Medium
7.	LIBRARY	1	R-22	1,810	Medium
8.	LIBRARY TOP	2	Unknown	--	--
9.	LIBRARY	6	R-22	1,810	Medium
10.	SERVER ROOM	2	R-22	1,810	Medium
11.	COMPUTER LAB	12	R-22	1,810	Medium
12.	CADD/CAM LAB	5	R-22	1,810	Medium
13.	LIBRARY	5	R-22	1,810	Medium
14.	LIBRARY	2	R-22	1,810	Medium
15.	LIBRARY	2	R-22	1,810	Medium
16.	ADMIN	15	R-22	1,810	Medium
17.	B.ARCH LIBRARY	3	R-32	675	Zero
18.	MSE LAB	3	R-22	1,810	Medium
19.	MBA Meeting Hall	2	R-22	1,810	Medium
20.	MBA Biz WaLT	2	R-22	1,810	Medium
21.	Fulcrum	2	R-22	1,810	Medium

- **Note:** The most environment-friendly refrigerants that are available in Indian market currently are “R-290” and “R-600A”. They are Hydrocarbons and their chemical names are “Propane” for R-290 and “Iso-Butane” for R-600A
- They are completely halogen free, have no ozone depletion potential and are lowest in terms of global warming potential. They also have high-energy efficiency but are highly flammable as they are hydrocarbons. (Kindly refer: https://www.bijlibachao.com/air-conditioners/comparison-of-various-refrigerants-r-410a-r-22-r-290-r-134a-used-for-air-conditioners-and-refrigerators.html).

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

6. USAGE OF CHEMICALS, SALTS & ACIDS

(STORAGE, HANDLING & BEST OPERATING PRACTICES)

6.1: General Instructions given to the Students while working in the Laboratories:

- Enter the lab with the appropriate lab coat
- If you do not attend lab lecture, you will not be permitted to do that lab.
- Closed shoes with socks must be worn at ALL times
- Before obtaining any chemicals, carefully read the label on the reagents bottles
- Securely replace lids, caps and stoppers after removing reagents from containers
- Report any accident or injury, inform to your instructor immediately
- All personal belongings should be placed in the bookcases as you enter the laboratory
- Clean up any spill immediately
- Eating are not allowed in a chemistry laboratory
- Long hair and loose clothing must be confined while in a laboratory
- Know the location and proper use of the fire extinguishers and first aid kits
- Do not perform unauthorized experiments or work in a laboratory alone
- Never return unused chemicals to their original container
- Before leaving the laboratory, make sure your work area is clean and dry. Ensure that all gas, water, Vacuum, and in air valves are completely turned off
- Your instructor is available for any assistance you may need. Never hesitate to ask questions especially if there are any questions concerning proper operating procedure. Be sure that you understand every instruction before you proceeding
- Thoroughly wash your hands after leaving the laboratory
- Data must be in INK and signed off by your assigned in charge before leaving lab
- Appropriate clothing must be worn all times while in the laboratory

6.2: Storage of Chemicals/Salts/Acids:

Less concentrated chemicals, salts and acids are stored in proper racks, cupboards and high concentrated acids are stored in separate area filled with sand.

- Most of the chemicals, salts and acids used in the science departments are inorganic in nature and no harmful effects are created during the experiment process
- Only trained teaching and non-teaching staffs are handling the chemicals and also they are well trained to handle any abnormal situations

Fig.2: Storage of Chemicals/Salts/Acids & Laboratory Equipments

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. 3 shows the sample eco-friendly Green Pro certified cleaning agents

Fig.3: 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. **CARE COLLEGE OF ENGINEERING** gets the water from different sources. Table-12 shows the source of water, location of storage along with their application.

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

<table>
<tr><th>Type of Water</th><th>Source</th><th>Location of Storage</th><th>Application</th></tr>
<tr><td rowspan="2">Fresh Water</td><td>Open well – 1 No</td><td rowspan="2">• Open well water is pumped to overhead tank (25-30 KL capacity in Admin Block) and also in the hostel building</td><td>Drinking & Cooking (Through RO Process)</td></tr>
<tr><td>Bore – 2 No (One at hostel + one at college)</td><td>Utensil Cleaning, Bathing, Cloth Washing</td></tr>
<tr><td rowspan="2">Rain Water</td><td rowspan="2">Rain Water collected through i) buildings run off and ii) road run-offs</td><td>Routed to an open well & also routed to Pond</td><td rowspan="2">Used to increase the ground water level</td></tr>
<tr><td>Recommend to apply to Ministry of Jal Sakthi for maintaining excellent water body</td></tr>
<tr><td>Treated Water from STP</td><td>Final output treated water from STP plant</td><td colspan="2">Used only for Gardening application</td></tr>
</table>

7.2: 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 using TDS meter 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

<table>
<tr><th>S. No.</th><th>Parameters</th><th>Description</th></tr>
<tr><td>1.</td><td>Total no. of RO Plant</td><td>• 02 No’s (Total 1,500 LPH)</td></tr>
<tr><td rowspan="2">2.</td><td rowspan="2">Capacity of each RO Plant</td><td>• College RO Plant – 1,000 LPH</td></tr>
<tr><td>• Hostel RO Plant – 500 LPH</td></tr>
<tr><td>3.</td><td>Source of raw water</td><td>• Bore water + Open Well Water</td></tr>
<tr><td>4.</td><td>% of RO & grey water output</td><td>• 50 RO water : 50 % grey water</td></tr>
<tr><td>5.</td><td>Usage of grey water</td><td>• Used for gardening application</td></tr>
<tr><td>6.</td><td>Cleaning schedule of filter (5 & 10 Micron)</td><td>• Weekly twice</td></tr>
<tr><td>7.</td><td>Cleaning schedule of membrane</td><td>• Yearly twice</td></tr>
</table>

8.	Back washing duration & Frequency	• 20 min for every day
9.	Functioning of RO Plant	• Floating sensor based water level automatic control of RO Plant in college • Manual operation of RO plant in hostel
10.	Quality of RO water	• Maintained less than 40-50 TDS
11.	Addition treatments	• Carbon and sand filter
12.	RO water storage	• Stored in food HPDE tank and then pumped for distribution
13.	Quality of water & testing certificates	• At regular interval (yearly twice); both RO and grey water quality was tested in the chemistry lab (Internal)
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 • Convert the hostel RO from manual operation to sensor based mode • Test the quality of the water (both RO & grey water) in a NABL accredited lab

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.4: Different Types of Taps used in Water Distribution Network

7.4: Sewage Treatment Plant (STP):

- The Institution has implemented conventional wastewater treatment plant with a total capacity of 1**,00,000 Liters/day**)

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

Collection Tank Capacity	100 KLD (8 x 6 x 3.5 ft)
Aeration Tank Capacity	100 KLD (10 x 6 x 3.5 ft)
Clarifier Tank	100 KLD (8 x 6 x 2.5 ft)
Sludge Sump	65 KLD (8 x 4 x 2 ft)
Intermittent & Treated Water Sump	65 KLD (8 x 4 x 2 ft)
Sludge Drying Bed	Internal tank (2 x 3 x 1.5 ft)
Usage of Treated Water & Sludge	Gardening Application

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

- The audit team appreciates the effects taken by the management of CARE COLLEGE OF ENGINEERING 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 building run off are collected through each pits mostly located in each buildings. Common area and road run-off are properly collected and routed to i) Pond and ii) Open well.

Fig.5: Rain Water Harvesting (RWH) system implemented in the College

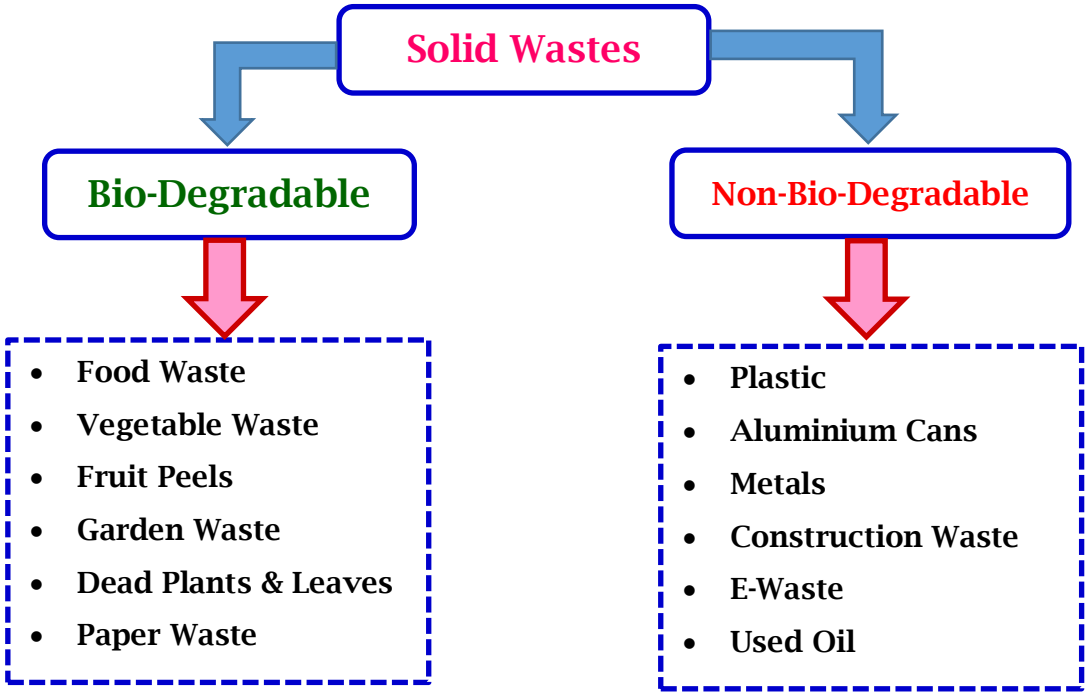
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

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-15 shows the process of treating the solid waste generated inside the college campus.

Table-15: 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	Separately given below. 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.6: Solid Waste Management (Collection, Segregation and Storage)

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-C: GREEN AUDIT REPORT

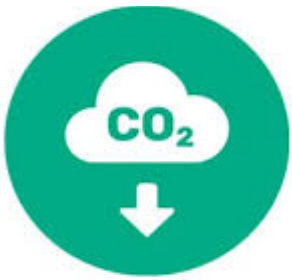
9. ASSESSMENT ON MATURE TREES, GREEN ENERGY GENERATION & BIO-DIVERSITY

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 ***1,097 with 10 varieties of trees.*** Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowering shrubs and bushes. Table-16 shows the list of mature trees available inside the college + hostel campus.

Table-16: List of Mature Trees Available in the College Campus

S. No.	Location	Name of the Tree	Botanical Name	Quantity
1.	Boys Hostel	Mixed Trees	--	81
2.	Girls Hostel	Mixed Trees	--	71
3.	Main Road	Mixed Trees	--	209
4.	Entrance	Mixed Trees	--	28
5.	Ground	Mixed Trees	--	69
6.	Common Area	Plumeria	Frangipani	77
7.	Common Area	Itchi Tree	Litchi Chinensis	4
8.	Common Area	Palm Tree	Arecaceae	63
9.	Common Area	Arasamaram	Ficus religiosa	7
10.	Common Area	Batham Tree	Prunus Dulcis (Almond)	28
11.	Common Area	Mahogany	Swietenia	92
12.	Common Area	Coconut	Cocos Nucifera	342
13.	Common Area	Neem	Azadirachta Indica	8
14.	Common Area	Mixed Trees	--	18
Total				**1,097**



Total No. of Mature Trees available in the college campus is **1,097** which contributes for reduction of **23.9 Tons of CO_2 emission/Annum**

9.2: Hot Water Generation using Solar Thermal System:

- In order to promote more green generation; the management has installed Solar Thermal system in the staff quarter's roof top and generates hot waters for bathing application
- It is a good practice to use renewable energy based system for hot water generation by avoiding conventional heating methods (electricity or wood based)
- The specifications of the existing solar thermal hot water system is shown in Table-17.

Table-17: Specifications of the Solar Thermal Hot Water System

Total Capacity (LPD)	250 Litre x 2 Nos	250 Litre x 1 No
Make and Model	Sudarshan saur	Sudarshan saur
Location	Boys hostel	Girls Hostel
Panel Orientation	North - South face	North - South face
Source of Water	Bore well	Bore well
Application	Bathing only	Bathing only
Year of Installation	2014	2014
Total Capacity	**500**	**250**

Fig.7: Solar Thermal Hot Water Generating System for Bathing Application

Annual energy saved from the solar hot water system used for bathing is ***7,750 kWh*** which reduces ***6.4*** Tons of CO_2 Emission/Annum.

9.3: Campus Green Environment, Indoor Plants & Common Water Body:

- The audit team appreciates that the management has a vision to provide lush green and best environment for the learning system by building equal to green building guidelines with the following advantages; i) More natural lighting penetration, ii) Clean indoor air, iii) Less heat load on the roof and wall, iv) better collection of rain water and v) planting indoor plants & trees.
- 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.8: Indoor Plants and Green Coverage in the College Campus

9.4: Bio-Diversity in the Campus:

- Biodiversity is all the different kinds of life you'll find in one area—the variety of animals, plants, fungi, and even microorganisms like bacteria that make up our natural world.
- Each of these species and organisms work together in ecosystems, like an intricate web, to maintain balance and support life.
- Biodiversity supports everything in nature that we need to survive: food, clean water and shelter.
- **CARE COLLEGE OF ENGINEERING campus is blessed with more varieties of resident birds (species always living inside the campus)** and amphibians (Amphibians are small vertebrates that need water, or a moist environment, to survive).

9.5: 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
- **Reptile & Amphibian survey:** Similar to bird survey; conduct a survey to list the amphibians available in the campus

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

10. AUDIT SUMMARY & CONCLUSION

SUMMARY OF THE AUDIT PROCESS:

In order to make the **CARE COLLEGE OF ENGINEERING** campus 100 % energy efficient; Environmental sustainability and lush Greenery; the audit team recommends to implement the following measures:

I. Energy Conservation & Management – Electrical Energy:

- Operate the transformer mostly at 50 % load and reduce the self-loss of the transformer.
- Monitor the transformer self-loss daily and compare with the design value. It the value is higher; discuss with the OEM.
- Propose a scheme to replace the existing transformer (YoM of 1998 and 2000) into IS-1180 star rated energy efficient transformer which has lesser self-consumption at 50 % and 100 % load condition. While proposing this ENCON; support the ensured energy saved through the existing readings. Buy back offer is the best option to replace the transformer.
- Counter reading in the OLTC must be recorded at regular interval. Proper maintenance (like cleaning of brushes) to be carried out.
- Monitor the health of the APFC & FC. Fine tune reactive power based on the load condition
- As per the Solar Purchase Obligations (SPO) as the Tamil Nadu Solar Policy-2019, it is recommended to install a 50 kW roof top plant and reduce the dependency of EB utility power. However; it is optimized to design the power capacity of the solar plant based on the day time consumption
- 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
- 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 types 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
- 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

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 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 quantity of inlet & outlet water
- 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
- Captures 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 faculties

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
- 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 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. Installation of Roof Top Solar Photovoltaic Power Plant (SPP):

- All the electricity consumers (irrespective of their tariff structure) are eligible to install SPP in their roofing; start generating power and being fully utilized by the consumer (connecting the inverter output to any of the SSB or in the MV panel).
- Now TANGEDCO opens all the consumers can install SPP in their roofing and connected the power through net metering system in order to export the power to utility during excess generation. Also it allows the consumer to import power from the utility when the college needs power.
- Installation of renewable energy based power generation might be mandatory in future (as per policies of either state or central or both). Some bankers are now insisting that the consumer has to install a quantum of renewable energy system to reduce their carbon footprint when they avail top-up loads for expansion activities.
- Further; during the environment assessment; power generation from the solar plant is being utilized to neutralize the CO2 emission. Hence it will be value added utility for the company.
- After measuring the terrace; appropriate power capacity of SPV plant must be installed. However the audit team recommends the following options on the total capacity;
- **Option-I:** 10 kW capacity of SPP roughly generates 40 to 50 units per day and generates nearly 12,800 to 16,000 units per annum (considering 320 working days) which contributes 20 % of the total annual electricity consumption.
- **Option-II:** 25 kW capacity of SPP roughly generates 100 to 125 units per day and generates nearly 32,000 to 40,000 units per annum (considering 320 working days) which contributes 50 % of the total annual electricity consumption.

VII. 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 report is prepared as a part of the Energy, Environment and Green Audit process conducted at **CARE COLLEGE OF ENGINEERING,** # 27, Thayanur , Trichy – 620 009, Tamilnadu, 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 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. 71968

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.

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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

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

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ISO 14064-3:2019
ISO 14066:2011
ISO 14067:2018

AND CERTIFY HIM/ HER AS

IMPLEMENTOR & AUDITOR
CARBON FOOTPRINT MANAGEMENT

This certificate is awarded for successful completion of Global Virtual Training course conducted from August 27, 2021 to September 01, 2021. It's serves as a proof of his/her knowledge, competence and ability to implement, verify and validate carbon footprint as per above mentioned standards and methods. This certificate was awarded on August 01, 2021.

01.09.21
DATE

SIGNATURE

010920211006

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