SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY
An Autonomous Institution| Approved by AICTE| Affiliated to Anna University
Kuniamuthur, Coimbatore - 641008

7.2.3 - CARBON REDUCTION AND EMISSION REDUCTION PROCESS

EXECUTIVE SUMMARY

Energy Analysis:

→ A detailed audit was conducted SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY, Kuniamuthur, Coimbatore, Tamil Nadu – 641 008 India.

→ The audit team has come out with *Energy Conservation Proposals (ENCONs)* and the summary of all the ENCONs are given below:

S. No.	Description	Parameters		
		Present		Savings
1.	Annual Energy Consumption	2833219 kWh + 14,155 kg LPG	2576102 kWh + 8,120 kg LPG	2,57,117 kWh + 6,035 kg LPG
				Rs. 25.8 Lakhs
3.	Annual CO2 Emission	2561.3 Tons	2,136.9 Tons	424.4 Tons
	Initial Investment Required	Rs. 24.3 Lakhs		
5.	Simple Payback Period	Nearly 1.0 Year		
	Overall Reduction of Energy	9.07 % Electricity + 15.5 % 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)

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4.1: Assessment of Existing Electrical and Thermal Energy Systems:

<table>
<tr><th>S. No.</th><th>Description</th><th colspan="6">Details</th></tr>
<tr><td colspan="8">Electrical Energy Usage</td></tr>
<tr><td>1.</td><td>Name of the customer</td><td colspan="6">SRI KRISHNA COLLEGE OF ENGINEERING AND TECHNOLOGY,</td></tr>
<tr><td>2.</td><td>Communication Address</td><td colspan="6">Kuniamuthur, Coimbatore, Tamil Nadu – 641 008 India.</td></tr>
<tr><td>3.</td><td>Service Number Type of Supply & Tariff</td><td colspan="6">High Tension Consumer HT SC No – 221; HT-IIB2</td></tr>
<tr><td rowspan="6">4.</td><td rowspan="6">Tariff Structure (As per ToD)</td><td>ToD</td><td colspan="5">From July-23</td></tr>
<tr><td>Industrial</td><td colspan="5">Rs. 7.65/kWh</td></tr>
<tr><td>Peak Hour</td><td colspan="5">Rs. 1.90/kWh</td></tr>
<tr><td>Night Rebate</td><td colspan="5">Rs.0.4125/kWh</td></tr>
<tr><td>Fixed Charge</td><td colspan="5">Rs. 562/kVA</td></tr>
<tr><td colspan="6">90 % of the Permitted PD</td></tr>
<tr><td>5.</td><td>Energy Suppliers</td><td colspan="6">Tamilnadu Generation & Distribution Corporation (TANGEDCO)</td></tr>
<tr><td>6.</td><td>Generator Details</td><td colspan="6">500 X 2 kVA (External fuel tank – 990 L)
125 X 2 kVA (Internal fuel tank – 220 L)
63 X 1 kVA (Internal fuel tank – 80 L)</td></tr>
<tr><td>7.</td><td>DG Operation</td><td colspan="6">500, 500, 125 kVA Manual operation only
125, 63 kVA Automatic operation</td></tr>
<tr><td colspan="8">Annual Electrical Energy Consumption, Electricity Consumption from DG & Diesel Consumption</td></tr>
<tr><td colspan="2">Electricity</td><td>2833219 kWh</td><td>Diesel for DG</td><td>23,320 Litres</td><td>Units Generated</td><td colspan="2">88,968 kWh</td></tr>
<tr><td colspan="8">Thermal Energy Used</td></tr>
<tr><td rowspan="2">8.</td><td colspan="3">Liquified Petroleum Gas (LPG)</td><td colspan="4">Cooking</td></tr>
<tr><td colspan="3">Diesel (Ordinary)</td><td colspan="4">Transport + DG</td></tr>
<tr><td colspan="8">Annual Energy Consumption of Thermal System</td></tr>
<tr><td colspan="2">LPG</td><td>14,155 kg</td><td>Diesel for Transport</td><td colspan="4">50,760 Litres</td></tr>
<tr><td colspan="8">General Loads (Both Electrical and Thermal)</td></tr>
<tr><td rowspan="2">9.</td><td rowspan="2">Lighting System</td><td colspan="6">❖ Indoor lighting: The management is now committed to convert the existing FTL into LED in a phased manner</td></tr>
<tr><td colspan="6">❖ 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</td></tr>
<tr><td>10.</td><td>Fan Loads (Ceiling)</td><td colspan="6">❖ Conventional ceiling fans only</td></tr>
</table>

		❖ The audit team requested to change the conventional fans into BLDC based Electronically Commutated fans in a phased manner
11.	Air Conditioning System	• Mostly BEE star rated ACs and the outdoor units are mostly placed in shaded area of the respective building
12.	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
13.	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 380 kVA

Table-2: Annual Energy Consumption and Energy Generation (2023-24)

S.No.	Month	Electricity Consumption (kWh)	LPG Consumed (kg)	Diesel Consumed (L)		
				DG	Transport	Total
1.	Jun-23	218628	950	1510	4,100	5610
2.	Jul-23	219657	1,140	2270	4,220	6490
3.	Aug-23	253347	1,330	740	4,370	5110
4.	Sep-23	231401	1,235	4500	4,300	8800
5.	Oct-23	253546	1,140	1530	3,870	5400
6.	Nov-23	230488	1,235	1740	4,150	5890
7.	Dec-23	242670	1330	1170	4,300	5470
8.	Jan-24	214607	1330	2520	4,370	6890
9.	Feb-24	243124	1235	2480	4,350	6830
10.	Mar-24	299361	1235	2310	4,260	6570
11.	Apr-24	259078	1425	1500	4,370	5870
12.	May-24	167312	570	1050	4,100	5150
Total		28,33,219	14,155	23,320	50,760	74,080

- The cost of the electricity is Rs. 11.40 /kWh.
- The cost of the LPG is Rs. 100. 0/kg
- The average Unit Per Litre (UPL) of the DG is 3.1 kWh/Litre of Diesel.

5.1 : 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 equipment's	From TANGEDCO
2.	Diesel	Transport vehicles and Diesel Generator (Captive Generation)	From authorised distributor
3.	Liquified Petroleum Gas (LPG)	Used only for cooking	
4.	Mature Trees, Bushes & Shrubs	The college has nearly 7,925 mature trees of different varieties which are more than 10 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-4: Environmental System: CO_2 Balance Sheet (2023-24)

S. No.	Annual Energy Consumption & CO_2 Emission			Annual CO_2 Neutralization		
	Description	Energy	CO_2 Emission (Tons)	Description	Parameters	CO_2 Neutralized (Tons)
1.	Electricity	28,33,219 kWh	2323.2	Solar Hot Water	2,17,000 kWh[1]	177.9
2.	Diesel	74,080 Litres	195.6	Mature Tree	7,925 Nos	172.8
3.	LPG	14155 kg	42.5	Electricity (DG)	70,832 kWh	58.1
Total Emission			2,561.3	Total-Neutralized		408.8
Balance CO_2 to be Neutralized = 2,152.5 Tons/Annum; Per capita Emission = 0.37 Tons/Person						

(Note: No. of Students, Faculty & Staff for the year 2023-24 is 5,760)

([1] Electrical equivalent is considered)

5.3 : Calculation Table:

For Electricity = $\left[\text{kWh} \times \frac{0.82 \text{ kg of } CO_2 \text{ emission}}{\text{kWh}}\right]$

For Diesel = $\left[\text{Diesel Consumption (Litre)} \times \frac{2.64 \text{ kg of } CO_2 \text{ emission}}{\text{Litre of Fuel Consumption}}\right]$

For LPG = $\left[\text{LPG Consumption (kg)} \times \frac{3.0 \text{ kg of } CO_2 \text{ emission}}{\text{kg of LPG Consumption}}\right]$

A mature tree is able to absorb nearly CO_2 at a rate of 21.8 kg/annum; $\frac{(21.8 \times 7925)}{1,000} = 172.8 \frac{\text{Tons}}{\text{Annum}}$

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.

5.5 : 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

CO_2 Emission:

2,561.3 Tons/Annum

CO_2 Reduction

408.8 Tons/Annum

CO_2 to be Neutralized

2,152.5 Tons/Annum