# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

***AUDIT CONDUCTED FOR***

## CMS COLLEGE OF ENGINEERING

**CMS Nagar, Eranapuram (Post), Namakkal – 637 003, Tamil Nadu, India.**

***DATE OF AUDIT***

**08 JUNE 2023**

**(Audited and accounted from June 2022 to May 2023)**

***AUDIT CONDUCTED BY***


**RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING**

**(Chennai ♦ Coimbatore ♦ Erode)**

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## 1. ACKNOWLEDGEMENT

## ACKNOWLEDGEMENT

The audit team of RAM-**KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING,** Coimbatore – 641 062 is thankful to the Management, Principal, Faculty and Technical team members of **M/s. CMS COLLEGE OF ENGINEERING,** CMS Nagar, Eranapuram (P.O), Namakkal – 637 003, 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 **M/s. CMS 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.

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. C. MUTHUSAMY** | CHAIRMAN |
| **Mr. M. SRIDHAR** | VICE CHAIRMAN |
| ***Head of The Institution*** | |
| **Dr. K. MAHADEVAN** | PRINCIPAL |

| ***Audit Team Members*** | |
|---|---|
| **Dr. S.R. SIVARASU** | **BEE Certified Energy Auditor (EA-27299)**<br>Lead Auditor-ISO-14001:2015 (EMS),<br>IGBC AP, GRIHA CP, CII CP in SWM<br>Carbon Footprint Auditor & Implementor<br>**Mobile: +91- 80567 19372, 99420 29372** |
| **Er. P. MALLIGARJUN** | **Director (Technical)** |
| **Er. S.T. ASWIN** | **Junior Engineer** |



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## 2. INTRODUCTION

## TO

## ENERGY-ENVIRONMENT-GREEN

## AUDIT PROCESS

***2.1: Preface about the Institution:***

- **CMS College of Engineering (CMSCE)** was established in 2007 in the rural area of Namakkal district, Tamil Nadu. It is a co-educational self-financial institution approved by AICTE and affiliated with Anna University, Chennai.
- The College is located in Eranapuram, 8 kilometres from Namakkal (nearby Namakkal District Collectorate) and 42 Kilometres from Erode, providing a serene environment for learning.
- Founded by Chairman and Industrialist **Thiru C. Muthusamy**, CMSCE aims to offer value-based courses that align with global requirements, especially focusing on uplifting rural communities by providing quality education".

***2.2: Vision:***

→ To transform the institution into an institution of excellence with global standards.

***2.3: Mission:***

- To attain academic excellence by conveying knowledge and skills through problem
- solving, hands on training and the creation of innovative projects through design and development
- To foster leadership and interdisciplinary team skills, by the way of effective communication training and instilling ethical behaviour.
- To conduct applied research in Engineering & Technology and Promote continuous lifelong learning.

***2.4: Quality Policy:***

- Engaging in applied research within the field of Engineering & Technology while advocating for ongoing lifelong learning is our primary focus.
- Offering top-notch facilities and creating an environment conducive to learning.
- Adapting proactively to evolving industry, parental, and societal demands by embracing the latest technological trends in the education sector.
- Adhering to standard requirements and consistently endeavouring to enhance the operational quality of the institution.



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***2.5: Major Activities in the Institution:***

1. Knowledge Transferring through teaching learning process
2. Innovative research and development activities
3. Training programs( Academic & Industry)
4. Value added and certification courses
5. Career and Placement opportunities

***2.6: Scope of the Audit Process:***

- **Energy Audit:** To conduct a detailed energy audit in the college campus with a main focus to identify judicious usage of electrical and thermal energy (where, when, why and how energy is being utilized).
- **Environmental Audit:** Identification of history of activities, present environmental practices followed, monitoring records and known sources of environmental issues inside the college.
- **Green Audit:** Assessment on Campus greenery in terms of mature trees, flowering shrubs, bushes, medicinal plants, adoption of green energy generation and utilization, reduction of $CO_2$ due to green energy system and identification of possible implementation and enhancement of current greenery practices.

***2.7: Outcomes of the Audit Process:***

- Recommendations based on field measurement with achievable **Energy Conservation** (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

***2.8: Audit Approach:***

The audit team completed the assessment of energy consumption in the factory premises and operating hours of each machine (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.



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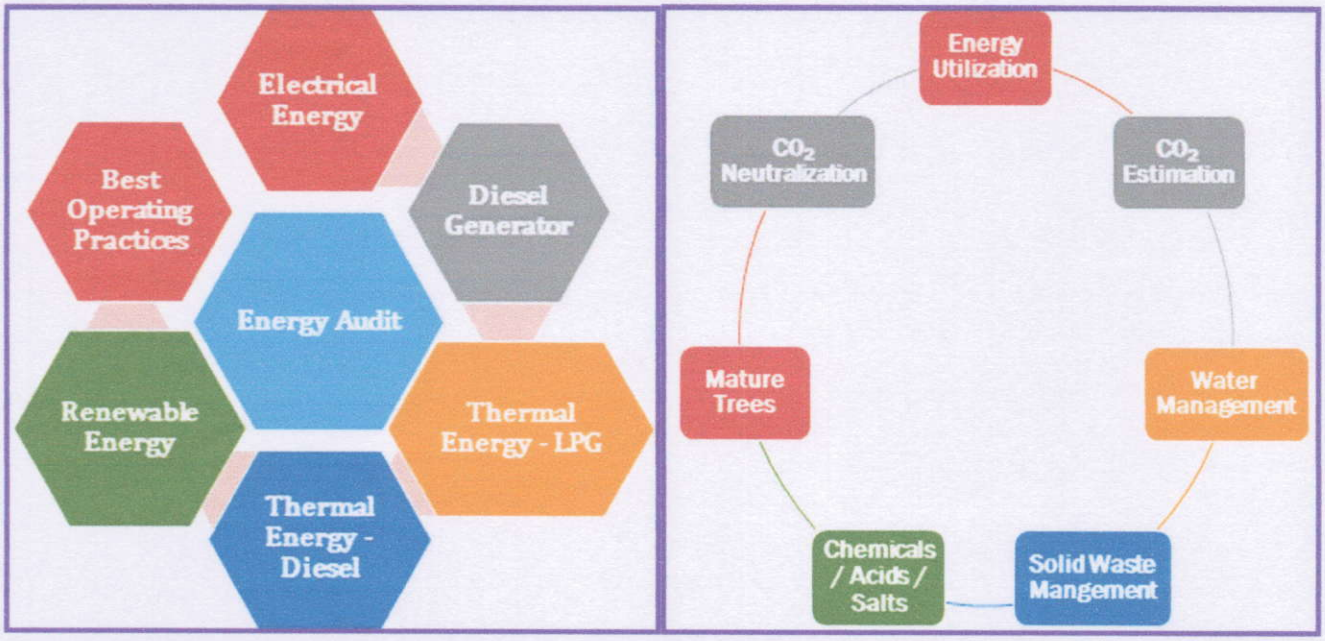
***2.9: Coverage in Energy- Environment & Green Audit Process:***




***2.10: List of Faculties assisted the Audit Process & Data Collection:***

| S. No. | Faculty Details | Contribution |
|---|---|---|
| 1. | **Mr. S. DHINESH**<br>Assistant Professor, Department of CSE | Coordinator for the Audit Process |
| 2. | **Mr. P. VINOTH**<br>Assistant Professor, Department of EEE | Collection of Electrical Energy Parameters, Water, Fuel consumption details from College side |
| 3. | **Mr. C. RAGU RAJ**<br>Maintenance Engineer, Electrical & Hostels | Collection of Electrical Energy Parameters, Water, Fuel consumption details from Hostel Side |
| 4. | **Mr. B. PALANIYANDI**<br>Assistant Professor<br>Department of Science and Humanity | Collection of Chemicals/Salts/Acids |
| 5. | **Mr. P. SUYAMBULINGAM**<br>Store Keeper | Collection of LPG Consumption Data |



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## 3. EXECUTIVE SUMMARY

## *EXECUTIVE SUMMARY*

***Energy Analysis:***

→ A detailed audit was conducted **M/s. CMS COLLEGE OF ENGINEERING,** CMS Nagar, Eranapuram (P.O), Namakkal – 637 003, Tamilnadu, India

→ The audit team has come out with ***07 Energy Conservation Proposals (ENCONs)*** and the summary of all the ENCONs are given below:

| S. No. | Description | Parameters | | |
|---|---|---|---|---|
| | | Present | After | Savings |
| 1. | Annual Energy Consumption | **1,70,973 kWh + 8,640 kg LPG + 100 Tons Wood** | 1,32,664 kWh + 8424 kg LPG + 80.0 Tons Wood | **38,309 kWh + 216.0 kg LPG + 10.0 Tons Wood** |
| 2. | Annual Financial Cost | **Rs.26.5 Lakhs** | Rs. 23.6 Lakhs | **Rs. 4.9 Lakhs** |
| 3. | Initial Investment | Rs. 4.4 Lakhs | | |
| 4. | Payback Period | **Nearly 0.9 Years (10.8 Months)** | | |
| 5. | Overall Energy Reduction | **22.4 % Electricity + 5.0 % LPG + 10.0 % Wood** | | |

**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**) used for regular applications are considered for this audit process.

**Audit Conducted & Verified by**

S.R. Sivarasu

**(Dr. S.R. SIVARASU)**

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Table-1: Energy Conservation Proposal (ENCON) along with Annual Energy and Financial Savings

| S. No. | Proposed Energy Conservation Measures | % Saving & Source | Estimated Savings | | Initial Investment (Rs.) | Payback Period |
|---|---|---|---|---|---|---|
| | | | Annual Energy Savings | Monetary Savings (Rs.) | | |
| 1. | Reduction of Cable Losses and Active Power Consumption using Capacitor Compensation | 2 % on Electrical | 3,419 kWh | 37,267 | 20,000 | 0.54 Years |
| 2. | Replacement of Fluorescent Lamps with Energy Efficient Lamps (Considering only **100 Nos of Lamps** in Phase-I Implementation swapping to LED Lamps) | 50 % on Lighting | 6,000 kWh | 65,400 | 60,000 | 0.92 Years |
| 3. | Retrofit of AIRCON Energy Saver, AC House Keeping and Optimization of AC Operation (Consider for **09 Nos** of AC units) | 15 % on AC Loads | 7,290 kWh | 79,461 | 90,000 | 1.13 Years |
| 4. | Replacement of Existing Convention Ceiling Fans into EC BLDC Fans (Considering only **100 Nos of fans** in Phase-I Implementation swapping to BLDC Fans) | 50 % on Fans Load | 10,500 kWh | 1,14,450 | 1,80,000 | 1.57 Years |
| 5. | Replacement of Existing Water Pumps into Energy Efficient Motor-Pumps. | 20 % on Motor | 11,100 kWh | 1,20,990 | 50,000 | 0.40 Years |
| 6. | Reduction of LPG Consumption using Burner Cleaning and Swapping of Active Burners. | 5 % of LPG for Stoves | 216 kg | 18,576 | 5,000 | 0.30 Years |
| 7. | Reduction of Heat Energy in the Boiler Outer Side + Steam Pipes Lines using TCC | 10 % Wood on Boiler | 10.0 Tons | 50,000 | 30,000 | 0.60 Years |
| **Total** | **38,309 kWh + 216.0 kg LPG + 10.0 Tons Wood** | | | **4,86,144** | **4,35,000** | – |

***Recommendations and Best Operating Practices:***

- ⊕ All SSB must be fitted with digital energy meters.
- ⊕ Prepare block wise maintenance checklist of electrical and thermal system
- ⊕ Calculate the Unit Per Litre (UPL) for every run of DG and average it for monthly
- ⊕ Convert the existing conventional lightings and fans into energy efficient lights and fans
- ⊕ Earth pits must be visible for easy access, should be done regular maintenance and measure their values annually
- ⊕ Similar to Fan, now BLDC based ACs are made available in the market; which consumes less amount of energy (Power) during its starting and running condition.
- ⊕ It is essential and the right time to form an **Energy Management Team**



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## PART-A: ENERGY AUDIT REPORT

# 4. STUDY
# ON
# ENERGY CONSUMPTION PATTERN

***4.1: Assessment of Existing Electrical and Thermal Energy Systems:***

<table>
<tr><th>S. No.</th><th>Description</th><th colspan="4">Details</th></tr>
<tr><td colspan="6">Electrical Energy Usage</td></tr>
<tr><td>1.</td><td>Name of the customer</td><td colspan="4">CMS COLLEGE OF ENGINEERING</td></tr>
<tr><td>2.</td><td>Communication Address</td><td colspan="4">CMS Nagar (Nearby Collectorate), Eranapuram (P.O),<br>Namakkal – 637 003, Tamilnadu, India</td></tr>
<tr><td>3.</td><td>Service Number Type of Supply & Tariff</td><td colspan="4">SC No: 04203010395; Low Tension; Tariff-LM 2B2</td></tr>
<tr><td rowspan="3">4.</td><td rowspan="3">Tariff Structure:<br>↗ Old: Before July 2023<br>↗ New: From July 2023</td><td>Description</td><td colspan="2">Old</td><td>New *</td></tr>
<tr><td>Unit Charge</td><td colspan="2">Rs.8.50/kWh</td><td>Rs. 8.70/kWh</td></tr>
<tr><td>Fixed Charge</td><td colspan="2">Rs.325 /kW</td><td>Rs. 664/kW</td></tr>
<tr><td>5.</td><td>Energy Suppliers</td><td colspan="4">Tamilnadu Generation & Distribution Corporation (TANGEDCO)</td></tr>
<tr><td>6.</td><td>Generator Details</td><td colspan="4">125 kVA – Cummins - (Inbuilt fuel tank – 250 L)</td></tr>
<tr><td>7.</td><td>DG Operation</td><td colspan="4">Manual Operation</td></tr>
<tr><td colspan="6">Annual Electrical Energy Consumption, Electricity Consumption from DG & Diesel Consumption</td></tr>
<tr><td>Electricity</td><td>1,70,937 kWh</td><td>Diesel for DG</td><td>845 Litres</td><td>Units Generated</td><td>2,704 kWh</td></tr>
<tr><td colspan="6">Thermal Energy Used</td></tr>
<tr><td rowspan="2">8.</td><td colspan="2">Liquified Petroleum Gas (LPG)</td><td colspan="3">Cooking</td></tr>
<tr><td colspan="2">Diesel (Ordinary)</td><td colspan="3">Transport+ DG</td></tr>
<tr><td colspan="6">Annual Energy Consumption of Thermal System</td></tr>
<tr><td colspan="2">LPG</td><td>8,640 kg</td><td>Diesel (Transport)</td><td colspan="2">44,907 Litres</td></tr>
<tr><td colspan="6">General Loads (Both Electrical and Thermal)</td></tr>
<tr><td rowspan="2">9.</td><td rowspan="2">Lighting System</td><td colspan="4">❖ Indoor lighting: The management is now committed to convert the existing FTL into LED in a phased manner</td></tr>
<tr><td colspan="4">❖ Outdoor lighting: All the street lightings are LED based energy efficient lamps<br>❖ 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="4">❖ All the ceiling fans are conventional type only which consumes nearly 60-70 W/fan at maximum position.<br>❖ The audit team requested to change the conventional fans into BLDC based Electronically Commutated fans in a phased manner.<br>❖ The average power consumption will be 35 W/fan at maximum position (More than 50 % reduction)</td></tr>
</table>



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| | | |
|---|---|---|
| 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<br>• Small motors are used in hotel kitchen equipment's & in the canteen |
| 13. | Uninterrupted Power System (UPS) | • All the computers, server, surveillance, projectors, telephonic units are connected with UPS with nominal back up time of **2.5 hours.**<br>• Total capacity of the UPS is nearly **27 kVA.** |

**Table-2: Annual Energy Consumption and Energy Generation (2022-2023)**

| S. No. | Month | Electricity Consumption (kWh)* | Wood Consumption (Tons) | LPG Consumed (kg) | Diesel Consumed (L) | | |
|---|---|---|---|---|---|---|---|
| | | | | | DG | Transport | Total |
| 1. | Jun-22 | 9,292 | 10.0 | 768 | 75 | 2,591 | 2,666 |
| 2. | Jul-22 | 5,818 | 10.0 | 768 | 115 | 4,145 | 4,260 |
| 3. | Aug-22 | 8,425 | 10.0 | 768 | 105 | 4,318 | 4,423 |
| 4. | Sep-22 | 15,861 | 7.0 | 672 | 90 | 3,454 | 3,544 |
| 5. | Oct-22 | 12,683 | 7.0 | 672 | 60 | 4,491 | 4,551 |
| 6. | Nov-22 | 17,842 | 7.0 | 672 | 65 | 4,145 | 4,210 |
| 7. | Dec-22 | 19,140 | 10.0 | 768 | 90 | 4,145 | 4,235 |
| 8. | Jan-23 | 12,306 | 10.0 | 768 | 50 | 3,800 | 3,850 |
| 9. | Feb-23 | 15,723 | 10.0 | 768 | 45 | 3,454 | 3,499 |
| 10. | Mar-23 | 18,222 | 7.0 | 768 | 50 | 3,282 | 3,332 |
| 11. | Apr-23 | 18,470 | 7 | 672 | 50 | 3,973 | 4,023 |
| 12. | May-23 | 17,154 | 5 | 576 | 50 | 3,109 | 3,159 |
| Total | | 1,70,937 | 100.0 | 8,640 | 845 | 44,907 | 45,752 |

- The cost of the electricity is Rs. 11.00/kWh.
- The cost of the LPG is Rs. 86.33/kg
- The cost of the Wood is Rs. 5,000/Tons



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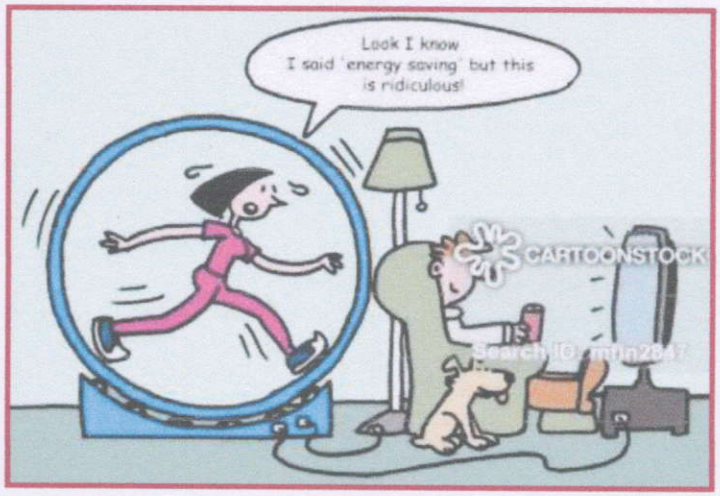
## PART-A: ENERGY AUDIT REPORT

## 5. ENERGY CONSERVATION PROPOSALS (ENCONs)



| ENCON-I | Reduction of Cable Losses and Active Power Consumption using Load End Capacitor Compensation (At DB Level) |
|---|---|
| Assessment Area | Electrical Distribution System |
| Observations | • LT electrical system from power house is being distributed through various electrical distribution panel board conveniently located in each building all over the college campus.<br>• Supply side power factor is maintained by fixed capacitors; whereas the load end PF is to be corrected by connecting suitable values of FC, mostly at the distribution panels. |
| Assessments | • In any electrical distribution network, the distribution losses may account for 2-6 % and this can be reduced by i) Selecting proper cable size (class 1 or 2) with reduced resistance and ii) Compensate the distribution losses by connecting load end capacitors at each higher capacity load and/or at DB level.<br>• This method has many advantages like i) reduction of kVA demand (applicable for HT consumer), ii) reduction of distribution losses and iii) maintaining the terminal voltage from source to load end. |
| Recommendation (Target) | • Connect suitable rating of capacitors (Nearly 5 kVAr, 3-Phase, 440/400 V, Heavy Duty) at the PCC and try to reduce the distribution line loss. |

***Energy & Financial Saving Calculation:***

| Parameters | Description | |
|---|---|---|
| No. of DBs (Approx. Value) | 5 No's. (Fix as a trail at the entry of each block) | |
| kVAr required to connected | 10 kVAr each in all DB | |
| Energy Calculation | **Before** | **After** |
| Expected % of Energy Saving | – | **2.0 %** |
| Annual Energy Consumed | 1,70,937 kWh | 1,67,519 kWh |
| Annual Energy Saving | – | **3,419 kWh** |
| Annual Financial Saving | – | **Rs. 37,267/-** |
| **(3,419 kWh x Rs.10.90/kWh = Rs. 37,267/-)** | | |
| Initial Investment | - | **Rs. 20,000 /-** |
| Per kVAr charge of Heavy-Duty Standard Make Capacitor is around **Rs.400/-**. Hence for 10 kVAr x 5 locations = **50 kVAr**; the initial investment is **Rs. 20,000/-** | | |
| **Simple Payback** | – | **0.54 Years** |
| **$CO_2$ Reduction** | – | **2.8 Tons/Annum** |



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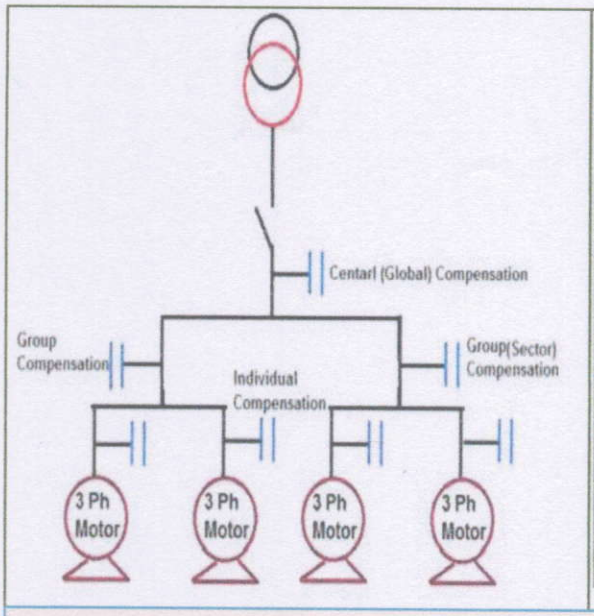
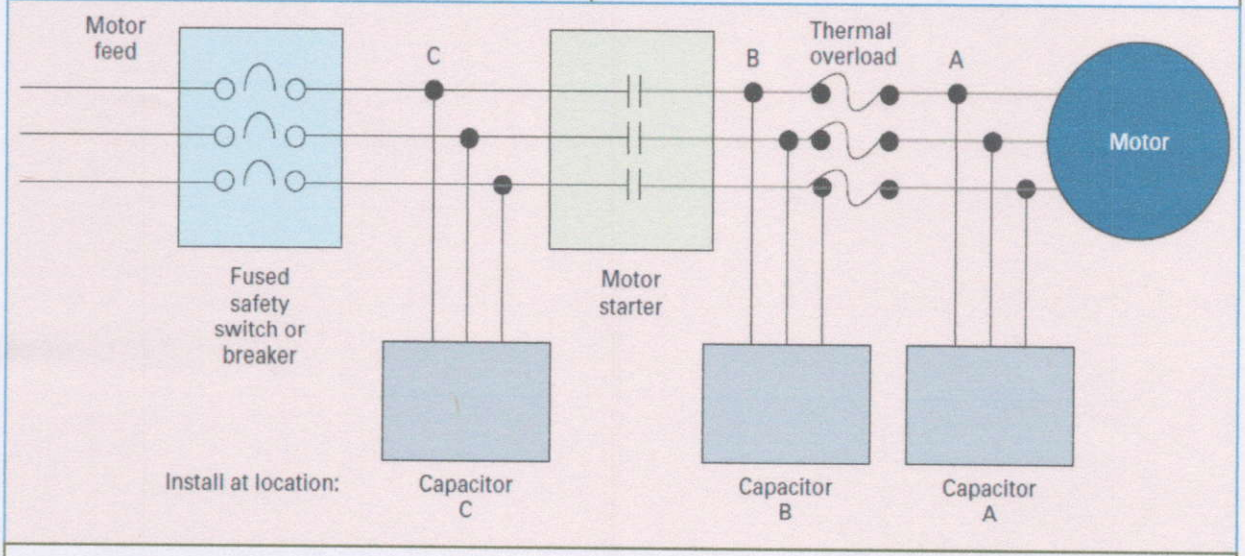
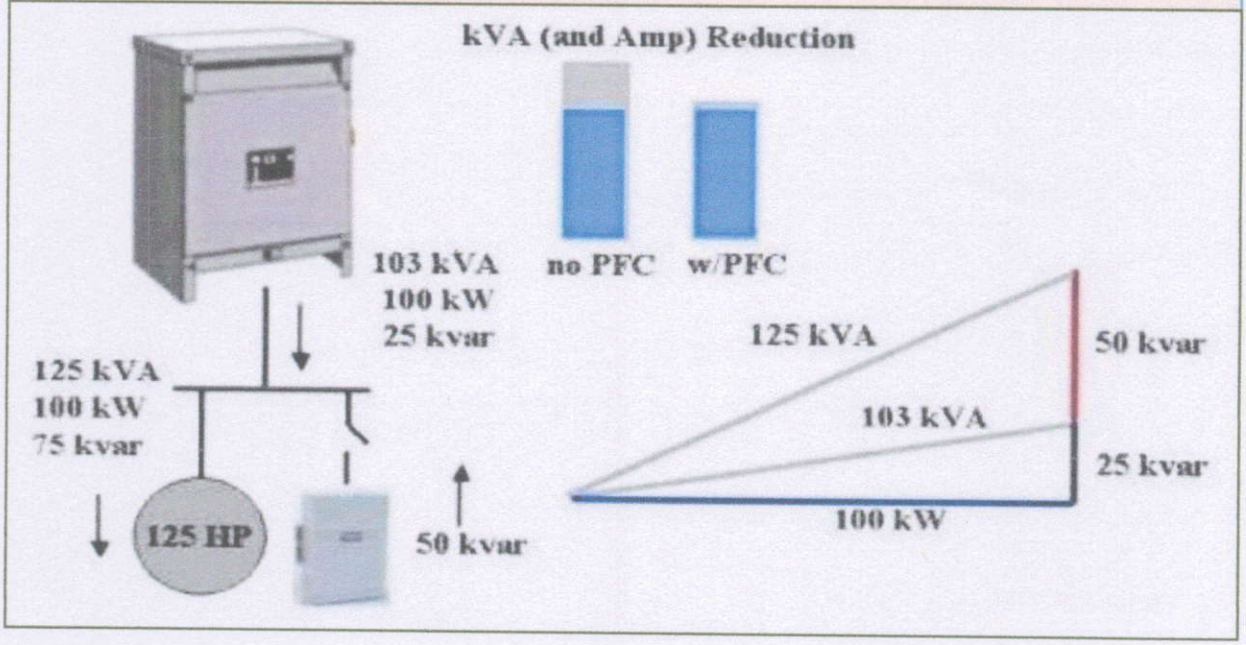



**CASE STUDY -CAPACITOR BANK AT LOAD END**
**CONNECTED LOAD 970 KW AT 200 METERS**
**FROM POWER HOUSE CAPS OFF – 0.8 PF & CAP ON – 0.97 PF**

| Description | Capacitor at powerhouse | Capacitor at load end |
|---|---|---|
| Rating | 1211 KVA | 1000 KVA |
| Line current | 1715 amps | 1443 amps |
| Cables in I I | 5 runs | 5 runs |
| Current /cable | 343 mps | 289 amps |
| Cable losses | 35 kw | 25 kw |
| cable loss pm | 22000 units | 15000 units (for 700 hrs) |
| Net savings | nil | 7000 units per month |



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| ENCON-II | Replacement of Fluorescent Lamps with Energy Efficient Lamps (Swap FTL to LED Lamps) |
|---|---|
| Assessment Area | Compact Fluorescent Lighting System located in college area with magnetic/electronic choke fitting |
| Observations | College Area – Main Building (Including Class, Lab and Others)<br>FTL + CFL + LED lightings |
| Assessments | • The college is now replacing FTL and CFL into LED and this step must bring considerable amount of energy saving.<br>• A 36 W FTL consumes 40 W including power consumption of the Choke.<br>• Lighting loads are more sensitive to voltage variations. Supplying a constant voltage provides i) Reduction of breakdown of lamps and luminaries and ii) Considerable amount of energy saving.<br>• In order to reduce the lighting bulb failures, it is necessary to supply a safe working voltage (say about 210 V) through a dedicated Servo Stabilizer (SS) connected at the output of the lighting DB. |
| Recommendation (Target) | • College administration has to replace the FTL to LED (20 W with choke) of branded round LED tube fitting without Blue Tinge. |

***Energy and Financial Saving Calculation:***

| Parameters | Description | |
|---|---|---|
| Replacement Lighting Quantity | 36 W FTL in hostel area (100 Nos) contributes nearly **4.0 kW (40 W including choke)** | |
| Power rating of new lamps | LED-18 W (One to One – 20 W including choke) with the total power consumption of (100 X 20 W) = **2.0 kW** | |
| Approx. Operating Hours (Average assumed value) | **10 hours/day & 300 days/Annum = 3,000 Hours/Annum** (Actual operating hours may change) | |
| Energy Calculation | **Before** | **After** |
| Power Consumed (Approx.) | 4.0 kW | 2.0 kW |
| Expected Power Savings | – | 2.0 kW |
| Annual Energy Saving | – | **6,000 kWh** |
| Annual Financial Saving | – | **Rs. 65,400/-** |
| Initial Investment | - | **Rs. 60,000 /-** |
| (Considering **Rs. 600/Lamp** fittings of branded LED Day Cool Light) | | |
| **Simple Payback** | – | **Nearly 0.92 Years** |
| **$CO_2$ Reduction** | – | **4.9 Tons/Annum** |



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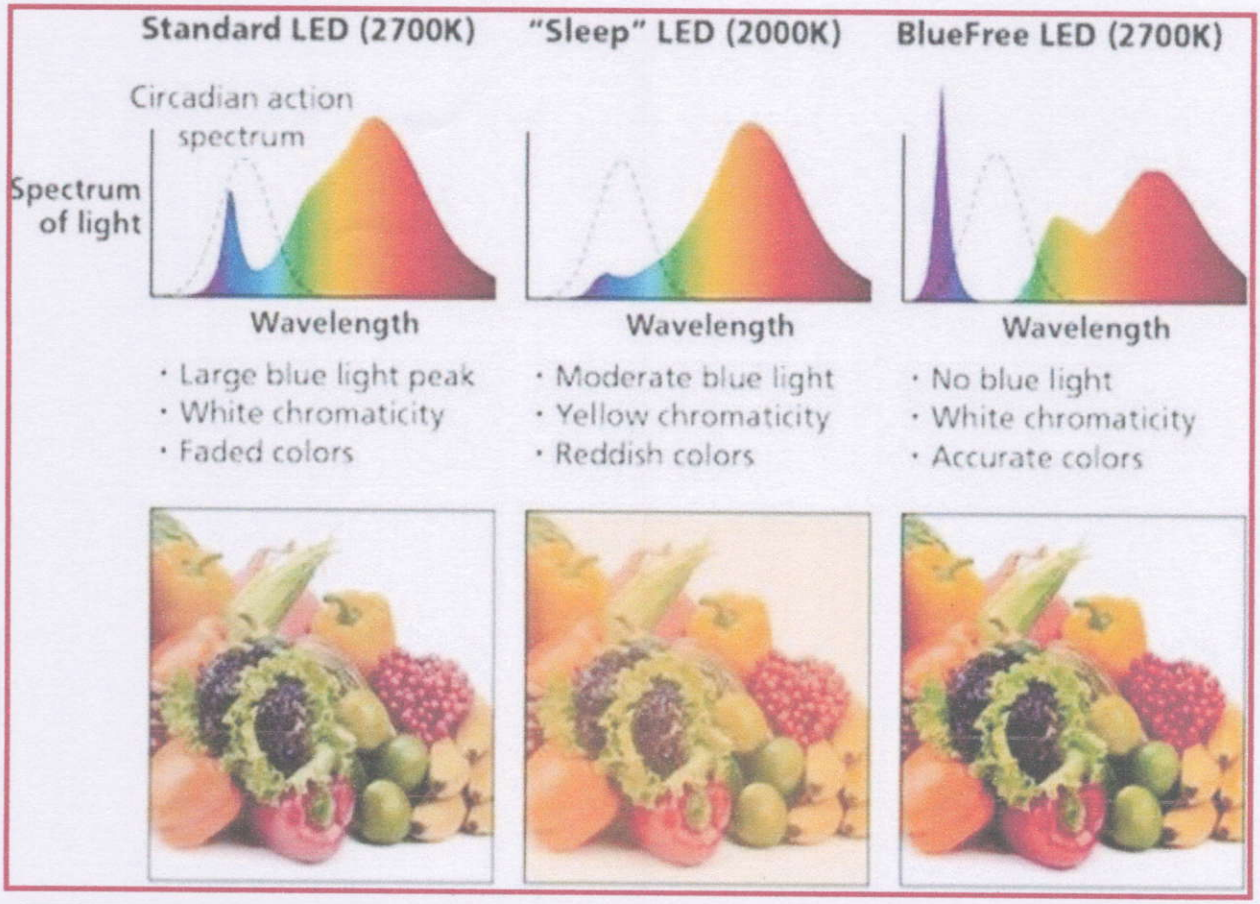


| Tube Light with Copper Choke | | | | | | |
|---|---|---|---|---|---|---|
| V | I | W | VA | VAR | PF | Lumens |
| 200 | 0.278 | 31.96 | 55.60 | 45.50 | 0.5748 | 877 |
| 210 | 0.313 | 35.65 | 65.73 | 44.22 | 0.5424 | 971 |
| 220 | 0.346 | 39.25 | 76.12 | 65.22 | 0.5156 | 1033 |
| 230 | 0.377 | 42.70 | 86.71 | 75.47 | 0.4924 | 1089 |
| 240 | 0.415 | 46.96 | 99.60 | 87.83 | 0.4715 | 1157 |
| 250 | 0.438 | 49.70 | 109.5 | 97.57 | 0.4539 | 1163 |
| LED Light | | | | | | |
| 200 | 0.137 | 20.83 | 27.40 | 17.80 | 0.7602 | 1315 |
| 210 | 0.126 | 21.10 | 26.46 | 15.97 | 0.7974 | 1280 |
| 220 | 0.122 | 20.44 | 26.84 | 17.40 | 0.7615 | 1267 |
| 230 | 0.120 | 19.68 | 27.60 | 19.35 | 0.7130 | 1277 |
| 240 | 0.108 | 19.97 | 25.92 | 16.52 | 0.7704 | 1270 |
| 250 | 0.105 | 19.27 | 26.25 | 17.82 | 0.7341 | 1275 |



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| ENCON-III | Retrofit of AIRCON Energy Saver, AC House Keeping and Optimization of Air Conditioning Operation |
|---|---|
| Assessment Area | Unitary AC Network |
| Observations | • Nearly **09 No's** of unitary air conditioning units and are located in various places inside the college and all are **Non – Inverter ACs** which are running nearly **6-7 hours/day.**<br>• The running hours of the ACs system differ from each other and purely depend on the availability of the workplace/members in the respective rooms/floor area. |
| Assessments | • The set temperature of the indoor units is mostly between **21 $^0$C to 24 $^0$C** and depends on the application.<br>• The total tonnage capacity of the unitary AC units is nearly **27 TR.** |
| Recommendation (Target) | • Install AIRCON energy saver gadget which works on dynamic un-saturation principle in conjunction with the sensor algorithms so that the air conditioners run hours are cut by 20 to 25 %.<br>• AIRCON constantly analyses the temperature transfer profiles of the air and evaporator coil. Once the conditioned air has reached the point of energy transfer saturation and achieve a constant temperature, further refrigeration of the coil is ineffective. The aircon controls the compressor and thus reduces the running kW of the compressor units.<br>• The Aircon Energy Saver is an intelligent control which is specifically designed to measure the off-coil temperature of the AC unit and control the compressor to prevent overcooling. This retrofit device will yield more results when the AC unit is fitted in oversized rooms.<br>• AC unit will start less often; and this will dramatically reduce energy consumption and financial cost. Compressor on/off is completely control by this device and hence the lifespan of the compressor also increases. |

***Energy and Financial Saving Calculation:***

| Index | Retrofit of AIRCON Energy Saver, AC House Keeping and Optimization of Air Conditioning Operation |
|---|---|
| Investment | The cost of the AIRCON retrofit varies depends on the TR capacity (as it highly depends on the compressor system). On an average the unit of an AIRCON is nearly **Rs.5,000** and hence a total initial invest for **18 Units** comes around **Rs. 90,000/-** |
| Energy Savings | The average power consumption of **1 TR** capacity AC units is nearly **1.2 kW.** For **27 TR** capacity; the total power consumption comes nearly **32.4 kW** (However it may vary depends on the i) Compressor cut-off, ii) AC unit on/off and iii) other parameters). |



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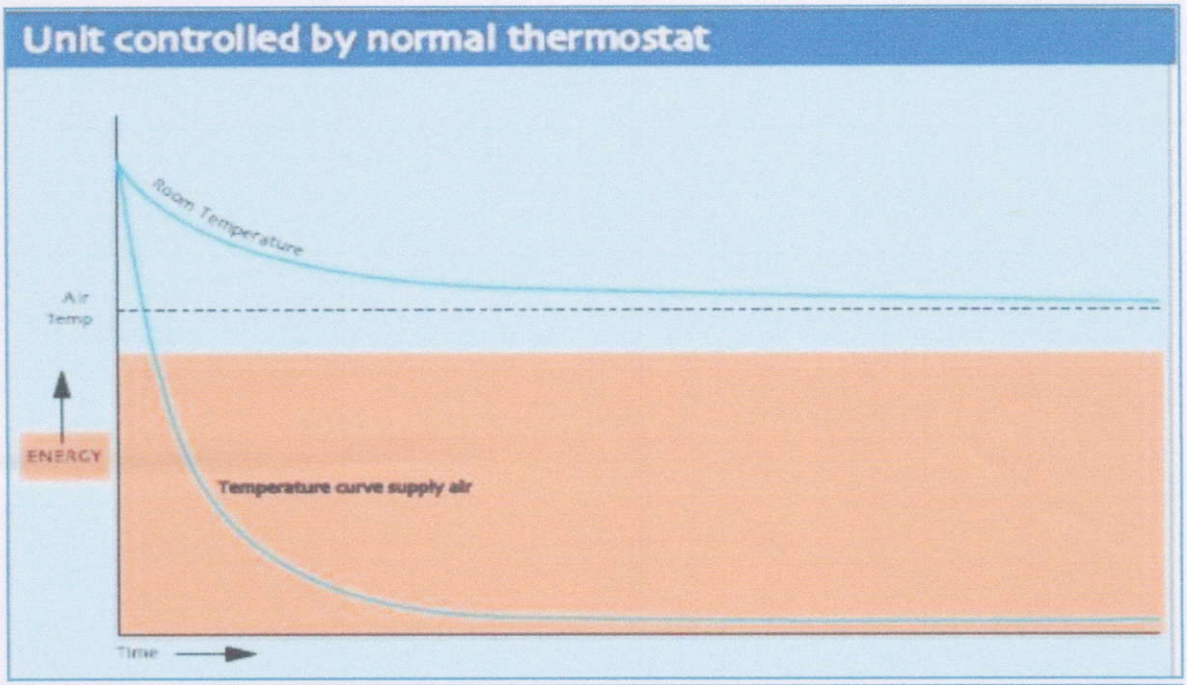
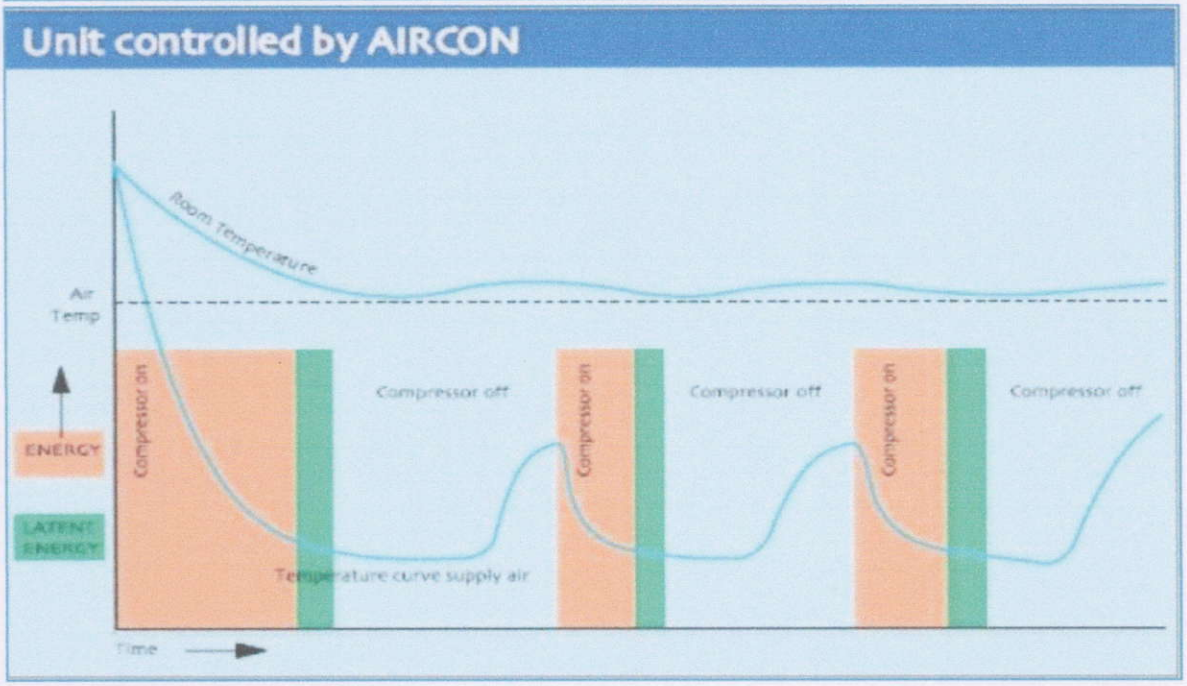
| | |
|---|---|
| | Assuming **15 % savings** on the **32.4 kW = 4.86 kW** running for 6 **hours/day** x **250 days/annum = 7,290 kWh/Annum.** |
| **Financial Savings** | Annual cost saving for **7,290 kWh** x Rs. 10.90/kWh = **Rs. 79,461/-** |
| **Simple Payback** | Initial investment of **Rs. 90,000/-** with simple payback is **1.13 Years.** |
| **Plan of action** | ➢ Conduct the trial and observe the before and after the study. Ascertain the result and expand the same for all other AC Units. |

(**Note-I:** Installation of AIRCON also reduced the kVA demand of the AC and thereby reduces the overall kVA which is the need of the hour.

**Note-II:** The same AIRCON is also be installed in 3-phase duct AC units which provides good results. The management has to make a trial the device in 1-phase AC units and ensure the kW and kVA savings. Then extent the same to other 3-phase AC units also.)



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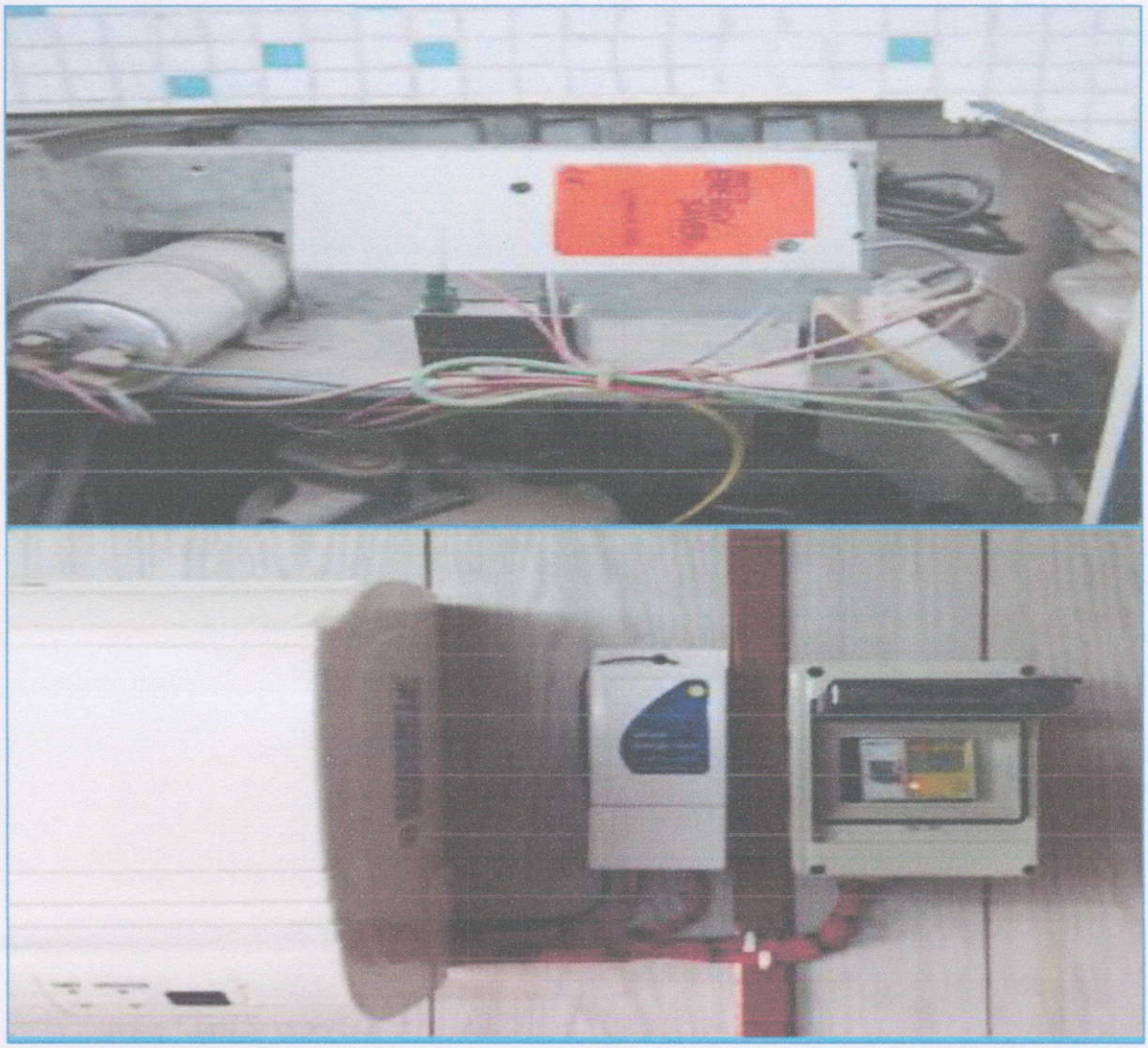

***Case Study on AIRCON Energy Saver:***

| Time Period | Without AIRCON (kWh) | With AIRCON | Savings (kWh) |
|---|---|---|---|
| **1 Hour** | 2.39 | 1.79 | 0.6 |
| **1 Month (for 12 hours)** | 872 | 653 | 219 |
| **1 Year (365 Days)** | **10,468** | **7,840** | **2,628** |
| Test Date & Duration | | 09-11-2009 & 2 Hours | |
| Capacity of AC, Make and Type of AC | | 1.5 Ton, Videocon, Split | |
| Percentage of Energy Savings | | 25.10 % | |
| Cost/Unit of AIRCO | | Rs. 6,250 + (Applicable Tax) | |
| **Estimated Payback Period** | | **Approximately 3 Months** | |



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| ENCON-IV | Replacement of Existing Convention Ceiling Fans into Electronically Commutated BLDC Fans |
|---|---|
| Assessment Area | Energy conservation in ceiling fans located in the college campus |
| Observations | College area including all Buildings, Class, Lab, Faculty cabins, Auditorium, Hostel rooms & Other areas |
| Assessments | • BLDC fans operate in less energy with same air delivery. Similarly, these fans generate lesser noise, runs with inverter supply, remote control-based speed control, aesthetic look and better lifespan.<br>• Conventional fans consume 1 unit of electricity for approximately 12-13 hours of running period, whereas the BLDC fans consume the same 1 unit of electricity for nearly 28-29 hours. |
| Recommendation (Target) | • Recommended to replace the existing conventional fans into EC BLDC fans in a phased manner and ensure good energy saving. |

***Energy and Financial Saving Calculation:***

| Parameters | Description | |
|---|---|---|
| Total No. of Fans available | Consider **100 Nos** of conventional fans available in both the hostels which accounts for **7.0 kW** | |
| Approx. Operating Hours (Average assumed value) | **10 hours/day & 300 days/Annum = 300 hours/annum** (Actual operating hours may change) | |
| Energy Calculation | **Before** | **After** |
| Power Consumed (Approx.) | 7.0 kW | 3.5 kW |
| Expected Reduction of Power | – | **3.5 kW (50 % ↓)** |
| Annual Energy Saving | – | **10,500 kWh** |
| Annual Financial Saving | – | **Rs. 1,14,450/-** |
| Initial Investment | - | **Rs. 1,80,000/-** |
| (Considering Rs. 2,000/fan - Salvage value of Rs. 200/fan for old fan = Rs. 1,800/fan) | | |
| **Simple Payback** | – | **Nearly 1.57 Years** |
| **$CO_2$ Reduction** | – | **8.6 Tons/Annum** |

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



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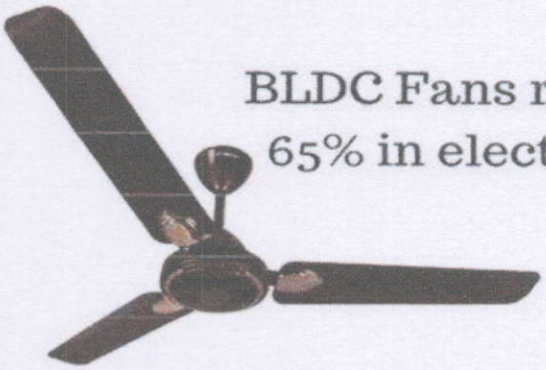


BLDC Fans reduce up to 65% in electricity bills

## Economics of Ceiling Fans in India

| | Regular Fan | BEE 5 Star Rated Fan | Super Efficient Fan |
|---|---|---|---|
| Price | Rs 1500 | Rs 1940 | Rs 2600 |
| Regulator Cost | Rs 200 | Rs 200 | Rs 0 |
| Wattage | 75 Watts | 50 Watts | 35 Watts |
| Air Delivery | 230 cum/min | 210-220 cum/min | 230 cum/min |
| Units Consumed Per Year | 180 Units | 120 Units | 84 Units |
| Electricity Cost Per Year | Rs 900 | Rs 600 | Rs 420 |
| Electricity Cost For 10 Years | Rs 10800 | Rs 7200 | Rs 5000 |

Assumptions: 1) Usage of 12 hours per day for 200 days. 2) Electricity Cost of Rs 5 per unit. 3) Electricity cost to increase by 4% every year for 10 years. 4) Prices as available on Internet on Aug 2013. 5) Calculations are for 1 Fan. 6) Electricity consumption is at top speed.

Bijli Bachao! because saving electricity saves money



| | | Speed Positions | | | | |
|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 |
| Super Fan | Power (W) | 3.8 | 7.7 | 13.8 | 22.7 | 35.0 |
| 5-Star rated Fan | | 13 | 24 | 30 | 40 | 55 |
| Regular Fan | | 13 | 26 | 39 | 48 | 76 |

| ENCON-V | Replacement of Existing Collection Tank Water Pumps into BEE Star Labelled Energy Efficient Pumps | | | |
|---|---|---|---|---|
| Assessment Area | Water Pumping System | | | |
| Observations | • 3 Nos. of water pumping **system (2.2 kW/3 HP – 2 Nos + 3.7 kW/5.0 HP – 01 No** water pump motor) is being utilized to feed the water (bore water pump + salt water pump).<br>• Most of the pumps are rewinded several times which reduces the efficiency below the name plate value. | | | |
| | $\eta$ Old Pumps | **Nearly 50 %** | $\eta$ New Pumps | **More than 70 %** |
| Assessments | • BEE star labelled pump system has i) High efficiency motor, ii) Lightweight materials and iii) Optimized suction-delivery system, ensures greater energy saving during their continuous operation. | | | |
| Recommendation (Target) | • Recommended to replace the older pumps into BEE star rated pumps which offers best efficiency (more than 70 %). | | | |

***Energy and Financial Saving Calculation:***

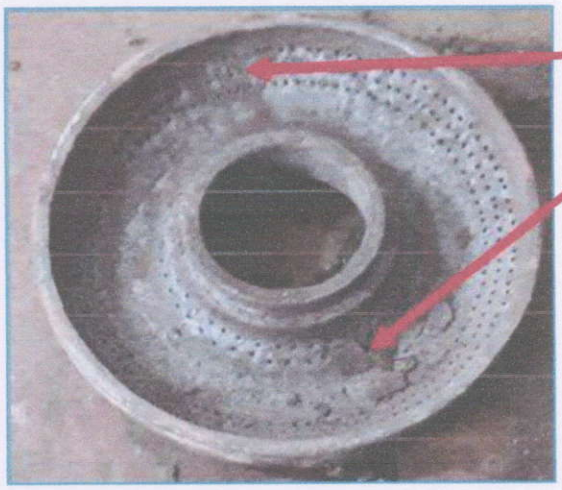
| Parameters | Description | |
|---|---|---|
| Total No. of Pumps | **03 Nos (2.2 kW/3 HP – 2 Nos + 3.7 kW/5.0 HP – 01 No)** | |
| Energy Calculation | **Before** | **After** |
| Power Capacity | **13.0 kW** | **9.3 kW** |
| • Assuming the efficiency of 50 % and loading factor of 80 % for old conventional pumps<br>• Assuming the efficiency of **70 %** and loading factor of 80 % for Energy Efficient pumps | | |
| Expected Power Reduction | – | **3.7 kW** |
| (Star rated pumps ensure a minimum savings of 20 % & Assume 3,000 running hours per Annum) | | |
| Annual Energy Saving | – | **11,100 kWh** |
| Annual Financial Saving | – | **Rs. 1,20,990 /-** |
| Initial Investment | - | **Rs. 50,000/-** |
| • Initial cost of 2.2 kW/3 HP; star rated EE motor is **Rs.15,000/- motor** + Initial cost of 3,7 kW/5 HP EE motor is **Rs.20,000/-**. Hence the cumulative investment of **Rs. 50,000/-** for replacing all the motors.<br>• Investment includes the cost of pump and **installation of kWh meter** to monitor the energy consumption | | |
| **Simple Payback** | – | **Nearly 0.4 Years** |
| **$CO_2$ Reduction** | – | **9.1 Tons/Annum** |

| ENCON-VI | Reduction of LPG Consumption using Regular Burner Cleaning and Swapping of Active Burners. |
|---|---|
| Assessment Area | LPG Consumption (Cooking system in kitchen area) |
| Assessment | • Cooking system in the college mess mainly uses LPG as an energy carrier and utilize Gas stoves as a medium to cook the food.<br>• Gas stoves are easy to maintain. However, when the flow of gas gets blocked, the burner heads cannot burn efficiently.<br>• The best indicator for the efficiency of LPG system is the irregular flame pattern and yellow flames.<br>• Formation of soot in both side of the burners, cleaning methods and interval improves the efficiency and reduce the LPG consumption. |
| Recommendation (Target) | • LPG commercial burners are made up of cast iron in which smoke formation is high and frequently able to crack due to aging.<br>• It is recommended to clean the burner every week with solvent, rinse and gently clean the holes with ordinary fine cloth. Also, it is highly encouraged to swap with active spare burners. The investment on spare burners are less expensive. Make it a practice to swap the burner every week.<br>• Identify an alternative with Stainless Steel (SS) burners (slightly costlier compared with existing one). But the lifespan is longer and replacement cost is much reduced.<br>• Recommend to clean the burner at least twice in the week and saves nearly 5 % assured LPG saving. |

***Energy and Financial Saving Calculation:***

| Parameters | Description | |
|---|---|---|
| Swapping of new burners every week and cleaning of existing burner with natural ingredients (Ex: Dishwashing detergent, Non-abrasive scrub pad, Microfiber towels) | | |
| Energy Calculation | **Before** | **After** |
| Expected Savings on LPG | – | **5 %** |
| LPG Consumption/Annum | **4,320 kg** | **4,104 kg** |
| (Note: from the total LPG consumption; assuming nearly 50 % of gas is being consumed by burner-based stoves; and hence 50 % of 8,640 kg = 4,320 kg). | | |
| LPG Savings/Annum | – | **216 kg** |
| The expected financial savings is 216 kg x Rs. 86/kg = **Rs. 18,576/Annum** | | |
| Initial Investment | - | **Rs. 5,000 /-** |
| **Purchasing of cleaning ingredients for Rs. 5,000 with a payback of 0.3 Years** | | |
| **$CO_2$ Reduction – 0.65 Tons/Annum** | | |

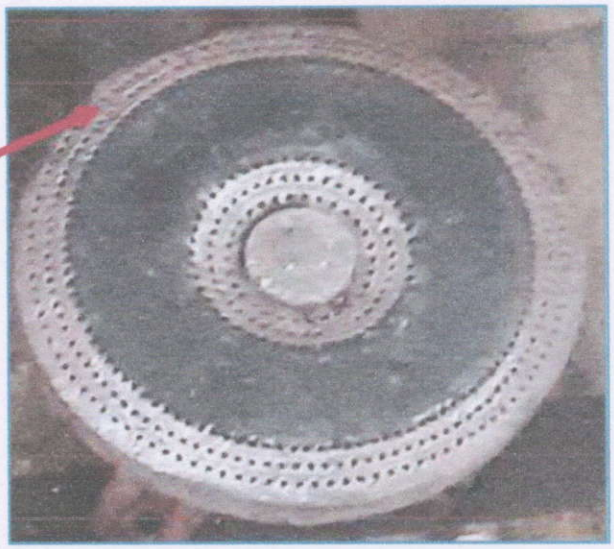
***Examples of Soot Formation in LPG burners:***



Uneven Surface in the holes

Soot Deposit

Semi Closed Holes





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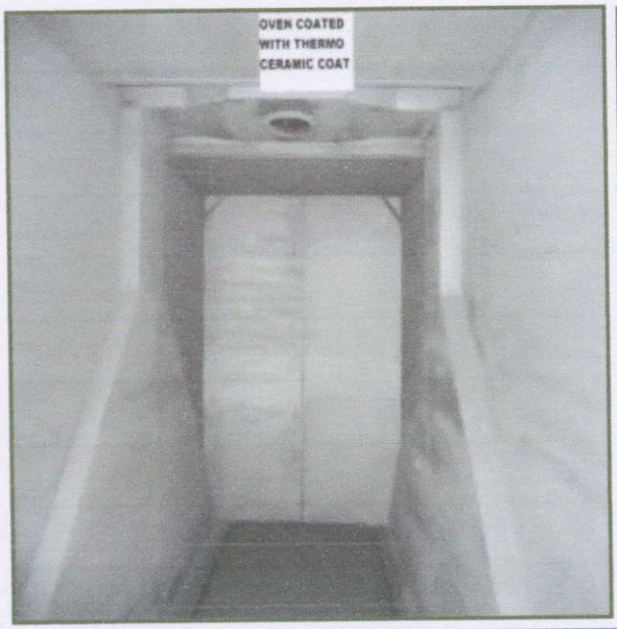
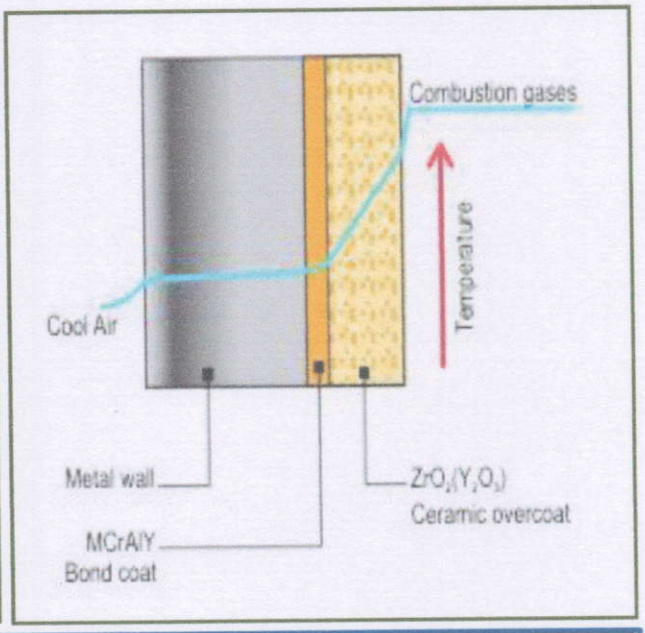
| ENCON-VII | Reduction of Heat Energy Exposed in the Steam Pipes Lines (Especially in Pipes Joints) using Thermo Ceramic Coating (TCC) |
|---|---|
| Assessment Area | Steam Boiler use for Cooking System in Hostel Mess |
| Assessment | • The major consumption of wood in the cooking system is in the boiler which is used to generate steam for cooking application.<br>• Optimization in any form in the boiler will lead to a huge savings and reduced the specific energy consumption significantly.<br>• Steam is distributed to the cooking application through proper piping system operated at required pressure and flow.<br>• All the pipes are surrounded two-layer insulation namely i) Ceramic wool insulation acts as a first layer and ii) then covered by metal cladding.<br>• These insulations prevent the heat exposed in the atmosphere due to which the energy content in the steam is being maintained. Also, it avoids the condensation while exposing to atmosphere air.<br>• However, the pipe joints; bends (T and L bends) and left-over pipes are usually uncovered and are directly exposed to the atmosphere. These areas where energy loss happens and usually the surface temperature is high (nearly 70-80 $^0$C).<br>• It is a good practice to maintain the skin temperature at a maximum of 20 $^0$C above the ambient temperature. This will lead to consume less fire wood and thus saves energy. |
| Recommendation (Target) | • The heat exposed to the atmosphere also leads to the energy loss. The audit team recommends arresting the heat and hence saving the energy.<br>• Thermo Ceramic Coating (TCC) - an energy saving coating is a combination of specialized high temperature resins and heat reflecting ceramics.<br>• Applied on the outside metallic pipes and it reflects radiation heat back in the process area, thereby preventing radiation heat losses and save the fuel energy.<br>• The benefits of using TCC coating are i) saving on running time, ii) reduction in heat in internal walls and ceilings, iii) no damage (change) in the existing insulation, iv) zero maintenance and v) saves energy between 5-10 %.<br>• Two types coating material is available namely i) TCC -1200 $^0$ C or applying on Internal Ceramic Wool/ Blanket and ii) TCC-200 $^0$C for applying on External Shell of Furnace. |

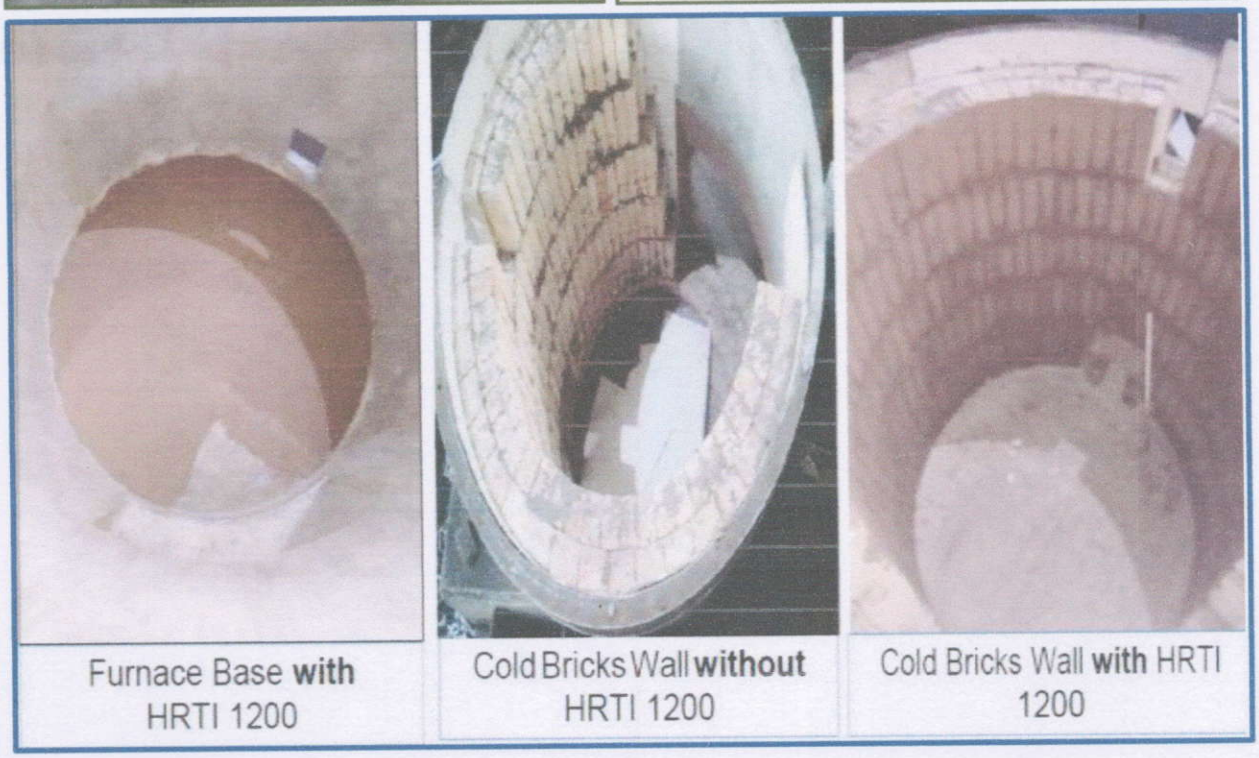
***Energy and Financial Saving Calculation:***

| Parameters | Description | |
|---|---|---|
| Energy Calculation | Before | After |
| Expected Savings on wood | – | 10 % |
| LPG Consumption/Annum | 100.0 Tons | 90.0 Tons |

| | | |
|---|---|---|
| LPG Savings/Annum | – | 10.0 Tons |
| The expected financial savings is 10.0 Tons x Rs. 5,000/Ton = Rs. 50,000/Annum | | |
| Initial Investment | - | Rs. 30,000 |
| Simple Payback | – | 0.6 Years |
| $CO_2$ Reduction | – | 19.0 Tons/Annum |



Furnace Base **with** HRTI 1200

Cold Bricks Wall **without** HRTI 1200

Cold Bricks Wall **with** HRTI 1200



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## PART-B: ENVIRONMENT AUDIT REPORT

# 6. ESTIMATION

# OF

# $CO_2$ EMISSION & NEUTRALIZATION

(ELECTRICITY, LPG, DIESEL & MATURE TREES)

***6.1: 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 (LT Service - 01 No) | 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 **38 mature trees** of different varieties which are more than **20 years old.** | |

***6.2: 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 (2022-23)**

| S. No. | Annual Energy Consumption & $CO_2$ Emission | | | Annual $CO_2$ Neutralization | | |
|---|---|---|---|---|---|---|
| | Description | Energy Quantity | Emission (Tons) | Description | Energy Quantity | Neutralized (Tons) |
| 1. | Electricity | 1,70,937 kWh | 140.2 | Electricity (DG) | 2,704 kWh | 2.2 |
| 2. | Diesel | 45,752 Litres | 120.8 | | | |
| 3. | LPG | 8,640 kg | 25.9 | Mature Tree | 38 Nos | 0.8 |
| 4. | Wood | 100 Tons | 190.0 | | | |
| Total Emission | | | 476.9 | Total-Neutralized | | 3.0 |
| Balance $CO_2$ to be Neutralized = 473.8 Tons/Annum; Per capita Consumption = 1.22 Tons/Person | | | | | | |

Note: No. of Students, Faculty & Staff for the year 2022-23 is 388)



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***6.3: 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 LPG = $\left[\text{LPG Consumption (kg) x } \frac{3.0 \text{ kg of CO2 emission}}{\text{kg of LPG Consumption}}\right]$ |
| For Wood = [Wood Consumption (kg) x 1.9 kg of CO2 Consumption] |
| A mature tree is able to absorb nearly $CO_2$ at a rate of 21.8 kg/annum; $\frac{(21.8 \times 38)}{1,000} = 0.8 \frac{\text{Tons}}{\text{Annum}}$ |

***6.4: 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.

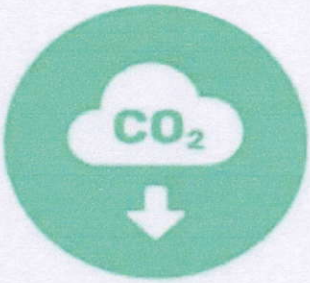
- Increase the foot print of trees planted inside the college campus.
- Encourage the students to plant more trees and account them all.
- It is a right time to install considerable amount of roof top solar PV plant and generate the electricity. This must reduce the utility supply and hence reduce the 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.

***6.5: 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:**
**476.9 Tons/Annum**




**Planned $CO_2$ Reduction**
**3.0 Tons/Annum**


**$CO_2$ to be Neutralized**
**473.8 Tons/Annum**



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## PART-B: ENVIRONMENT AUDIT REPORT

# 7. TRANSPORT

# &

# REFRIGERANT GASES

# IN

# AC SYSTEM

***7.1: List of Transport Vehicles:***

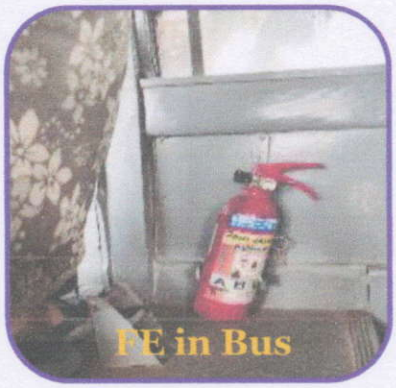
Pollution level of all vehicles are regularly monitored and are maintained within the prescribed limit since the college is committed to provide green environment for better atmosphere. The list of transporting vehicles along with their type of engine are represented in Table-5.

**Table-5: List of Transporting Vehicles available in the College**

| S. No. | Type of Vehicle | Fuel used | No. of vehicles | Pollution certified (Y/N) |
|---|---|---|---|---|
| 1. | Bus | Diesel | 05 | Yes |
| Total No. of Vehicles | | | 05 | Yes |

***7.2: Details of Pollution Free Transport Vehicles & Copy of Pollution Certificate:***

- The college is committed to green environment not only in the campus; but also, to the entire atmosphere. In order to commute the students and staff; the management is operating vehicle services from various places to the college.
- These vehicles are well maintained by a set of dedicated bus operators and are continuously monitored by the management officials.
- No history of accidents (either major and/or minor) for the past five years. Maintaining best performance on the engine, tyre and other accessories.
- Maintaining proper records on each trip, fuel consumption, distance travelled, no. of passengers and mileage (kmpl)
- All the drives and helpers are well experienced with good track records on i) fuel economy, ii) maintenance free operation, iii) accident free and iv) student friendly.
- All the vehicles are checked periodically and are having valid pollution certificate and certificate of insurance. These vehicles are fitted with Bharat Standard (BS)-IV type engines. However, the management has a commitment to convert the vehicles to BS-VI; once the life time of the vehicles are ended.
- The college administration is also providing skill development training to the bus operator through renowned experts and improve their productivity. Further the management is also conducting regular medical camps for all the bus operator through which i) complete body check-up, ii) blood pressure, iii) blood sugar level, iv) vision check-up and v) other general medical examination are carried out.
- **High Speed Diesel (HSD)** is used as fuel for all the vehicles; which emits less $CO_2$ in the atmosphere than compared to conventional fuel. Further; the fuel is procured from a single consumer and hence it maintains the quality and provides good engine life.



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Form 59

[See rules 115 (2)]

**Pollution Under Control Certificate**

Authorised By :
State Transport Department

| | | |
|---|---|---|
| Date | : | 18/06/2024 |
| Time | : | 14:35:08 PM |
| Validity upto | : | 17/12/2024 |

**Test Validity**

| | | |
|---|---|---|
| Certificate SL. No. | : | TN02800250021207 |
| Registration No. | : | TN28AF0830 |
| Date of Registration | : | 23/Dec/2009 |
| Month & Year of Manufacturing | : | October-2009 |
| Valid Mobile Number | : | ******0000 |
| Emission Norms | : | BHARAT STAGE II |
| Fuel | : | DIESEL |
| PUC Code | : | TN0280025 |
| GSTIN | : | |
| Fees | : | Rs.60.00 |
| MIL observation | : | No |

Vehicle Photo with Registration plate
60 mm x 30 mm

**Vehicle Number**


| Sr. No. | Pollutant (as applicable) | Units (as applicable) | Emission limits | Measured Value (upto 2 decimal places) |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
| Idling Emissions | Carbon Monoxide (CO) | percentage (%) | | |
| | Hydrocarbon, (THC/HC) | ppm | | |
| High idling emissions | CO | percentage (%) | | |
| | RPM | RPM | 2500 ± 200 | |
| | Lambda | - | 1 ± 0.03 | |
| Smoke Density | Light absorption coefficient | 1/metre | 2.45 | 1.85 |

This PUC certificate is system generated through the national register of motor vehicles and does not require any signature.

Note : 1. Vehicle owners to link their mobile numbers to registered vehicle by logging to https://puc.parivahan.gov.in

Authorised Signature with stamp of PUC operator
60mm x 20 mm

T.L.S POLLUTION TESTING CENTRE
NAMAKKAL - 637 003.
Mobile : +91 94422 21556.

**Sample Pollution Certificate for a Transport Vehicle**



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***7.3: List of Air Conditioning System along with its Refrigerant:***

The AC system has combined of **R-22** as refrigerant which has different **Global Warning Potential (GWP) and Ozone Depletion Potential (ODP).**

**Table-6: List of Multi-variant AC System available in the SEC**

| S. No. | Location | Quantity | Refrigerant Type | Global Warning Potential (GWP) | Ozone Depletion Potential (ODP) |
|---|---|---|---|---|---|
| 1. | Principal Room | 1 | R-22 | 1,810 | Medium |
| 2. | AICTE Room | 1 | R-22 | 1,810 | Medium |
| 3. | Exam Cell | 1 | R-22 | 1,810 | Medium |
| 4. | Vice Chairman Room | 1 | R-22 | 1,810 | Medium |
| 5. | Admission Hall | 1 | R-22 | 1,810 | Medium |
| 6. | Chairman Room | 1 | R-22 | 1,810 | Medium |
| 7. | Computer Lab – I | 1 | R-22 | 1,810 | Medium |
| 8. | Computer Lab – II | 1 | R-22 | 1,810 | Medium |
| 9. | Computer Lab – III | 1 | 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).

| 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 |

# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## PART-B: ENVIRONMENT AUDIT REPORT

# 8. USAGE OF CHEMICALS, SALTS & ACIDS

(STORAGE, HANDLING & BEST OPERATING PRACTICES)

***8.1: Handling of Chemicals/Salts/Acids used in the Laboratories:***

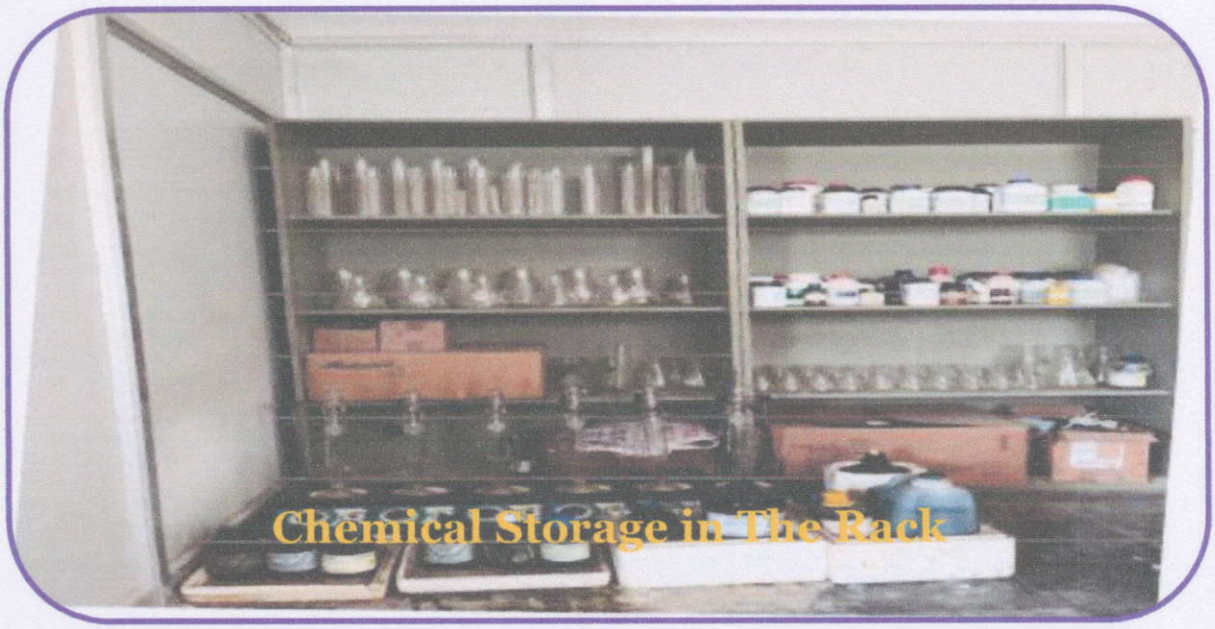
The science departments & Department of S & H and Civil Engineering use chemicals for experimental applications and are having strict safety rules as follows;

- 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

***8.2: 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 choke pit.
- Only trained teaching and non-teaching staffs are handling the chemicals and also, they are well trained to handle any abnormal laboratories with chemicals are well ventilated with proper emergency exits. Adequate and correct sequence of fire extinguishers are placed near all the laboratories



Chemical Storage in The Rack



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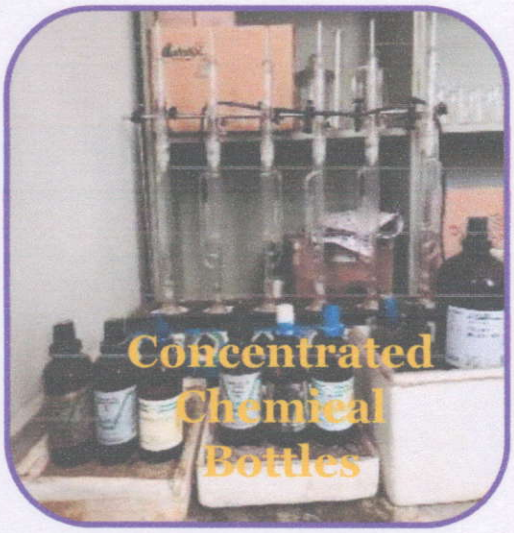



**Storage of Chemicals/Salts/Acids Storage**

***8.3: 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

***8.4: 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-7 shows the cleaning agents used to clean the above-mentioned area;

**Table-7: Cleaning Agents used for Floor and Vessel Cleaning**

| S. No. | Cleaning Agent | Application |
|---|---|---|
| 1. | Soap Oil | Vessel Cleaning |
| 2. | Soap Oil | Floor Cleaning |



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**Cleaning & Refreshing Agents used for Vessel & Floor Cleaning**

***8.5: Recommendations: Eco Friendly – Green Cleaning Agents:***

- 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


**Green Pro Certified Eco-Friendly Cleaning Agents (ZERODER)**



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## PART- C: GREEN AUDIT REPORT

# 9. WATER UTILIZATION, CONSERVATION & WATER MANAGEMENT

***9.1: Source of Water, Storage and Distribution:***

Table-8 shows the source of water, location of storage along with their application.

**Table-8: Source of Water, Location of Storage and Application**

| Type of Water | Source | Application |
|---|---|---|
| Fresh Water | Product RO Plant | Drinking application |
| Bore Water | **Total No. of Bore - 05 Nos.**<br>1. Near neem tree (Ground) – 480 ft<br>2. Boys hostel – 580 ft<br>3. Garden – 1000 ft (Not in use)<br>4. Inside canteen – 400ft (Not in use)<br>5. Front of girl's hostel – 450 ft (No water) | Utensil Cleaning, Bathing, Cloth Washing & RO Plant |
| **Rain Water Harvesting System (RWHS)** | ↗ **Used to increase the ground water**<br>↗ **To store building run-off only** | |

***9.2: Details of the Water Utilities, Storage, Motor Capacity and Approximate Run Hours:***

The following table provides the details of the Water Utilities, Storage, Motor Capacity and Approximate Run Hours available inside the college for regular application.

**Table-9: Details of the Water Utilities, Storage, Motor Capacity and Approximate Run Hours**

| S. No. | Location | Depth | Motor Capacity | Storage - I | Motor Capacity | Usage |
|---|---|---|---|---|---|---|
| 1. | Bore – 1 | 480 ft | 3 HP | UG – Sump<br>1 – Lakh Litters<br>(RCC – Tank) | 3 HP | Girls Hostel UG Sump<br>20,000 – Litters; RCC – Tank |
| | Bore – 2 | 580 ft | 5 HP | | 3 HP | Boys Hostel O.H Tank<br>10,000 – Litters; RCC – Tank |
| | | | | | 5 HP | Main Building Centre<br>O.H Tank - 20,000 Litters<br>(RCC – Tank) |
| | | | | | | Main Building Top of RO Plant<br>O.H Tank – 20,000 Litters<br>(RCC – Tank) |
| 2. | Girls Hostel UG Sump<br>20,000 – Litters; RCC – Tank | | | | 3 HP | Girls Hostel O.H. Tank<br>10000 Litters – RCC Tank |
| 3. | R.O Plant from Main Building Top Tank | | | | 2 * 2,000 Litters HDPE Tank | |



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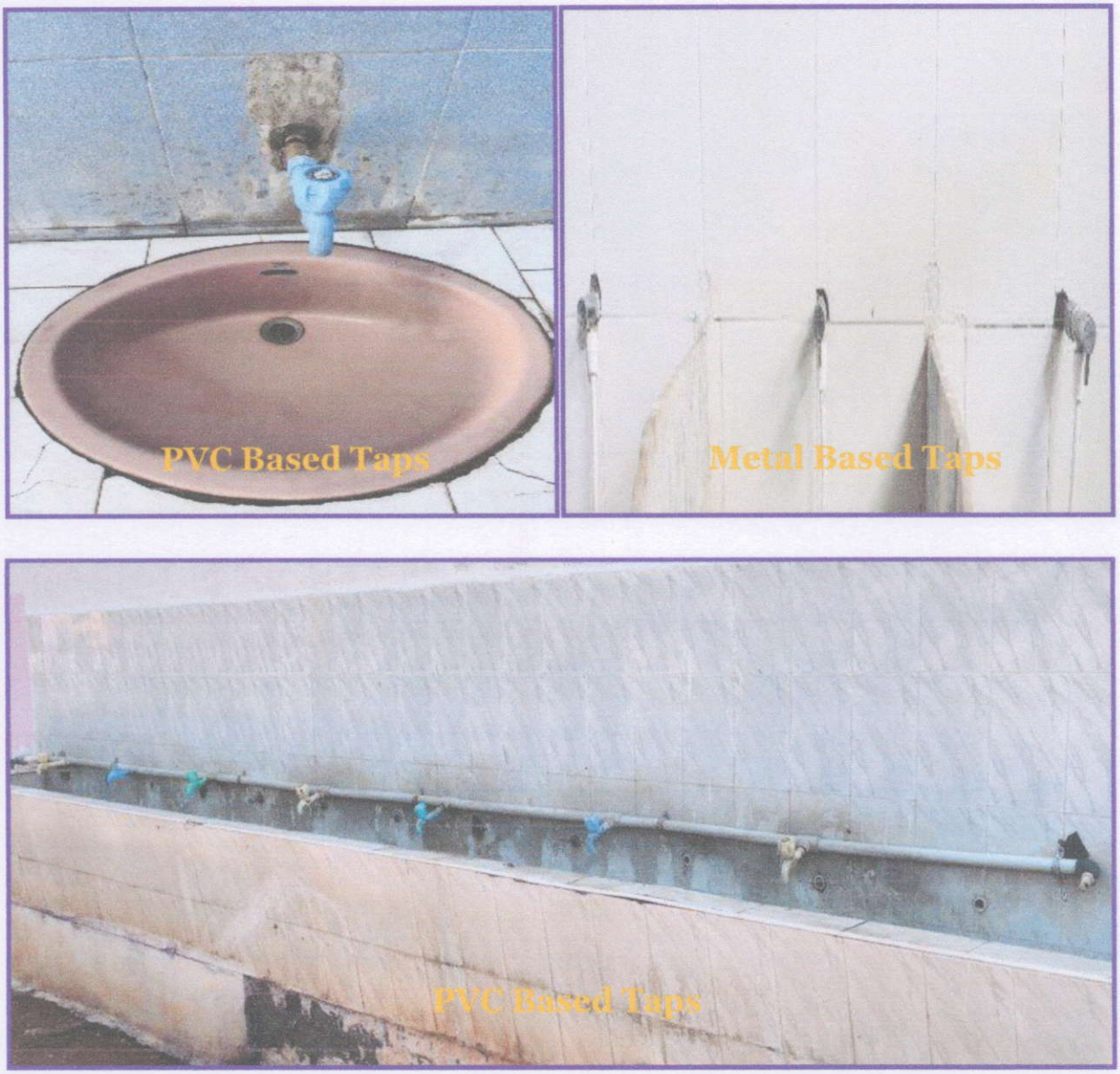
**Note:**

- ☞ Over Head (OH) tanks are made using cement construction.
- ☞ The maintenance team ensure to clean the tank for six months once.
- ☞ Bleaching power is mostly used to clean the inside tank.

***9.3: 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 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 Utensil Cleaning, Bathing & Cloth Washing.




**PVC and Metal Based Taping System for Water Distribution Line**



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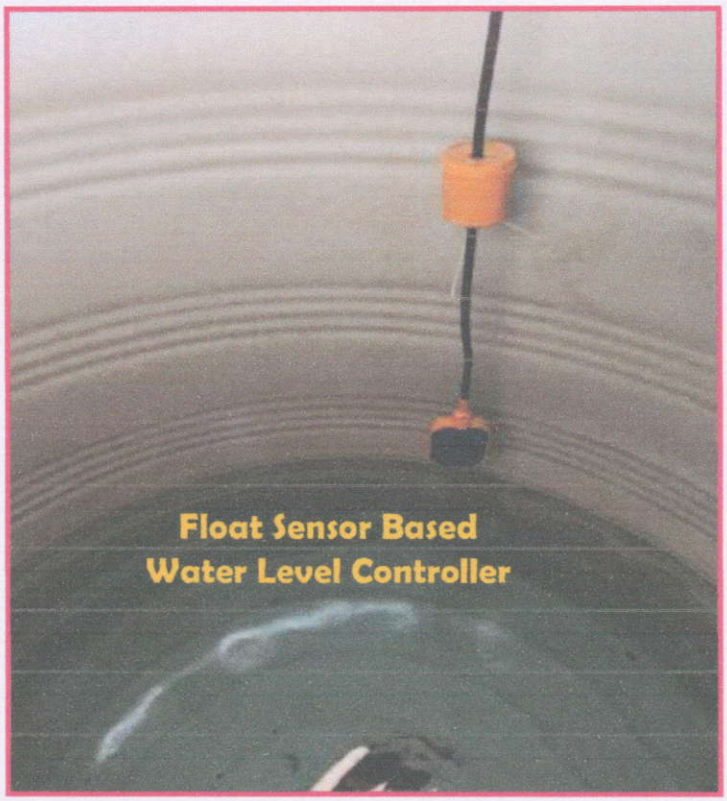
***9.4: Sensor Based Water Saving:***

- CMS College Management is much keen on conserving not only energy; but also, water as water is a precious commodity in the world.
- The college management; has implemented **Float Sensor based Water Level Controller** in the output tank of the RO Plant.
- The use of float switches for pumps is an economical and effective method to measure the water level in the pumping pit of the basement.




***9.5: Water Savings in Foreign Toilets:***

- The list of availability of Indian & Foreign style toilets are presented in the below Table-10.

**Table-10: List of Indian & Foreign Style Toilets**

| S. No. | Location | Description (Quantity) | |
|---|---|---|---|
| | | Indian | Foreign |
| 1. | Main Building | 24 | - |
| 2. | Boys Hostel | 120 | - |
| 3. | Girls Hostel | 120 | - |
| **Total** | | **264** | - |

- 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.



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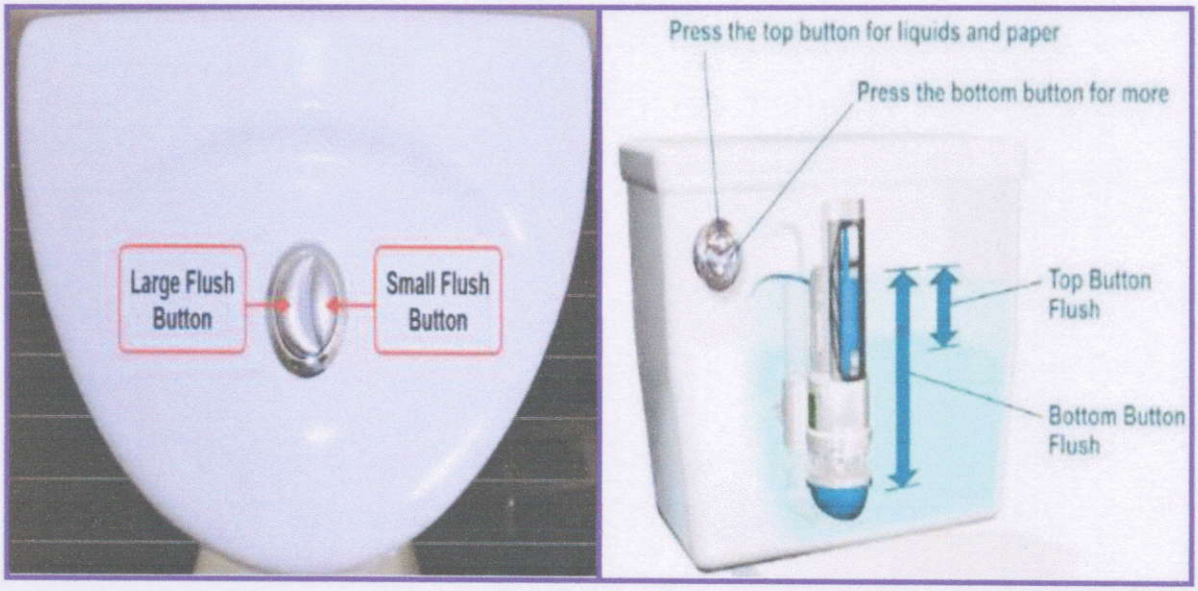


***9.6: General Recommendations for Rain Water Harvesting:***

- 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.
- Increase the no. of RWH pits and may be developed to place at least 2 per building.


**Sample Name Board in front a Rain Water Harvesting System**



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***9.7: General Recommendations:***

→ It is advisable to replace all the old taps without aerator into aerator-based taps in a phased manner.

→ Aerators helps to reduce and regulate water flow and also offer the following benefits;

- ✓ Lower Water Bills & Improved Water Pressure
- ✓ Increased Filtration & Minimized Splashing

- All the pump motor must be fitted and controlled by floating sensor and hence the motors are automatically ON and OFF. It avoids the overflow; saves water and electrical energy.
- All the buildings are fitted with water flow meters & hence the water utilization must be properly accounted. Similar to the water flow meter; energy consumption of all pumping motors is recorded using panel board meters.
- Fault and leakage in the water distribution line will be promptly informed by the respective in-charges to the maintenance team and immediately arrested.

***9.8: Installation on Fire extinguishers:***

- The college has installed Fire extinguishers at all the vulnerable points.
- They are also refilled and in good condition (with adequate pressure indicated in the meter)


**Sample Fire extinguishers & First Aid Kit Placed in the College**



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## PART – C: GREEN AUDIT REPORT

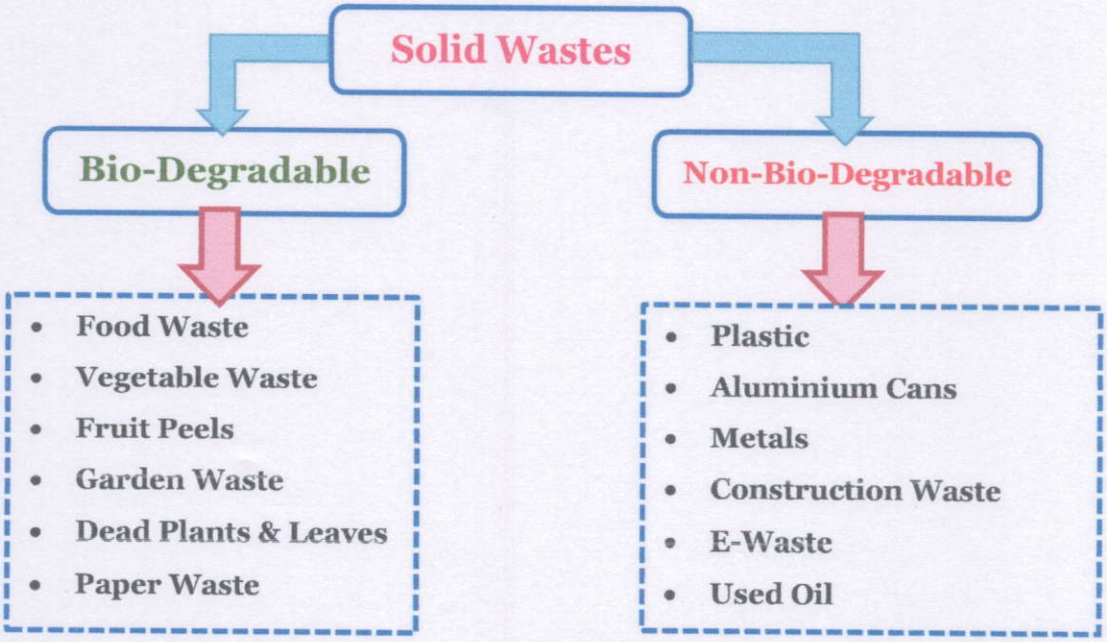
# 10. WASTE HANDLING

# &

# MANAGEMENT

***10.1: Solid Waste Management System:***

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




***10.2: Process of Waste Management:***

The college management practised some methods to treat the waste generated and Table-11 shows the process of treating the solid waste generated inside the college campus.

**Table-11: Process of Waste Management**

| S. No. | Waste Type | Waste Treatment |
|---|---|---|
| **Bio-Degradable Waste Management** | | |
| 1. | Food and Vegetable Waste | • Collected and given to nearby fam |
| 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 |
| | | • Daily paper waste stored in a yard |
| **Non-Bio-Degradable Waste Management** | | |
| 4. | Plastics | • Banned in the college campus (**Welcome step**).<br>• 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 Construction Purpose Only |
| 9. | Vehicle & Computer Batteries | • Procuring new batteries with buyback offer<br>• (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 |

***10.3: 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)

***10.4: 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)



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**Solid Waste Management (Collection, Segregation, Storage & Safe Disposal)**

***10.5: E-Waste Management:***

- With the proliferation of electronics also comes the challenge of their proper disposal. The institute has very efficient mechanism to dispose E wastes generated from various sources.
- The major e-waste such as written-off instruments/equipment, old version computers, printers, electronic gadgets/circuits, kits have been written off on regular basis and condemned devices and materials from computer lab are sold to the e-waste management companies/buyers in Coimbatore.
- All the miscellaneous e-waste such as CDs, batteries, fluorescent bulbs, PCBs, and electronic items are collected and delivered for safe disposal. Minor repairs are addressed by the lab technician with the support of staff members whereas the major issues are repaired by professionally trained personnel.

# SAI SRI WASTE MANAGEMENT PVT.LTD

SF No-443/1B2,443/2A, Padaiveedu Village, Kumarapalayam Taluk, Namakkal. Tamilnadu - 637 304
E.Mail:info@saiwaste.in website : www. saiwaste.in Phone : 99424 29447

## Destruction certificate

Date:20.10.2023

RefNo: SSWMPL/PPM/CSM/003/2023-2024 SPCB 21EFZ36609231

This is to certify that **Sai Sri Waste Management Pvt Ltd** has undertaken the rights and Ownership Of the end of life electronic equipment's consisted of Total No: 1680KGS.

**From M/S CMS Group of institutions,Namakkal-637212**

The above said quantity has been processed in an environmental friendly manner in accordance

With the guidelines sent by the state pollution control board/committee at our **padaveedu** facility

By recycling the aforesaid Material, both the companies are ensuring their social responsibility.

Sai Sri Waste Management Pvt. Ltd.

Authorised Signatory

Regd.Office : 54 Nehru Nagar, Pallipalayam, Kumarapalayam Taluk,Namakkal. Tamilnadu - 638 006
CIN:U74140TZ2019PTC032889

**Sample bill for battery**



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## PART - C: GREEN AUDIT REPORT

# 11. ASSESSMENT ON MATURE TREES, & BIO-DIVERSITY

***11.1: Campus Greenery:***

The college is completely covered with mature trees grown for more than 20 years. The total number of mature trees available in the college campus is ***38 with many varieties of trees.***

**Table-12: List of Mature Trees available in the College Campus**

| S. No. | Location | Name of the Tree | Quantity |
|---|---|---|---|
| 1.0 | Entire Campus | Variety of Mature Trees | 38 |

**Total No. of Mature Trees available in the college campus is 38 which contributes for reduction of 0.8 Tons of $CO_2$ emission/Annum**

**Campus Greenery Initiatives Taken by the College Management**

***11.2: 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**



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**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

***11.3: 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.

***11.4: 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.

***11.5: 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.

***11.6: 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.

***11.7: Formation of Green Energy Team (GET):***

- It is essential and the right time to form an Energy Management Team comprising of the following members with their roles and responsibilities as shown in Table-9:

**Table-7: Roles of Responsibilities of Green Energy Team (GET)**

| S. No | Members | Roles | Responsibilities |
|---|---|---|---|
| 1. | Management Commitment | Overall Monitoring | • Encourage members to carry out the activities<br>• Propose possible think tank ideas to be implemented in the college campus |
| 2. | Head of the Institution | Team Head | • Monitoring all energy related activities<br>• Report to the Management |
| 3. | Heads of various Departments | Team Manager | • Assessing the energy target<br>• Monitoring the energy performance<br>• Revising the target based on performance<br>• Monitoring projects/activities/implementation |
| 4. | Faculty members from various department | Team Members | • Identify the viable energy saving projects<br>• Prepare the detailed work plan/time frame<br>• Project guides for energy related projects<br>• Pre and post project implement study<br>• Rework if there is any deviation |
| 5. | Student volunteers | Energy Ambassadors | • Responsible of identified areas<br>• Floor in-charge for energy utilities<br>• Development energy saving projects<br>• Testing and Implementation |

- Educate all the faculty, staff and students about the need for the energy conservation
- Energy conservation related projects are to be implemented in the college premises
- Nominate brand ambassadors for energy saving among students (for each building/floor)
- Cash incentives/awards may be given to the prominent energy achievers
- Circulate the success stories as energy conservation measures



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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## 12. AUDIT SUMMARY & CONCLUSION

***I. Energy Conservation & Management – Electrical Energy:***

- 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.
- Regularly clean the stove burners and ensure that the flame should be in light bluish colour

***II. Water Conservation & Management:***

- Utilize more amount of treated water; 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
- 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
- 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**
- 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



Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D.
PRINCIPAL
CMS COLLEGE OF ENGINEERING,

***III. 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**

***IV. 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 **M/s. CMS COLLEGE OF ENGINEERING,** CMS Nagar (Nearby collectorate), Eranapuram (P.O), Namakkal - 637 003, Tamilnadu, India. by **RAM-KALAM CENTRE FOR ENERGY CONSULTANCY AND TRAINING,** Coimbatore-641 109 Tamil Nadu, India.



CMS COLLEGE OF ENGINEERING NAMAKKAL-3

Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D.
PRINCIPAL
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# ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

## *ANNEXURE:*

## AUTHORISED CERTIFICATES OF THE AUDITOR

ZERTIFIKAT ◆ CERTIFICATE ◆ 認証書 ◆ СЕРТИФИКАТ ◆ CERTIFICADO ◆ CERTIFICAT

# CERTIFICATE

**The Certification Body**
**of TÜV SÜD South Asia Private Limited**

certifies that

## M/S RAMKALAM CENTRE FOR ENERGY CONSULTANCY & TRAINING

**No.8, VPK Garden, Velanaipatti, Coimbatore – 641 062, India**

has implemented Quality Management System

in accordance with **ISO 9001:2015**

for the scope of

**Providing Energy, Environment, Green audits to industry, Academic institutions and organizations**

The certificate is valid from **2023-11-22** until **2026-11-21**

Subject to successful completion of annual periodic audits

The present status of this certificate can be obtained through TUV SUD website by scanning below QR code and by entering the certificate number (without spaces) on web page. Further clarifications regarding the status & scope of this certificate may be obtained by consulting the certification body at info.in@tuvsud.com

Certificate Registration No. **99 100 23573**

Date of Initial certification: **2023-11-22**

Issue Date: **2023-11-22** Rev. **00**

Rahul Kale
Head of Certification Body
of TUV SUD South Asia Private Limited,
**Mumbai**
Member of TUV SUD Group

TUV SUD South Asia Pvt. Ltd. ● TUV SUD House ● Saki Naka ● Andheri (East) ● Mumbai - 400072 ● Maharashtra ● India



CMS COLLEGE OF ENGINEERING NAMAKKAL-3

Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D.
PRINCIPAL
CMS COLLEGE OF ENGINEERING,

Reg No.: EA-27299

Certificate No.: 9645/19

# National Productivity Council

(National Certifying Agency)

## PROVISIONAL CERTIFICATE

*This is to certify that Mr./ Mrs./ Ms.* **SIVARASU SULUR RATHINAVELU**

*son / daughter of Mr.* **P RATHINAVELU** *has passed the National certification Examination for Energy Auditors held in September 2018, conducted on behalf of the Bureau of Energy Efficiency, Ministry of Power, Government of India. He / She is qualified as* ***Certified Energy Manager*** *as well as* ***Certified Energy Auditor.***

*He / She shall be entitled to practice as Energy Auditor under the Energy Conservation Act 2001, subject to the fulfillment of qualifications for Accredited Energy Auditor and issuance of certificate of Accreditation by the Bureau of Energy Efficiency under the said Act.*

*This certificate is valid till the Bureau of Energy Efficiency issues an official certificate.*

Digitally Signed by K V R RAJU
Mon Apr 22 16:22:42 IST 2019
Controller of Examination, NPC AIP Chennai

Place : Chennai, India

Date : **22nd April, 2019**

**Controller of Examination**

TÜV NORD

**ISO 14001:2015 Lead Auditor**
**(Environmental Management Systems)**
**Training course**

it is hereby certified that

**Dr. S. R. Sivarasu**

has successfully completed the above mentioned course and examination

08th - 12th December 2017

Coimbatore, India

Certificate No. 3521 2982 02

Delegate No. 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



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Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D
PRINCIPAL
CMS COLLEGE OF ENGINEERING,

IGBC

CII
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



CMS COLLEGE OF ENGINEERING NAMAKKAL-3

Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D.
PRINCIPAL
CMS COLLEGE OF ENGINEERING,
NAMAKKAL-637 003

CII

Confederation of Indian Industry

This is to certify that

**SIVARASU S R**

is a

**CII Certified Professional in Sustainable Waste Management**

K S Venkatagiri
Executive Director
CII - Godrej GBC

Pradeep Bhargava
Chairman
CII GreenCo Council

IGBC

Learning

HSSERisk Academy

# CERTIFICATE

OF APPRECIATION

EMPOWERING PEOPLE THROUGH KNOWLEDGE TRANSFER

THIS CERTIFICATE IS AWARDED TO

*Sivarasu Rathinavelu*

FOR SUCCESSFUL COMPLETION 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

01.09.21.0281.0006

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Dr.K.MAHADEVAN,B.E.,M.E.,Ph.D
PRINCIPAL
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