ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

AUDIT CONDUCTED FOR

SRM COLLEGE OF AGRICULTURAL SCIENCES

Vendhar Nagar, Baburayanpettai, Chengalpattu (Dt),

Tamil Nadu – 603 201, India.

SRMCAS
College of Agricultural Sciences

DATE OF AUDIT

20 APRIL 2023

AUDIT CONDUCTED BY

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING

(Chennai ♦ Coimbatore ♦ Erode)

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ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

1. ACKNOWLEDGEMENT

ACKNOWLEDGEMENT

RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING, Coimbatore – 641 062 is thankful to the Management, Principal, Faculty and Technical team members of **SRM COLLEGE OF AGRICULTURAL SCIENCES,** Vendhar Nagar, Baburayanpettai, Chengalpattu (Dt), Tamil Nadu – 603 201, 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 **SRM COLLEGE OF AGRICULTURAL SCIENCES** 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.

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.

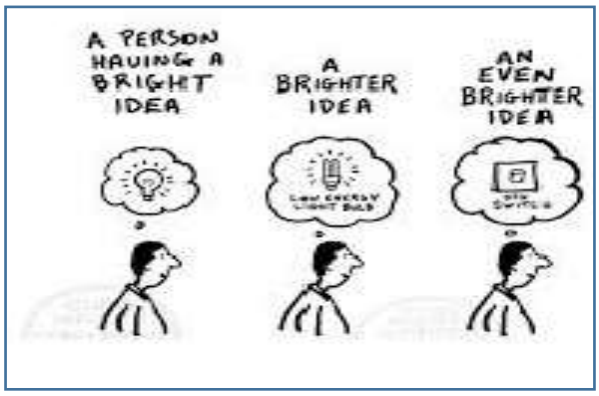
Management Team Members	
Dr. T. R. PAARIVENDHAR	Chancellor & Founder
Dr. RAVI PACHAMOOTHOO	Pro-Chancellor (Administration)
Dr. P. SATHYANARAYANAN	Pro-Chancellor (Academic)
Prof. C. MUTHAMIZHCHELVAN	Vice Chancellor
Dr. S. PONNUSAMY	Registrar
Dr. M. JAWAHARLAL	Dean, SRMCAS

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. R. Marimuthu	**Junior Engineer**

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

2. INTRODUCTION TO

ENERGY-ENVIRONMENT-GREEN AUDIT



2.1: Preface about the Institution:

- **SRM-COLLEGE OF AGRICULTURAL SCIENCES** comes under the umbrella of its parent institution, SRM Institute of Science and Technology. The UG programme B.Sc., (Hons) Horticulture was started from the academic year **2018-19** and B.Sc., (Hons) Agriculture was introduced from **2019-20**.
- A **new campus** has been established in **Vendhar Nagar, Baburayanpettai near Acharapakkam** in about 187 acres of land and started functioning from March 2021. The total strength of students on the campus is 823, including 635 in Agriculture and 188 in Horticulture.
- **SRM-CAS** provides the perfect learning environment with the main aim to educate and groom students into trained professional managers in the field of Agriculture and Horticulture.
- Several infrastructure facilities have been created towards Agricultural education. Adequate numbers of spacious classrooms with LCD Projectors & WiFi network, excellent computer facilities and departmental laboratories have been created in the **SRM-College of Agricultural Sciences**.
- Students can access high-speed internet connection at any time, no-matter wherever they are in the campus. Apart from this the institute has a good playground to encourage students to take part in sports, games and yoga activities.
- Fully equipped library with all latest subject related books and a main library with more than one lakh books. Conference hall with video conferencing facilities and audio – video (AV) laboratory to train students in spoken English and various skills essential for communication like listening, reading, speaking and writing through computer assisted language learning software.
- Students are also trained in various agriculture related software's such as QGIS, GrassGIS, ILWIS, Map Window for applying the geographical information systems (GIS) in Agriculture.
- A team of **eminent qualified Ph.D. Degree holders**, **well qualified, experienced and dedicated**, research minded, dynamic and committed Faculty and academic staff members in the relevant branches of Agriculture and Horticulture are available at **SRM-CAS** and this is the backbone for the institute. The college has excellent Faculty Student ratio.

2.2: Vision:

- To establish a Futuristic Institution for Higher Education and Research in Agriculture and Allied Sciences integrating Ecology, Food, Nutrition and Health

2.3: Mission:

- The overall mission of the Faculty of Agricultural Sciences is to provide knowledge and support for teaching, capacity-building and conducting research on the principles and practices for climate-smart, sustainable agriculture to produce healthy food under water-limiting conditions.
- Design appropriate agricultural courses which will meet the aspirations and needs of young students, agricultural professionals and Aspirational Farming Community
- Promote agroecological farming with principles to support the adaptation of agriculture and allied activities for coping with the hazards of climate change towards food and livelihood security
- Focus on innovative methods and practices in agricultural / horticultural crops for economic water use with enhanced water productivity

- Bridge the gap between agriculture and other sciences through, hybridized, integrated approaches
- Concentrate on value chain for agroecological market produce; strengthen community-based extension for changing agriculture to agribusiness.
- Foster the science of healthy food and nutrition for nutritional security with herbal and nutri farming
- Promote agricultural rural development with secondary agriculture; reversing the dis-interest in farming as a profession
- Empowering farmers and farm women with modern extension delivery system

2.4: Major Activities in the Institution:

2.5: 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.

2.6: Outcomes of the Audit Process:

- Recommendations based on field measurement with achievable **En**ergy **Con**servation (ENCON) proposals under **No cost/Low cost and Cost investment categories**
- **Minimization of present energy cost** by adjusting and optimizing energy usage and reduction of energy wastage without affecting the regular activities
- **Identification of possible cost and energy saving from energy conservation, waste reduction, reuse and recycling**
- Formation of methodology for long term road map for maintaining green environment within the campus and encourage the stakeholders for continuous improvements

2.7: Audit Approach:

The audit team completed the assessment of energy consumption in the factory premises and operating hours of each machines (system) using two approaches namely **i) Objective Approach** in which a detailed measurement was taken and **II) Subjective Approach** in which field data is collected from the maintenance department.

2.8: Standards Used:

- Bureau of Energy Efficiency (BEE) Guidelines to conduct the detailed energy audit process
- **ISO 14064-Part-1** – Specification with guidance at the organization level for quantification and reporting of GHG emissions and removals (Second Edition)
- **ISO 14064-Part-2** – Specification with guidance at the project level for quantification, monitoring and reporting of GHG emissions reductions or removal enhancement (Second Edition-2019)
- **ISO 14064-Part-3** – Specification with guidance for the verification and validation of GHG statements (Second Edition-2019)
- The Greenhouse Gas Protocol - A Corporate Accounting and Reporting Standard (Revised Edition) released by World Resources Institute & World Business Council for Sustainable Development – 2014
- Ministry of Environment, Forest and Climate Change Notification on **"Battery Waste Management Rules, 2020" & "E-Waste (Management) Rules, 2016", & "Solid Waste Management Rules, 2015"s**

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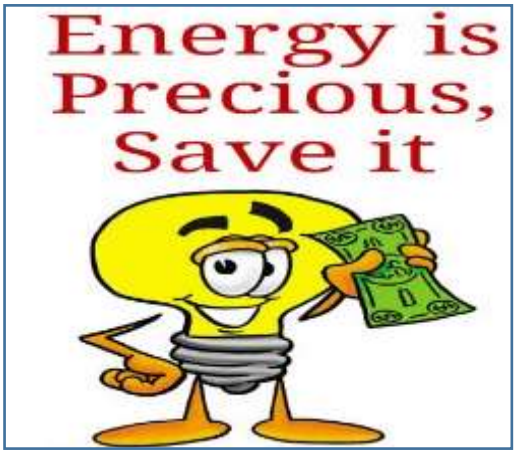
3. EXECUTIVE SUMMARY



EXECUTIVE SUMMARY

Energy Analysis:

A detailed audit was conducted **SRM COLLEGE OF AGRICULTURAL SCIENCES**, Vendhar Nagar, Baburayanpettai, Chengalpattu (Dt), Tamil Nadu – 603 201, India. The audit team has come out with ***10 Energy Conservation Proposals (ENCONs) + 01 ENCON on Renewable Energy Source*** and the summary of all the ENCONs are given below:

Description/Year		**2021-22**		**2022-23**
Annual Electricity Consumption (kWh)		**1,91,010**		**6,73,518**
Annual LPG Consumption (kg)		**14,190**		**22,512**
Summary of Energy Conversion (ENCON) Proposals				
S. No.	**Description**	**Parameters**		
		Present	**After**	**Savings**
1.	Annual Energy Consumption	**6,73,518 kWh + 22,512 kg LPG**	6,38,583 kWh + 16,448 kg LPG	**34,935 kWh + 6,064 kg**
2.	Annual Energy Cost	Rs. 112.8 Lakhs	Rs. 101.8 Lakhs	**Rs. 11.0 Lakhs**
3.	Annual CO_2 Emission	619.8	572.8	**47.0**
4.	Initial Investment	**Rs. 9.9 Lakhs**		
5.	Simple Payback Period	**Nearly 0.9 Years (11 Months)**		
6.	Overall Energy Savings	**5.2 % Electricity + 26.9 % LPG**		

Note:

- Apart from the Energy Conservation, the audit team proposes ***many technical recommendations*** focusing on energy, equipment's life improvement, safety and best operating practices
- All types of energy carriers (like Electricity, LPG and Wood) used for regular applications are considered

Audit Conducted & Verified by

(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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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
			Annual Energy Savings	Monetary Savings (Rs.)		
1.	Reduction of Cable Losses and Active Power Consumption using Capacitor Compensation	1 % on Electrical	6,735 kWh	89,576	32,000	0.4 Years
2.	Reduction of Belt & Pulley Transmission Losses from Motor to Machine in STP Aerator Blower Motor.	8 % on STP Motor	1,200 kWh	15,960	5,000	0.3 Years
3.	Reduction of Energy Consumption through retrofitting VFD in One of the Aerator Blower Motor.	20 & on STP Motor	2,800 kWh	37,240	50,000	1.4 Years
4.	Replacement of Existing Water Pumps into BEE Star Labelled Energy Efficient Motor-Pumps.	20 % on Motor	3,200 kWh	42,560	30,000	0.7 Years
5.	Replacement of Existing Convention Ceiling Fans into EC BLDC Fans	50 % on Fans Load	21,000 kWh	2,79,300	3,60,000	1.3 Years
6.	Reduction of LPG Consumption using Burner Cleaning and Swapping of Active Burners.	3 % of LPG for Stoves	270 kg	28,161	10,000	0.4 Years
7.	Reduction of LPG Consumption by converting VOT system in to Liquid Off-Take System	Technology Substitution	593 kg	61,850	90,000	1.5 Years
8.	Reduction of LPG Consumption in Dosa making Stove with Radiant Burners.	20 % LPG on Dosa Stove	1,351 kg	1,40,909	150,000	1.1 Years
9.	Reduction of Heat Energy Exposed in the Boiler Outer Side + Steam Pipes Lines using TCC	10 % LPG on Boiler	450 kg	46,935	60,000	1.3 Years
10.	Reduction of LPG Consumption in Boiler Feed Water Pre-heating using Solar Thermal Energy System	Fuel Substitution	3,400 kg	3,54,620	200,000	0.6 Years
Total			**34, 935 kWh + 6,064 kg**	**10,97,111**	**9,87,000**	–
ENCON on RES: Installation of Roof Top Solar Photovoltaic Power Plant (SPP) and Reduction in the Energy Billing						

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PART-A: ENERGY AUDIT REPORT

4. STUDY ON ENERGY CONSUMPTION & GENERATION PATTERN

4.1: Assessment of Existing Electrical and Thermal Energy Systems:

<table>
<tr><th>S. No.</th><th>Description</th><th colspan="5">Details</th></tr>
<tr><td colspan="7">Electrical Energy Usage</td></tr>
<tr><td>1.</td><td>Name of the customer</td><td colspan="5">SRM COLLEGE OF AGRICULTURAL SCIENCES</td></tr>
<tr><td>2.</td><td>Communication Address</td><td colspan="5">Vendhar Nagar, Baburayanpettai,
Chengalpattu (Dt), Tamil Nadu – 603 201, India</td></tr>
<tr><td rowspan="2">3.</td><td rowspan="2">Service Number</td><td colspan="5">SC No.: 09-589-003-762 (LT service with Load: 112 kW)</td></tr>
<tr><td colspan="5">SC No.: 09-909-411-1466 (HT service with Load: 250 kVA)</td></tr>
<tr><td rowspan="2">4.</td><td rowspan="2">Type of Supply & Tariff</td><td colspan="5">LT Tension (LT) Consumer; Tariff-LT-II B</td></tr>
<tr><td colspan="5">HT Tension (LT) Consumer; Tariff-HT-II B</td></tr>
<tr><td rowspan="4">5.</td><td rowspan="4">Tariff Structure (As per ToD) (*New tariff applicable from September-2022)</td><td rowspan="2">Description</td><td colspan="2">Old (Rs.)</td><td colspan="2">New * (Rs,)</td></tr>
<tr><td>LT</td><td>HT</td><td>LT</td><td>HT</td></tr>
<tr><td>Unit Charges</td><td>6.35/kWh</td><td>6.35/kWh</td><td>7.50/kWh</td><td>7.50/kWh</td></tr>
<tr><td>Fixed Charge</td><td>70/kW</td><td>350/kVA</td><td>150/kW</td><td>550/kVA</td></tr>
<tr><td>6.</td><td>Energy Suppliers</td><td colspan="5">Tamilnadu Generation & Distribution Corporation (TANGEDCO)</td></tr>
<tr><td rowspan="2">7.</td><td rowspan="2">Capacity of Diesel Generator (DG) Sets</td><td colspan="5">365 kVA (Internal fuel tank – 500 L)</td></tr>
<tr><td colspan="5">250 kVA (External fuel tank – 300 L)</td></tr>
<tr><td>8.</td><td>DG Operation</td><td colspan="5">Manual operation only</td></tr>
<tr><td colspan="7">Annual Energy Consumption, Generation from DG & Diesel Consumption</td></tr>
<tr><td colspan="3">Parameters</td><td>2021-22</td><td colspan="3">2022-23</td></tr>
<tr><td colspan="3">Electricity (kWh)</td><td>1,91,010</td><td colspan="3">6,73,518</td></tr>
<tr><td colspan="3">Diesel Consumed (L) for generating electricity</td><td>71,428*</td><td colspan="3">74,960*</td></tr>
<tr><td colspan="7">(* Note: During the initial days of college establishment; only DG power is being used)</td></tr>
<tr><td colspan="7">Thermal Energy Used</td></tr>
<tr><td rowspan="2">9.</td><td colspan="4">Liquified Petroleum Gas (LPG)</td><td colspan="2">Cooking</td></tr>
<tr><td colspan="4">Diesel (Ordinary) + Petrol (Ordinary)</td><td colspan="2">Transport+ DG</td></tr>
<tr><td colspan="7">Annual Energy Consumption</td></tr>
<tr><td colspan="3">Parameters</td><td>2021-22</td><td colspan="3">2022-23</td></tr>
<tr><td colspan="3">LPG (kg)</td><td>14,190</td><td colspan="3">22,512</td></tr>
<tr><td colspan="3">Diesel – Transport (L)</td><td>2,283</td><td colspan="3">6,665</td></tr>
<tr><td colspan="3">Petrol – Transport (L)</td><td>NIL</td><td colspan="3">834</td></tr>
</table>

General Loads (Both Electrical and Thermal)		
10.	Lighting System	❖ **Indoor lighting**: Mostly of 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 ❖ Requested to **retrofit timer based ON-OFF** control in the existing street lighting system
11.	Fan Loads (Ceiling)	❖ Conventional ceiling fans only ❖ The audit team requested to change the conventional fans into **BLDC based Electronically Commutated fans** in a phased manner
12.	Air Conditioning System	• Mostly **BEE star rated** ACs and the outdoor units are mostly placed in shaded area of the respective building
13.	Motors and Pump loads	• Mainly used for water distribution, purification and waste water treatment • Small motors are used in hotel kitchen equipment's & in the canteen
14.	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 nearly **66 kVA**

Table-2: Annual Energy Consumption and Energy Generation (2021-22)

S. No.	Month	Electricity Consumption (kWh)*	LPG Consumed (kg)	Diesel Consumed (L)		
				DG	Transport	Total
1.	Jun-21	8,680	0	205	0	205
2.	Jul-21	6,612	0	227	154	381
3.	Aug-21	17,154	273	116	0	116
4.	Sep-21	8,996	1,323	1,230	31	1,261
5.	Oct-21	21,066	1,197	4,750	327	5,077
6.	Nov-21	8,996	1,281	2,370	347	2,717
7.	Dec-21	19,794	1,785	2,520	307	2,827
8.	Jan-22	11,916	840	1,705	164	1,869
9.	Feb-22	30,478	1,764	7,205	153	7,358

10.	Mar-22	16,674	1,653	17,840	283	18,123
11.	Apr-22	21,972	2,058	18,600	302	18,902
12.	May-22	18,672	2,016	14,660	213	14,873
Total		1,91,010	14,190	71,428	2,283	73,711

- Electricity consumption includes both the LT services
- June & July is the initial period of the college establishment and hence the fuel consumption are less
- The cost of the electricity is Rs. 17.3/kWh.
- The cost of the LPG is Rs.78.5/kg

Table-3: Annual Energy Consumption and Energy Generation (2022-23)

S. No.	Month	Electricity Consumption (kWh)	LPG Consumed (kg)	Diesel Consumed (L)			Petrol Consumption (L)
				DG	Transport	Total	
1.	Jun-22	28,537	2,184	20,670	180	20,850	0
2.	Jul-22	45,982	2,268	16,420	449	16,869	0
3.	Aug-22	91,229	2,352	4,910	450	5,360	85
4.	Sep-22	42,191	2,205	5,550	794	6,344	173
5.	Oct-22	75,688	2,205	3,980	1,046	5,026	103
6.	Nov-22	70,455	2,331	5,450	674	6,124	75
7.	Dec-22	70,855	2,604	5,400	863	6,263	141
8.	Jan-23	87,377	2,520	1,760	372	2,132	58
9.	Feb-23	81,933	2,100	3,925	749	4,674	105
10.	Mar-23	79,271	1,743	6,895	1,089	7,984	94
Total		6,73,518	22,512	74,960	6,665	81,625	834

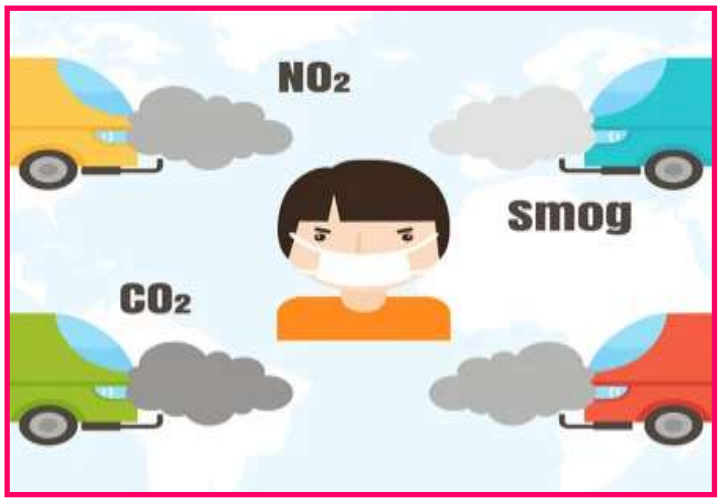
- The cost of the electricity is Rs. 13.30/kWh.
- The cost of the LPG is Rs.104.30/kg

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

5. ESTIMATION OF CO_2 EMISSION & NEUTRALIZATION

(ELECTRICITY, LPG, DIESEL, PETROL & MATURE TREES)



5.1: Assessment of Annual Energy Usage:

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

Table-4: Energy Carriers, Application area and their sources used for College Operation

S. No.	Type of Energy Carrier	Application Area	Source of Procurement
1.	Electricity (LT Services - 2 Nos)	Powering to all electrical / electronic / HVAC equipment's	From TANGEDCO
2.	Diesel	Transport vehicles and Diesel Generator (Captive Generation)	From authorised distributor
3.	Petrol	Transport vehicles	
4.	Liquified Petroleum Gas (LPG)	Used only for cooking	From authorised distributor
			From local vendor
5.	Mature Trees, Bushes & shrubs	The college has nearly **4,566** mature trees of different varieties which are more than 5 years old.	

5.2: Environmental System: CO_2 Balance Sheet:

→ CO_2 Balance sheet is the indicator on the carbon emission and their neutralization in a year

→ As per the Environmental Management System (EMS); only Scope-1 & Scope-2 based energy consumption is accounted.

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

Table-5: Environmental System: CO_2 Balance Sheet (2021-22)

S. No.	Annual Energy Consumption & CO_2 Emission			Annual CO_2 Neutralization		
	Description	Energy Quantity	CO_2 Emission (Tons)	Description	Parameters	CO_2 Neutralized (Tons)
1.	Electricity – EB	1,91,010 kWh	156.6	Electricity - DG	2,18,704 kWh	179.3
2.	Diesel	73,711 Litre	194.6	Mature Trees	4,566 Nos	99.5
3.	LPG	14,190 kg	42.6			
Total Emission			393.8	Total-Neutralized		278.9
Balance CO_2 to be Neutralized = 114.9 Tons/Annum						

Table-6: Environmental System: CO_2 Balance Sheet (2022-23)

S. No.	Annual Energy Consumption & CO_2 Emission			Annual CO_2 Neutralization		
	Description	Energy Quantity	CO_2 Emission (Tons)	Description	Parameters	CO_2 Neutralized (Tons)
1.	Electricity – EB	6,73,518 kWh	552.3	Electricity - DG	2,18,900 kWh	179.5
2.	Diesel	81,625 Litre	215.5			

3.	LPG	22,512 kg	67.5	Mature Trees	4,566 Nos	99.5
4.	Petrol	834 Litre	1.9			
Total Emission			837.2	Total-Neutralized		279.0
Balance CO_2 to be Neutralized = 558.2 Tons/Annum						

5.3: Calculation Table:

For Electricity $= \left[\text{kWh x } \frac{0.82 \text{ kg of CO2 emission}}{\text{kWh}}\right]$
For Diesel $= \left[\text{Diesel Consumption (Litre)x } \frac{2.64 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}\right]$
For Petrol $= \left[\text{Petrol Consumption (Litre)x } \frac{2.32 \text{ kg of CO2 emission}}{\text{Litre of Fuel Consumption}}\right]$
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 21.8 kg/annum; $\frac{(21.8\ x 4{,}566)}{1{,}000} = 99.5\ \frac{\textbf{Tons}}{\textbf{Annum}}$

5.4: Recommendations:

From the above discussion points; it is evident that activities taken forward to neutralize the CO_2 is predominant and to become a Net-Zero Carbon Emission buildings. The management has to plan several activities achieve the target.

- Increase the foot print of trees planted inside the college campus.
- Encourage the students to plant more trees and account them all.
- It is a right time to install considerable amount of roof top solar PV plant and generate the electricity. This must reduce the utility supply and hence reduce the direct CO_2 reduction. As per the Solar Policy-2019 from Government of Tamilnadu; for any educational institutions have to implement substantiate a minimum of 6 % of its energy generation from renewable energy source.
- Convert existing convention street lightings into solar based battery-operated lightings.
- Identify higher fuel consuming vehicle and either rework or replace it.
- Conduct training programmes for the transport staffs at regular interval and encourage them to maintain the vehicles at good condition throughout the year.

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

6. TRANSPORT & REFRIGERANT GASES IN AC SYSTEM

6.1: List of Transport Vehicles:

Pollution level of all vehicles are 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-7.

Table-7: List of Transporting Vehicles available in the College

S. No.	Type of Vehicle	Type of Engine	Fuel used	No. of vehicles	Pollution certified (Y/N)
1	BUS	BS-III	Diesel	03	Yes
	CAR	BS-IV	Petrol	01	Yes
3	CAR	BS-VI	Diesel	01	Yes
4	Minibus	BS-IV	Diesel	02	Yes
Total No. of Vehicles				**07**	

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

Most of the AC system has **R-32** as refrigerant which has **Global Warning Potential (GWP) of 675 and Ozone Depletion Potential (ODP) is Zero.**

Table-8: List of Multi-variant AC System available in the SRM-CAS

S. No.	Location	Tonnage Capacity (TR)	Quantity	Refrigerant Type
A - Block				
1.	Dean Office	3	1	R 32
2.	Conference Hall	2	2	R 32
3.	PA Room	1	1	R 32
4.	Academic Coordinator	1	1	R 32
5.	AME Office	1	1	R 32
6.	Accounts Office	1	1	R 32
7.	Office Room	1	1	R 32
8.	Office Room	1	1	R 32
9.	Chancellor Room	3+2	2	R 32
10.	Examination Cell	2	3	R 32
B – Block				
11.	Associate Director room	1.5	1	R 32
12.	Coordinator Room	2	1	R 32
13.	Data Center	3	2	R 32
14.	UPS Room	1.5	2	R 32
15.	S3 – Staff Room	3	1	R 32
16.	S4 – Staff Room	3	1	R 32
17.	Auditorium	3	3	R 32

18.	Auditorium	1	1	R 32
E – Block				
19.	Ground floor	1.5	1	R 32
20.	LB 204	3	2	R 32
21.	LB 205	3	2	R 32
D – Block				
22.	Seminar Hall	8	4	R 32
23.	Seminar Hall	8	4	R 32
RESIDENTIAL BLOCK				
24.	Dean quarters	1.5	3	R32
25.	Dean quarters	1.5	2	R 32
26.	Xerox room	1.5	1	R32
27.	Staff quarters – 802	1.5	3	R 32
28.	Staff quarters – 801	1.5	3	R 32
29.	Staff quarters – 603	1.5	1	R 32
30.	Staff quarters – 704	1.5	1	R 32
Total		**55 Nos with a total of 156 TR capacity**		

- **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).

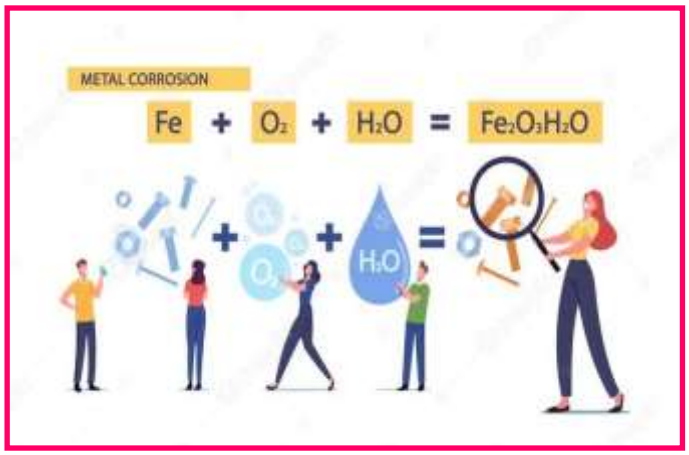
Refrigerant	Global Warming Potential	Ozone Depletion Potential
R-22	1810	Medium
R-410A	2088	Zero
R-32	675	Zero
R-134A	1430	Zero
R-290	3	Zero
R-600A	3	Zero

ENVIRONMENT & GREEN AUDIT REPORT

PART-B: ENVIRONMENT AUDIT REPORT

7. USAGE OF CHEMICALS, SALTS & ACIDS

(STORAGE, HANDLING & BEST OPERATING PRACTICES)



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

The science departments use chemicals for experimental applications and are having strict safety rules as follows;

- Well trained faculty and lab assistants who have knowledge about the hazardous nature of each and every chemical are only allowed to handle the chemicals safely
- Strictly follow the manufacturer's instruction on the container in order to prevent accidents
- Volatile or highly odorous chemicals, fuming acids are stored in a ventilated area
- Chemicals are stored in eye level and never on the top shelf of storage unit
- All stored chemicals; especially flammable liquids are kept away from heat and direct sunlight. Reactive chemicals are not stored closely
- Hazardous and corrosive chemicals are kept on sand platform to avoid corrosion
- First aid box and fire extinguishers are readily available in the laboratory

7.2: Storage of Chemicals/Salts/Acids:

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

- Most of the chemicals, salts and acids used in the science departments are inorganic in nature and no harmful effects are created during the experiment process
- However, after completion of each experiment, the wastes are washed in the water sink and are rooted to common STP
- Only trained teaching and non-teaching staffs are handling the chemicals and also, they are well trained to handle any abnormal situations
- Laboratories with chemicals are well ventilated with proper emergency exits. Adequate and correct sequence of fire extinguishers are placed near all the laboratories

Fig.1: Storage of Chemicals/Salts/Acids Storage & Protective Equipment's to handle the same

7.3: Recommendations:

- ⇒ Display the Dos and Don'ts inside the laboratory
- ⇒ Print the Dos & Don'ts in the Students laboratory manual
- ⇒ During the first class, demonstrate a PPT presentation and explain the safety procedures
- ⇒ Provide training to the teaching and technical staffs member on latest updates on chemical storage, handling, and safe disposal
- ⇒ Also encourage to conduct such type of training programmes by the faculty member to nearby schools and college (as an outreach programme)
- ⇒ Fix the First Aid Box (with all necessary medicines)
- ⇒ Place the names (along with their photo and mobile number) of the professionals training to handle fire extinguishers
- ⇒ Prepare & adopt a **Chemical Policy** (Including procurement, storage, handling, distribution, & disposal

7.4: Use of Chemical 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-9 shows the cleaning agents used to clean the above-mentioned area;

Table-9: 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

Fig.2: Cleaning & Refreshing Agents used for Vessel & Floor Cleaning

7.5: 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

8. WATER UTILIZATION, CONSERVATION & WATER MANAGEMENT

8.1: Source of Water, Storage and Distribution:

Table-10 shows the source of water, location of storage along with their application.

Table-10: Source of Water, Location of Storage and Application

Type of Water	Source	Application
Bore Water + Open Well Water	Different locations inside the university	Drinking & Cooking (through RO)
		Utensil Cleaning, Bathing & Cloth Washing
Rain Water	Collected from i) buildings run off and ii) road run-offs	Used to increase the ground water level
Grey Water from RO Plant	Final treated water from RO plant	Toilet Flushing & Gardening application
Treated Water from STP Plant	Treated clear water from STP Plant	Gardening application

8.2: Treated Water for Drinking Application:

- The college management is keen on providing uninterrupted, safe and healthy drinking water to all; throughout the year.
- Water dispenser are provided at appropriate places offering the treated RO water for the students (Both Normal and Hot temperature)
- The overhead tanks storing the well water are cleaned at regular intervals and the water management team has been maintaining a cleaning schedule

Fig.4: Water Source inside the College (Open Well & Natural Pond)s

8.3: Water Distribution for General Application (Sensor Based Water Control Methods):

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.

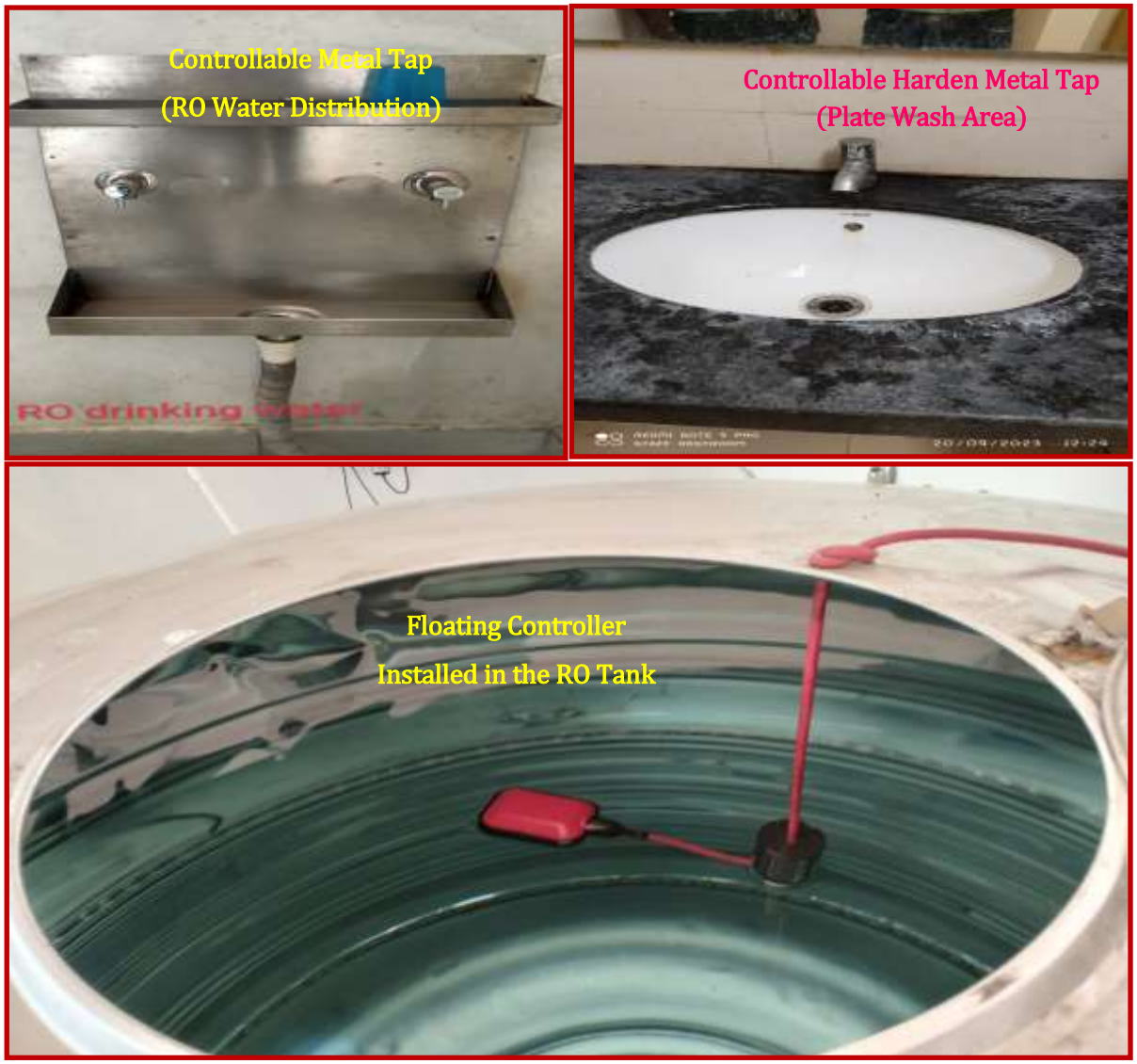


Fig.5: Sensor Based Water Distribution Network

8.4: Water Savings in Foreign Toilets:

- The list of availability of Indian & Foreign style toilets are presented in the below Table-11.

Table-11: List of Indian & Foreign Style Toilets

S. No.	Location	No. of Toilets	
		Indian	Foreign
1.	College – A block	04	19
2.	College – B block	-	03
3.	College – C block	12	44

4.	College – D block	12	44
5.	Hostel – Kundavai Illam	-	50
6.	Hostel – Panchavanmadevi Illam	06	51
7.	Hostel – Rajendra Illam	14	71
8.	Staff quarters	-	70
9.	Dean quarters	-	40
10.	Store and Commercial block	2	27
Total		**48**	**419**

- In general the flush tank capacity may be 8 to 10 Litres (depends on make and model). Water savings also leads to power saving it saves the operating duration of the water pumps directly.

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

- The audit team appreciates the effects taken by the management of **SRM COLLEGE OF AGRICULTURAL SCIENCES** for harvesting the rain water almost in all buildings.
- Nearly 10 nos of RWH pits are erected and in operation to capture the building run-off rains in the entire university (Almost all high-rise building has one RWH with adequate capacity)
- 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 pit
- The building run off are collected through each pit mostly located in each building. Common area and road run-off are properly collected and routed to nearby water body.

8.6: General Recommendations for Rain Water Harvesting:

- RWH has been fitted with their specifications indicating their i) year of installation, ii) approximate average rainfall and duration in the RWH location and iii) filter cleaning schedule (if any).
- Conduct a GIS based study on the improvement of ground water table especially before the rainy session and after rainy session. Compare the data and ensure that the water table improves due to percolation of rain water.
- Similar study mast be conducted (in future) before installing an RWH and after RWH.

8.7: General Recommendations for Rain Water Harvesting:

- Similar to numbering, all the RWH has been fitted with their specifications indicating their i) year of installation, ii) approximate average rainfall and duration, and iii) filter cleaning schedule (if any).
- Conduct a GIS based study on the improvement of ground water table especially before the rainy session and after rainy session.

Fig.6: Sample Rain Water Harvesting (RWH): Storage and Name Board Representation

8.8: Sewage Treatment Plant (STP):

- The Institution has implemented conventional wastewater treatment plant in the residential area and the details are represented in the below Table-12.

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

Location	Residential block
Collection Tank Capacity	190 kL
Aeration – I Tank Capacity	85 kL
Bar Screen Chamber Capacity	2 m3
Deep Settler - I & II	42 kL
Water Cleaning Sump	75 kL
Treated Water Tank	32 kL
No. of Sludge Bed	4
Duration & Quantity of Sludge removed	Monthly once
Usage of sludge	For gardening
• **Usage of Treated Water:** EWC flushing	

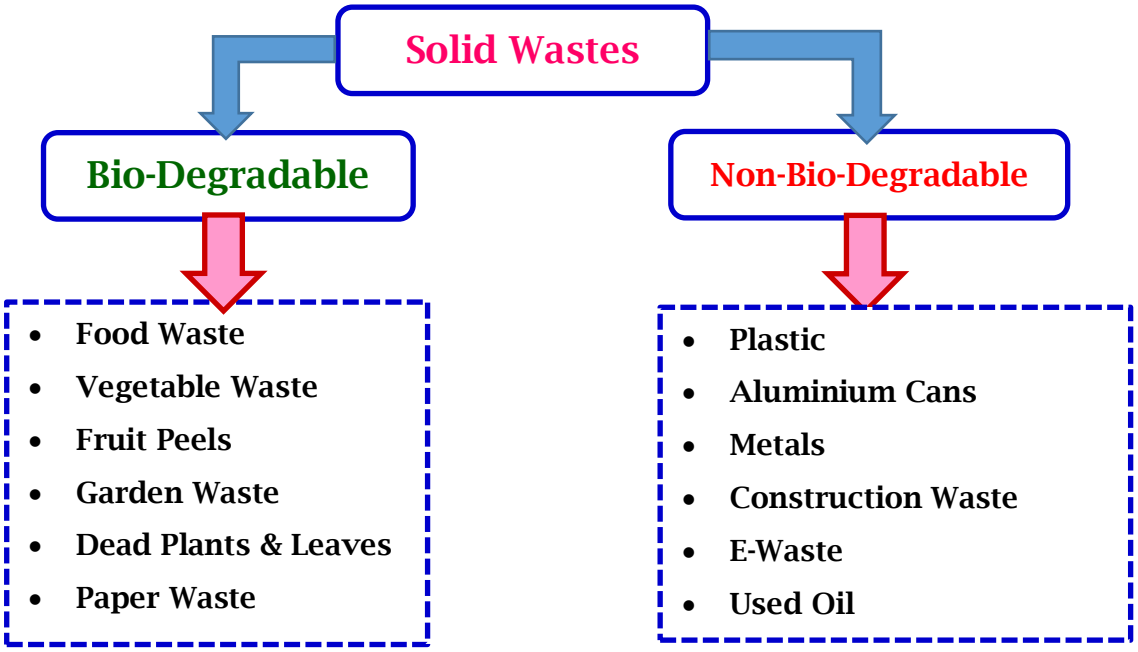
ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART - C: GREEN AUDIT REPORT

9. WASTE HANDLING& MANAGEMENT

9.1: Solid Waste Management System:

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



9.2: Process of Waste Management:

The college management practised some methods to treat the waste generated and Table-13 shows the process of treating the solid waste generated inside the college campus.

Table-13: Process of Waste Management

S. No.	Waste Type	Waste Treatment
Bio-Degradable Waste Management		
1.	Food and Vegetable Waste	• Collected and given to nearby farming
2.	Garden Wastes and Plant Leaves	• Daily collected and dumped in a yard • Taken back safely to nearby site for composite
3.	Paper Waste	• Collected and stored in a separate place
		• Sold to third party for recycling
		• Daily paper waste stored in a yard
Non-Bio-Degradable Waste Management		
4.	Plastics	• Banned in the college campus (Welcome step). • The chemical/salt storage 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 & sale to third party for recycling

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

9.3: Standards Followed for Waste Handling & Management:

1. Solid Waste Management Rules – 2016
2. E-Waste Management Rules – 2016
3. Hazardous Waste Management Rules – 2016 (Management & Transboundary)
4. Battery Management Rules – 2001 (Management & Handling)

9.4: General Note:

- Prepare a flow chart for collection of E-waste from Generation to Disposal and paste it on appropriate places
- An electronic weighing scale (with suitable capacity) must be installed in the storage yard and should be properly calibrated
- One emergency lamp (with UPS supply) must be installed along with suitable fire extinguisher. Ensure proper ventilation in the yard
- Form rule for declaring the waste as E-Waste & Assign the singing authorities
- Identify a third-party vendor to procure the E-waste from the college
- Establish MoU with that party. Disseminate the following information at appropriate places i) E-Waste Policy, ii) Process Methodology, iii) Copy of MoU with third party vendor, iv) Contact persons mobile number and E-mail.
- Identify certain vehicle to carry the waste from generation to storage yard
- Provide training to the man power who are handling the waste
- Maintain separate Delivery Challan, Billing, weighing mechanism for handling the E-Waste
- Update the status of E-waste (through digital circular) to all the concerned management representatives, faculty members and staff at regular intervals (month wise is good)

Fig.7: Solid Waste Management (Collection, Segregation, Storage & Safe Disposal)

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

PART - C: GREEN AUDIT REPORT

10. ASSESSMENT ON MATURE TREES & BIO-DIVERSITY

10.1: Campus Greenery:

The college is completely covered with mature trees grown for more than 5 years. The total number of mature trees available in the college campus is ***50 with many varieties of trees.***

Table-14: List of Mature Trees available in the College Campus

S. No.	Location	Name of the Tree	Quantity
	Entire Campus Location	Variety of Mature Trees	**4,566**
	Entire Campus Location	Variety of Bushes	2,536
	Entire Campus Location	Variety of Flowering Shrubs	644

Total No. of Mature Trees available in the college campus is **4,566** which contributes for reduction of **99.5 Tons of CO_2 emission/Annum**

10.2: Recommendations to Grow Indoor Plants as Natural Air Purifier:

- Indoor plants not only do plants look good while bringing life to our living space, they also help purify the air, according to a NASA study that explains that even a small plant inside the workspace can help remove at least three household toxins (benzene, formaldehyde, and trichloroethylene)

TULSI: Generates more oxygen per day

Aloe Vera:

- **Removes benzene and formaldehyde**
- **Eliminate harmful microorganism and absorb dust**

Snake Plant:

- Removes Xylene, Benzene, Formaldehyde, Trichloroethylene toxins.

Spider Plant:

- Removes CO and Formaldehyde
- Absorbs Nicotine

Money Plant (Devil IVY):

- Best air purifying plant
- Remove benzene & Formaldehyde

Bosten Fern:

- High humidity application
- Remove xylene & Formaldehyde

Chrysanthemum:

- Removes Ammonia, Xylene, Benzene & Formaldehyde

Kimberly Queen Fern:

- Works well in carriage
- Absorb vehicular exhaust

10.3: 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.

10.4: One Student – One Tree:

This is an Initiative of AICTE to increase the green coverage inside the campus and committed to reduce the Urban Heat Island Effect (UHIE), through NSS volunteers (or any other Green club); One Student: One Tree scheme. Through this scheme, college may plan to plant nearly 2,000 trees in future, make the entire campus with complete green cover and maintain a excellent bio-diversity.

10.5: 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.
- **SRI SRM COLLEGE OF AGRICULTURAL SCIENCES 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).

10.6: 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 **SRM COLLEGE OF AGRICULTURAL SCIENCES campus has an excellent pond; it is highly recommended to conduct the frog and toad survey around the pond and identify the species.**

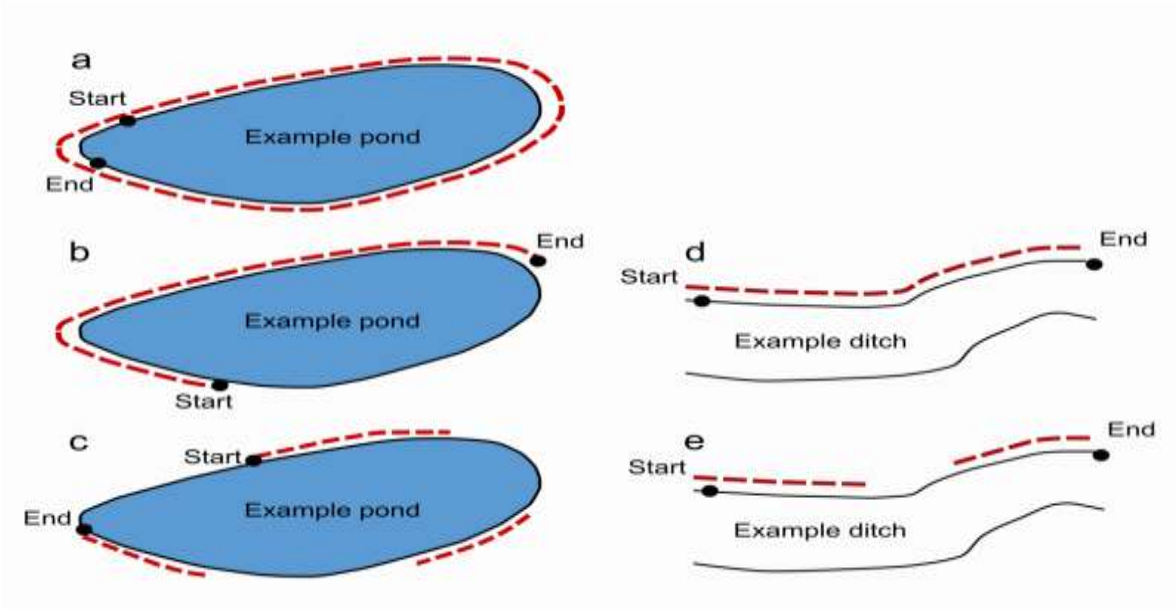


Fig.8: Diagram illustrating approaches to conduct the survey at a water body

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

11. AUDIT SUMMARY & CONCLUSION

I. Energy Conservation & Management – Electrical Energy:

- Monitor the health of the APFC & FC. Fine tune reactive power based on the load condition
- 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
- 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 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
- 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 of water utilized by each building by connecting digital water flow meter and optimize the water usage
- 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 environmentally 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 environmentally 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
- 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. 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**
- **Training for Faculty and Students on Vehicle Operation**
- **Training for Kitchen Employees**
- **General Medical Camps for Employees**
- **Training on Stress Management and Yoga**

V. 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
- 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 **SRM COLLEGE OF AGRICULTURAL SCIENCES**, Vendhar Nagar, Baburayanpettai, Chengalpattu (Dt), Tamil Nadu – 603 201, 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.

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

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

Learning

Issued by CII Sohrabji Godrej Green Business Centre

HSSERisk Academy

CERTIFICATE

OF APPRECIATION

THIS CERTIFICATE IS AWARDED TO

Sivarasu Rathinavelu

FOR SUCCESSFUL COMPETION OF TRAINING COURSE ON

ISO 14064-1:2018
ISO 14064-2:2019
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

0100202110006

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