

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

AUDIT CONDUCTED FOR

BHARATH COLLEGE OF SCIENCE AND MANAGEMENT

Thanjavur -613 005, Thanjavur District, Tamil Nadu, India.



AUDIT CONDUCTED BY



YOJO NETWORK

YOJO NETWORK & TRAINING CENTER

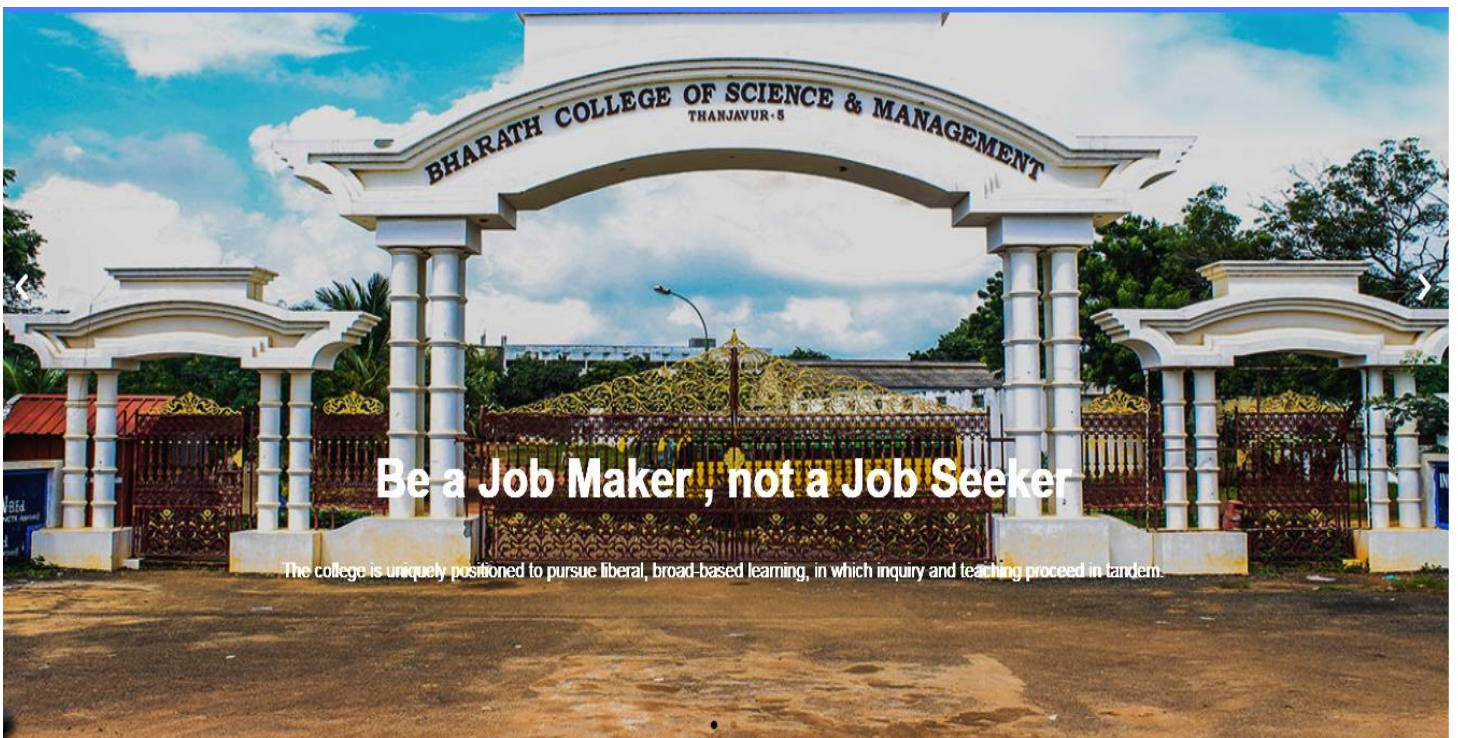
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Be a Job Maker, not a Job Seeker

The college is uniquely positioned to pursue liberal, broad-based learning, in which inquiry and teaching proceed in tandem.



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ACKNOWLEDGEMENT

Yojo Network & Training Center, Kumbakonam – 612 001 is thankful to the Board of Management, Head of Institution, Faculty and Technical team members of **BHARATH COLLEGE OF SCIENCE AND MANAGEMENT**, Thanjavur-613005, Thanjavur District, Tamil Nadu, India for providing an opportunity to conduct a detailed Energy, Environment and Green Audit process in the college premises. It is our great pleasure which must be recorded here that the Management of **BHARATH COLLEGE OF SCIENCE AND MANAGEMENT** extended all possible support and assistance resulting in thorough completion of the audit process. The audit team appreciates the co-operation and guidance extended during the course of site visit and measurements. We are also thankful to all those who gave us the necessary inputs and information to carry out this very vital exercise of green audit.

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

Management Team Members

Prof. N.Ganesan , M.Com., M.Phil., Ph.D.	Founder Chairman
Prof.Punitha Ganesan	Secretary

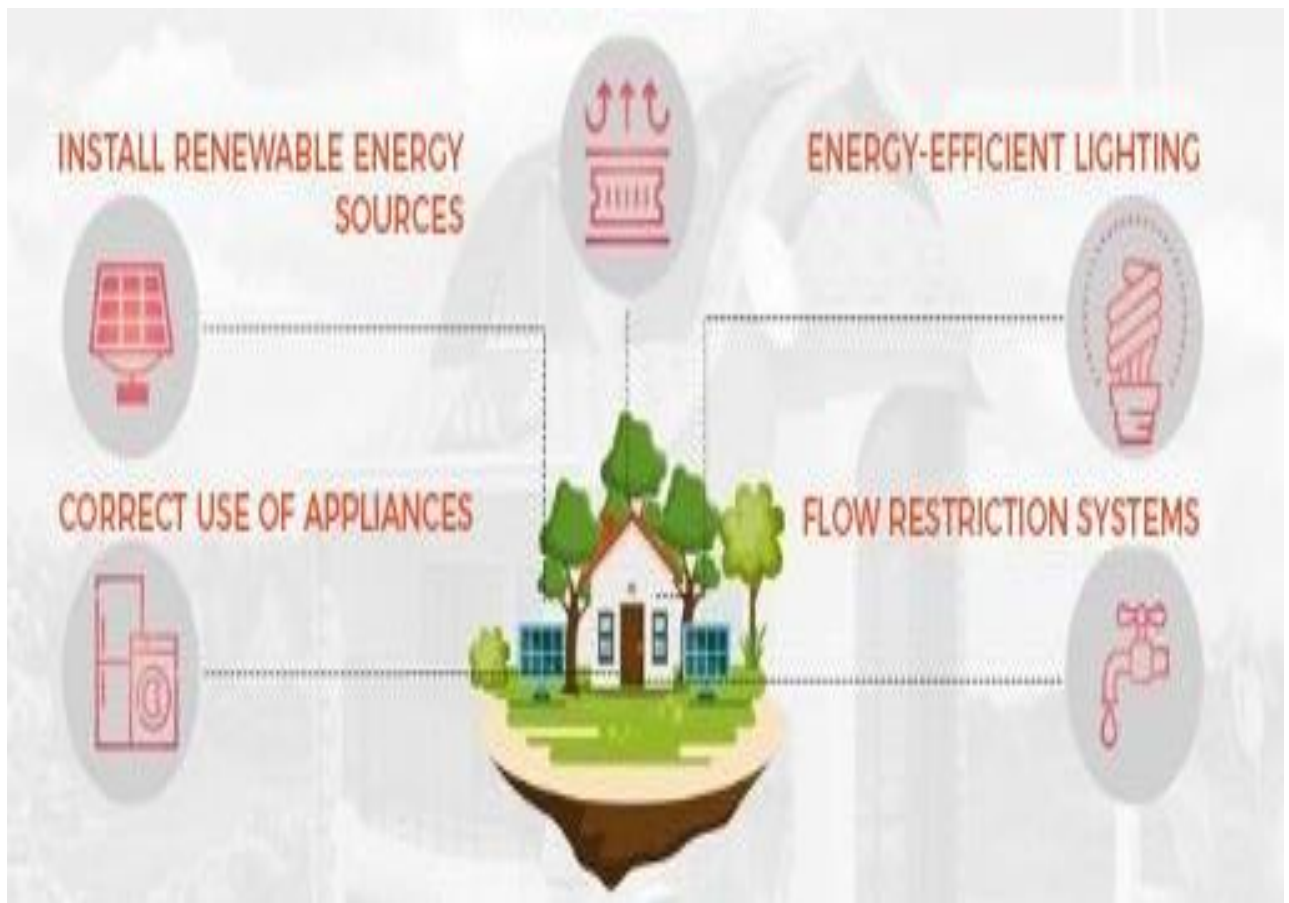
Audit Team Members

Er. V. Marimuthu., B.E., Er. C. Saravanakumar., B.E.,	UKAS Certified Energy Auditor (KQ-233) Lead Auditor-ISO-9001:2015 14001:2015(EMS), UKAS, KQ Reg., COC. Carbon Footprint Auditor Mobile:+91-9047205733
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ENERGY, ENVIRONMENT AND GREEN AUDIT REPORT

INTRODUCTION TO ENERGY- ENVIRONMENT-GREEN AUDIT

5 IDEAS FOR A SUSTAINABLE INSTITUTION INSULATE YOUR INSTITUTION





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1.1 : Preface about the Institution:

BHARATH COLLEGE OF SCIENCE AND MANAGEMENT was established in 2000 and it is now accomplishing 23 years of glory. It is located on a serene 15 - acre campus that offers a conducive academic environment while maintaining a sense of rural comfort. The college provides 13 undergraduate programmes, 10 post graduate programmes, and 4 +2 research programmes offered across six blocks which have suitable infrastructure.

To achieve its Vision and Mission, the College provides enough infrastructure and physical facilities for effective teaching and learning, as well as guarantees that they will be available for a positive learning environment.

Vision

To provide an idyllic environment of affection and care in the pursuit of knowledge. To contribute the excellence in technical education, scientific and research; to serve as a valuable resource for industry and society; and remain a source of pride for inclusive growth of the society

Mission

- The college is uniquely positioned to pursue liberal, broad-based learning, in which inquiry and teaching proceed in tandem. We challenge our students and ourselves to think rationally and creatively for lifelong engagement in our human and natural worlds.
- To create meaningful partnerships with the industry, academic, government and social sector such that sustainable businesses are built fulfilling the collective needs of various stakeholders and the society at large
- To generate new knowledge by engaging in cutting-edge research and to promote academic growth by offering state-of-the-art undergraduate, postgraduate and doctoral programmes
- To undertake collaborative projects which offer opportunities for long-term interaction with academia and industry.
- To develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

•
1.2 :Quality Policy:

BHARATH COLLEGE OF SCIENCE AND MANAGEMENT maintains various policies to enhance the growth of the students, staff along with the growth of the Institution.

The policies are as follows:

- ACADEMIC POLICY
- CODE OF CONDUCT
- RESOURCE MOBILISATION POLICY
- ENVIRONMENT POLICY
- ENERGY POLICY
- WASTE MANAGEMENT POLICY
- ADMISSION POLICY
- RESEARCH AND PUBLICATIONS POLICY
- E-GOVERNANCE POLICY
- GRIEVANC & REDRESSAL POLICY
- INFORMATION TECHNOLOGY POLICY
- PHYSICAL EDUCATION POLICY

1.3 : Moto of the Institution:

"BE A JOB MAKER, NOT A JOB SEEKER"

: 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 CO₂ due to green energy system and identification of possible implementation and enhancement of current greenery practices.

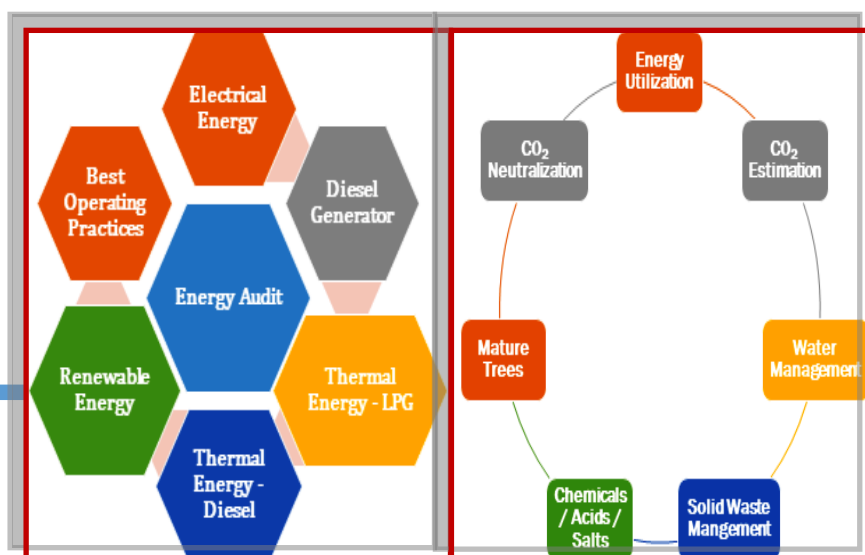
1.4 :Outcomes of the Audit Process:

- 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.

1.5 : Standards Used:

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

1.9 Coverage in Energy, Environment & Green Audit Process:



1.6 List of Faculty Members Involved in Audit Process & Data Collection:

S. No.	Faculty Details	Contribution
1.	Dr. A. Suraiya Head & Assistant Professor, Department of English.	Overall Coordinator for the Audit Process.
2.	Dr.J. Jeyasree Assistant Professor, Department of Bio-Technology.	Collection of RO water & Water Distribution system.
3.	Dr.A. Sarumathi Assistant Professor, Department of Bio-Technology.	Collection of Electrical Energy Parameters from College & Hostel.
4.	Dr.N.Sadanathanam Head & Assistant Professor, Department of Tamil.	Fuel consumption of Transport Vehicles & Transport In charge.
5.	Dr.K.Maheswari Assistant Professor, Department of Tamil.	Collection of Chemicals/Salts/ Acids.
6.	Dr.N.Sutha Assistant Professor, Department of Tamil	Collection of LPG & Fire Wood Data.
7.	P. Suba Head & Assistant Professor Department of Tamil Nutrition & Dietetics	Collection E.B utility & D.G Details.
8.	K. Rama, Head & Assistant Professor, Department of Mathematics.	Collection of Trees & Plants with Botanical Name.

**ENERGY, ENVIRONMENT &
GREEN AUDIT REPORT**

**PART-A: ENERGY AUDIT
REPORT**

**STUDY ON ENERGY CONSUMPTION &
GENERATION PATTERN**



1.10: Assessment of Existing Electrical and Thermal Energy Systems:

S. No.	Description	Details				
Electrical Energy (Consumption)						
1.	Name of the customer (As per the utility bill)	Bharath College of Science and Management.				
2.	Type of Utility Supply, Service No. & Tariff.	LTSC. No: 06-405--006-271; Tariff – LM51-2530 Units.				
3.	Tariff Structure	Rs.7.50/kWh+Rs.120/ kw as demand charges (fixed charges accounted for the sanctioned demand)				
4.	Energy Suppliers	Tamil Nadu Generation & Distribution Corporation (TANGEDCO)				
5.	Permitted Demand(PD)	SC.No:06-4405--006-271–100.0 kW				
6.	Capacity of Diesel Generator (DG) Sets	62.5 KVA–1 No.				
		All are air-cooling. Internal fuel tank & separate earthing done				
7.	Annual Electricity Consumption (kWh)	2016-17	2017-18	2018-19	2019-20	2020-21
		2,10,241	2,12,152	2,75,242	2,81,510	1,94,100
8.	Annual Electricity Generation from DG(kWh)	4,301 (2.1%)	4,108 (2.0%)	3,827 (1.2%)	4,029 (1.5%)	1,010 (2.5%)
9.	Annual Diesel Consumption for DG (L)	2,214	2,319	3,210	2,199	639
Thermal Energy (Consumption)						
10.	Types of Thermal Energy	Liquefied Petroleum Gas (LPG)+			Cooking	

	Used	Coconut Bat (Local + Purchased)				
		Diesel (Ordinary)			Transport + DG	
11.	Annual LPG Consumption (kg)	2016-17	2017-18	2018-19	2019-20	2020-21
		2,103	1514	2,911	2,647	298
12.	Annual Diesel Consumption for Transport (L)	2,70,080	2,78,245	2,86,329	2,81,956	23,619
13.	Annual Wood Consumption for Cooking (Tons)	12.9	13.5	12.6	13.6	6.1
General Loads (Both Electrical and Thermal)						
14.	Lighting System	<p>Indoor lighting: Conversion of Florescent Tube Light (FTL) into LED in a phased manner</p> <p>Outdoor lighting: All the street lightings are LED based Energy efficient lamps (100W).</p>				
15.	Fan Loads(Ceiling)	<ul style="list-style-type: none"> All the indoor ceiling fans are conventional fans 				
16.	HVAC System	<ul style="list-style-type: none"> Unitary air conditioning system installed in the Required places Most of the AC units are Three star rated and the outdoor units are mostly placed in sunshade Total capacity of the AC system is 75.5 TR 				
17.	Motors and Pump loads	<ul style="list-style-type: none"> Mainly used for water distribution, purification, Waste water treatment Small motors are used in kitchen equipments 				
18.	Uninterrupted Power System (UPS)	<ul style="list-style-type: none"> All the computers, servers, surveillance systems, projectors, telephonic units are connected with UPS with nominal backuptime of 15-30min The total capacity of the UPS is 80.5 kVA 				



1.1 :Recommendations and Best Operating Practices:

- All SSB must be fitted with digital energy meters the readings must be taken daily. Or connect those meters with EMS and monitor the energy pattern of each building
- Prepare block wise maintenance check list of electrical and thermal system
- Calculate the Unit per Liter (UPL) for every run of DG and average it for monthly
- Adopt a policy and fix a target to convert the existing conventional lightings and fans into energy efficient lights and fans
- Install AIRCON energy saver gadget which works on dynamic un-saturation principle with the sensor algorithms so that the air conditioners run hours are cut by 20 to 25 %.
- 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.
- Install a dedicated unbalanced type servo stabilizer (with suitable power rating maybe 15kVA, 3-Phase input; 3-Phase output) through which all the lighting loads may be connected to ensure the optimum voltage of say 210 V.
- It is essential and the right time to form an Energy Management Team.



**ENERGY, ENVIRONMENT &
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PART-B: ENVIRONMENT AUDIT REPORT

**ESTIMATION OF CO₂ EMISSION &
NEUTRALIZATION
(ELECTRICITY, DIESEL, LPG & MATURE TREES)**

1.2 : Assessment of Annual Energy Usage:

Table-2 Shows the types of energy carriers used for the irregular operation in the college campus along with application area and their source.

Table-2: 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 for College	Powering to all electrical & electronic/HVAC/Motors/Pumps	From TANGEDCO Captive power plant
2.	Diesel	Transport vehicles and Diesel Generator(Captive Generation)	From authorized distributor
3.	Liquefied Petroleum Gas(LPG)	Used for cooking application	
4.	Coconut Bat(Agri Bio-fuel)		Internally generated+ Locally purchased
5.	Mature Trees	Nearly 1,410 Nos of different varieties with more than 14 years old.	
6.	Bio gas Plat	From food and vegetable waste generated in the hostels	

1.3: Environmental System: CO2 Balance Sheet:

The following tables provide the balance sheet indicating various energy carriers associated with the regular activities and their CO₂ mapping.

Table-3: Environmental System: CO₂ Balance Sheet (2016-17)

S. No	Annual Energy Consumption & CO ₂ Emission			Annual CO ₂ Neutralization		
	Description	Usage	CO ₂ Emission (Tons)	Description	Usage	CO ₂ Neutralized (Tons)
1.	Diesel	2,60,080 Litres	12.9	Mature Trees	2,010No's	12.9
2.	Electrical Energy	2,11,241 kwh	79.7			
3.	Wood	10.11 Tons	25.5	Biogas	-	16.0
4.	LPG	2,103 kg	16.6			
Total Emission			134.7	Total-Neutralized		28.9
Balance CO ₂ to be Neutralized = 693.7 Tons / Annum & Per Capita CO ₂ Consumption = 0.30 Tons / Annum ¹						

(1, Total strength of students, teaching and technical staff = 1345)

1.3: Environmental System: CO₂ Balance Sheet (2017-18):

Table-4: Environmental System: CO₂Balance Sheet (2017-18)

S. No	Annual Energy Consumption & CO ₂ Emission			Annual CO ₂ Neutralization		
	Description	Usage	CO ₂ Emission (Tons)	Description	Usage	CO ₂ Neutralized (Tons)
1.	Diesel	2,68,245 Liters	13.5	Mature Trees	996 No's	20.5
2.	Electrical Energy	2,12,152 kWh	99.4			
3.	Wood	20.5Tons	29.1	Biogas	2,979kg	10.8
4.	LPG	2,414kg	15.9			
Total Emission			167.9	Total- Neutralized		31.3
Balance CO ₂ to be Neutralized = 660.9 Tons/Annum & Per Capita CO ₂ Consumption = 0.19 Tons/Annum ²						

(2, Total strength of students, teaching and technical staff = 1710)

1.3: Environmental System : CO₂ Balance Sheet (2018-19):

Table-5: Environmental System: CO₂ Balance Sheet (2018-19)

S. No.	Annual Energy Consumption & CO ₂ Emission			Annual CO ₂ Neutralization		
	Description	Usage	CO ₂ Emission (Tons)	Description	Usage	CO ₂ Neutralized (Tons)
1.	Diesel	1,76,329Litres	11.6	Mature Trees	987 No's	18.6
2.	Electrical Energy	1,45,242 kWh	172.6			
3.	Wood	09.6Tons	15.8	Biogas	1570 kg	09.3
4.	LPG	1,911kg	11.7			
Total Emission			211.7	Total- Neutralized		37.9
Balance CO ₂ to be Neutralized = 563.1 Tons / Annum & Per Capita CO ₂ Consumption = 0.9 Tons / Annum ³						

(3, Total strength of students, teaching and technical staff = 1610)



1.3: Environmental System: CO₂ Balance Sheet (2019-20):

Table-6: Environmental System: CO₂ Balance Sheet (2019-20)

S. No.	Annual Energy Consumption & CO ₂ Emission			Annual CO ₂ Neutralization		
	Description	Usage	CO ₂ Emission (Tons)	Description	Usage	CO ₂ Neutralized (Tons)
1.	Diesel	1,71,955 Litres	12.6	Mature Trees	870 No's	10.7
2.	Electrical Energy	1,71,241kWh	167.3			
3.	Wood	13.6 Tons	17.9	Biogas	985kg	6.9
4.	LPG	1,647kg	12.8			
Total Emission			210.6	Total- Neutralized		17.6
Balance CO ₂ to be Neutralized = 576.8 Tons / Annum & Per Capita CO ₂ Consumption = 0.12 Tons / Annum ⁴						

(4, Total strength of students, teaching and technical staff=1721)

1.3:Environmental System: CO₂ Balance Sheet (2020-21):

Table-7: Environmental System: CO₂ Balance Sheet (2020-21)

S. No.	Annual Energy Consumption & CO ₂ Emission			Annual CO ₂ Neutralization		
	Description	Usage	CO ₂ Emission (Tons)	Description	Usage	CO ₂ Neutralized (Tons)
1.	Diesel	24,619 Litres	7.1	Mature Trees	687 No's	16.1
2.	Electrical Energy	0,98,200 kWh	160.6			
3.	Wood	6.2 Tons	12.2	Biogas	90 kg	0.4
4.	LPG	298 kg	0.9			
Total Emission			180.8	Total-Neutralized		16.5
Balance CO₂ to be Neutralized = 445 Tons / Annum & Per Capita CO₂ Consumption = 0.03 Tons / Annum⁵						

(5, Total strength of students, teaching and technical staff=1345)

Note: Due to COVID Lock down; all the energy consumption during 2019-20 & 20-21 are less

1.3: Calculation Table:

For Electricity = [k Whx $\frac{0.82 \text{ kg of CO}_2 \text{ emission}}{\text{kWh}}$]
For Diesel = [Diesel Consumption (Liter)x $\frac{2.64 \text{ kg of CO}_2 \text{ emission}}{\text{Liter of Fuel Consumption}}$]
For LPG = [LPG Consumption (kg) x $\frac{3.0 \text{ kg of CO}_2 \text{ emission}}{\text{Kg of LPG Consumption}}$]
A mature tree is able to absorb nearly CO ₂ at a rate of 21.8 kg / annum; hence total CO ₂ to be neutralized. Is (21.8 x 1009) = 22.0 Tons 1,000 Anum





1.3 Observations:

- From the above table; it is evident that the college is now trying to neutralize their CO₂ emission through various initiatives like i) Installation of roof top solar PV system & solar thermal hot water generation (cooking & bathing application), ii) Reduction of LPG consumption, iii) Planting more number of trees and iv) implementing various energy conservation measures (FTL to LED conversion, conventional fan to BLDC fans, Energy efficient motor replacement, judicious use of all types of energy etc.,)
- Reduction of electricity consumption by replacing the entire boiler cooking system into LPG based or Wood pellets which reduces considerable amount of amount of CO₂. The management has to think and go for fuel substitution

1.3: References:

1. <https://ecoscore.be/en/info/ecoscore/co2>
2. <http://www.tenmilliontrees.org/trees/#:~:text=A%20mature%20tree%20absorbs%20carbon,the%20average%20car's%20annual%20mileage.>

ENERGY, ENVIRONMENT & GREEN AUDIT REPORT

**PART - B: ENVIRONMENT AUDIT
REPORT**

**TRANSPORT & REFRIGERANT GASES
IN AC SYSTEM**



1.3: List of Transport Vehicles:

Pollution level of all vehicles is regularly monitored and is maintained within the prescribed limit since the college is committed to provide green environment for better atmosphere.

All the transport vehicles are having pollution certificates and maintaining the emission level within the Pollution Control Board limits

The no. of vehicles available in the college campus is represented in Table-8.

Table-8: List of Transporting Vehicles available in the College

S. No.	Type of Vehicle	Quantity	Purpose
1.	Bus	22	Students & Faculty Transportation
2.	Jeep	02	Office and Administrative Works
3.	Car	03	Good Transportation

Form 59

[See rules 115 (2)]

Pollution Under Control Certificate

Authorised By :
State Transport Department

Date : 13/07/2022
Time : 12:03:58 PM
Validity upto : 12/01/2023



Certificate Sl. No. : TN04900130006037
Registration No. : TN49BE0370
Date of Registration : 07/Oct/2015
Month & Year of Manufacturing : July-2015
Valid Mobile Number : *****6151
Emission Norms : BHARAT STAGE III
Fuel : DIESEL
PUC Code : TN0490013
GSTIN :
Fees : Rs.110.0
ML observation : No

Vehicle Photo with Registration plate
60 mm x 30 mm



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	1.21

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://vahan.parivahan.gov.in>

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

Fig.1: Sample Pollution Certificate



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

Most of the AC system has **R-22** as refrigerant which has **Global Warning Potential (GWP) of 1,810** and **Ozone Depletion Potential (ODP) is Medium**. Some of the newly installed AC system are having R-32 as refrigerant which has **Global Warning Potential (GWP) of 675** and **Ozone Depletion Potential (ODP) is Zero**.

Table-9: List of Multi-variant AC System available in the College

S. No.	Tonnage Capacity (TR)	Quantity
1.	1.5	36 Nos
2.	2.0	06 Nos
Total		42 Nos

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 &
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**PART-B: ENVIRONMENT AUDIT
REPORT**

**USAGE OF CHEMICALS, SALTS & ACIDS
(STORAGE, HANDLING & BEST OPERATING PRACTICES)**



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

- The science departments use chemicals for experimental applications and are having strict safety rules as follows;
- Well trained faculty and lab assistants who have knowledge about the hazardous nature of each and every chemical are only allowed to handle the chemicals safely.
- Strictly follow the manufacturer's instruction on the container in order to prevent accidents.
- Volatile or highly odorous chemicals, fuming acids are stored in a ventilated area. Chemicals are stored in eye level and never on the top shelf of storage unit.
- All stored chemicals; especially flammable liquids are kept away from heat and direct sunlight. Reactive chemicals are not stored closely.
- Hazardous and corrosive chemicals are kept on sand platform to avoid corrosion.

First aid box and fire extinguishers are readily available in the laboratory.

1.3 Storage of Chemicals / Salts / Acids:

- Less concentrated chemicals, salts and acids are stored in proper racks; cupboard 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 routed to common STP.
- Only trained teaching and non-teaching staffs are handling the chemicals and also they are well trained to handle any abnormal situations.
- Laboratories with chemicals are well ventilated with proper emergency exits. Adequate and correct sequence of fire extinguishers is placed near all the laboratories.



Fig.2: Storage of Chemicals /Salts /Acids& Laboratory Equipments (Rack & Sand Bed)



1.3 Use of Chemical for Vessels & Floor Cleaning:

In order to maintain hygiene in the College campus; the administration regularly clean the floor and restrooms. In addition to this, the hostel management has to monitor the cleaning of vessels, kitchen floor, dining hall, store room and gas station. Table-10 shows the cleaning agents used to clean the above mentioned area;

Table-10: Cleaning Agents used for Floor and Vessel Cleaning

S. No.	Cleaning Agent	Application
1	Soap & Washing Power	Vessel Cleaning
2	Soap Oil & Bleaching Powder	Floor Cleaning

1.3: Recommendations: Eco Friendly – Green Cleaning Agents:

- On an average; the cleaning agents used today have about 62 harmful chemicals like Paraben, Phosphates or Chlorides. A lot of them are multi-purpose cleaners
- It is recommended to use natural ingredients like orange peel extract & vinegar. It leaves a mild and pleasant fragrance after use. The formula is free from all harmful chemicals & toxins. It is pH-neutral, gentle on the skin as well as on the surface where it is used
- Also these products are **IGBC GreenPro** certified. GreenPro is a mark of guarantee that the product is environment friendly throughout its life cycle
- Fig.3 shows the sample eco-friendly Green Pro certified cleaning agents.

Fig.3: Green Pro Certified Eco Friendly Cleaning Agents (ZERODER)



**ENERGY, ENVIRONMENT & GREEN AUDIT
REPORT**

**PART-C: GREEN AUDIT
REPORT**

**WATER UTILIZATION,
CONSERVATION &
WATER MANAGEMENT**

1.3: Source of Water, Storage and Distribution:

Table-11 shows the source of water, location of storage along with their application.

Table-11: Source of Water, Location of Storage and Application

Type of Water	Source	Application
Bore Water (Interconnected)	• Bore-1; East Side –760ft	• Input to the RO plant
	• Bore-2; D-Block Back–860ft	• Cooking Utensil Cleaning,
	• Bore-3; D-Block Front-700ft	• Bathing & Cloth Washing
Rain Water (6Nos) + One Pond	<ul style="list-style-type: none"> • Collected from i) buildings run off and ii) road run-offs • Each building has one RWH 	• Used to increase the ground water level
		• Small pond is also available to Collect the rain water
Treated Water using RO Plant (2Nos) from Bore and Well Water		• RO Water: Drinking and Cooking
		• Grey Water: Gardening & Toilet Cleaning (Good Imitative)
• Raw water tank capacity and Location	• Hostel–60,000L (Cement)	• 70,000Litres
	• Hostel–10,000L (HPDE)	
	• A-Block –10,000L (Cement)	• 10,000Litres
	• C-Block–30,000L (Cement)	• 30,000Litres

- All are tanks are cleaned monthly once (Good practice).
- Water filling is now in manual operation.

1.3: Treated Water for Drinking Application:

- The college management is keen on providing uninterrupted, safe and healthy drinking water to all; throughout the year.
- The over head tanks storing the drinking water are cleaned at regular interval sand the water management team has been maintaining a cleaning schedule
- The specifications of RO Plant and distribution of potable water to the entire campus is given inTable-12.

Table-12: Specifications of RO Plant and Potable Water Distribution System

S. No.	Parameters	Description
1.	Total no. of RO Plant	• 02 No's (Total 1,000L PH)
2.	Source of raw water	• Bore Water
3.	% of RO & grey water out put	• 60 % RO water: 40% grey water
4.	Usage of grey water	• Used for Toilet Cleaning (Good Initiative)
5.	Cleaning schedule of filter	• Once in three months (Replaced every year)
6.	Cleaning schedule of membrane	• Yearly twice
7.	Functioning of RO Plant	• Manual operation
8.	Quality of RO water	• Internally tested (50 TDS)
9.	RO water storage	• Stored in the HPDE tank sand distributed
10.	RO water tank capacity & location	• A Block – 5000 Litre & Hostel – 3000 Liter

1.3: Water Savings in Foreign Toilets:

The list of availability of Indian & Foreign style toilets are presented in the below Table-13.

Table-13: List of Indian & Foreign Style Toilets

S. No.	Location	No. of Toilets	
		Indian	Western
1.	A Block	45	6
2.	B Block	45	6
3.	C Block	2	2

4.	D Block	20	6
5.	E Block	20	-
6.	Auditorium Back Side	20	4
Total =		152	24

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

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

- The audit team appreciates the effects taken by the management of **Bharath College of Science and Management** for harvesting the rain water almost in all buildings.
- The roof area is so arranged to collect the rainwater and then passed through proper piping system, and then bring back to the RWH pits which are located close to each pits
- The building run off are collected through each pits mostly located in each buildings. Common area and road run-off are properly collected and routed to nearby water body.



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



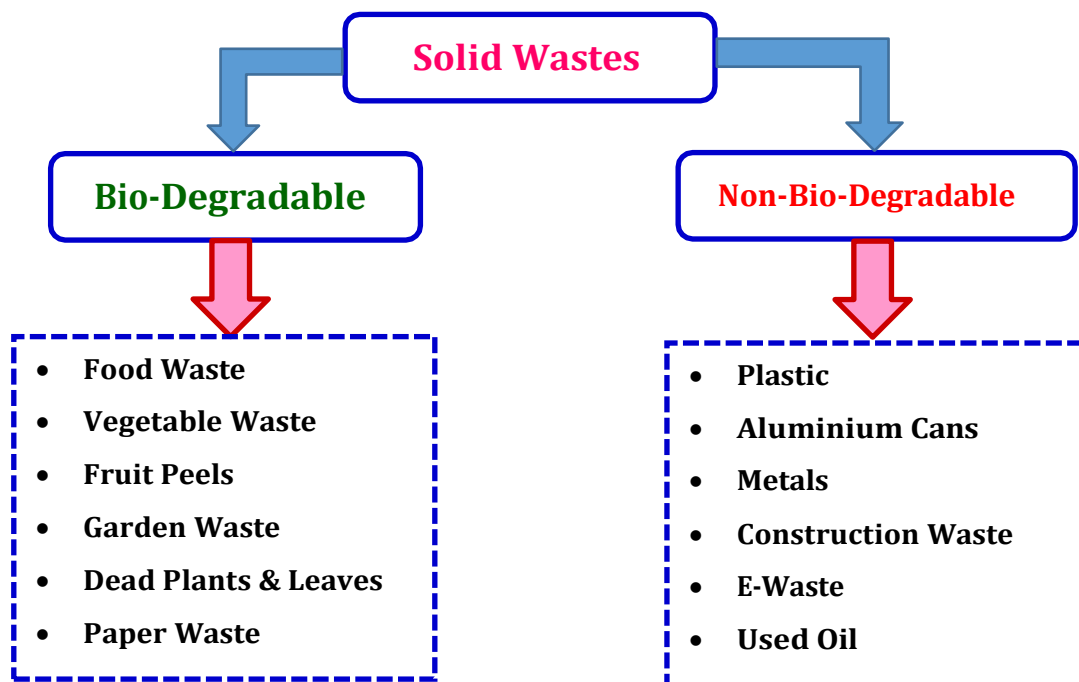
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2. WASTE HANDLING & MANAGEMENT

1.3: Solid Waste Management System:

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



1.3: Process of Solid Waste Management:

The college management practiced some methods to treat the waste generated and Table-14 shows the process of treating the solid waste generated inside the college campus.

Table-14: Process of Waste Management

S. No.	Waste Type	Waste Treatment
Bio-Degradable Waste Management		
1.	Food and Vegetable Waste	Collected and dumped in a yard (used as manure)
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
4.	Napkin Pads	Collected, dumped in a yard; set fire and destroyed
Non-Bio- Degradable Waste Management		
5.	Plastics	Banned in the college campus (Welcome step).The chemical / salt storage plastic containers are disposed to third party.
6.	Metals	Construction metals or metals from any other sources are stored in a separate place.
		Used for sale to third party for recycling
7.	Transport Oil + Tyres	Stored in a separate place and used for sale to third Party.
8.	Transport Vehicle and Computer Batteries	Procuring new batteries with buyback offer (old battery replacement)
9.	Used edible oil	Almost zero waste. Mostly used for internal cooking And frying.
10.	E- Waste Management	Used for sale to third party for recycling



Fig. 5: Solid Waste Management (Collection, Segregation, Storage & Safe Disposal)



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PART-C: GREEN AUDIT REPORT

2. ASSESSMENT ON MATURE TREES & BIO-DIVERSITY

2.1: Campus Greenery:

The college is completely covered with mature trees grown for more than 10 years. The total number of mature trees available in the college campus is 1,542 with 51 varieties of trees. Apart from the mature trees; preserving the ecology; the entire college campus is planted with various flowering shrubs and bushes.



Total No. of Mature Trees available in the college campus is 1,410 which contributes for reduction of 24.0 Tons of CO₂ emission/ Annum

2.1: Bio- gas Plant Generating Cooking Gas

- **The college management** has implemented a Bio-gas (natural fuel) plant generating energy from food, vegetable wastes and toilet solids daily generated in mess and canteen
- Production of biogas obtained from “**anaerobic digestion**” contains micro-organisms breaking down complex organic substances (lipids, protides, and glucides), that are present in plants, sludge and by- products of animal origin
- Biogas is primarily methane (CH₄) and carbon dioxide (CO₂) and may have small amounts of hydrogen sulphide (H₂S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen
- Food waste generated from cooked rice, cut portions of vegetables and non-used vegetables

Energy Saving Calculation	
• Capacity of the Bio-gas Plant	• 50m ³ /day
• Assuming 80% of the plant capacity ¹	• 40m ³ /day
• Energy Content in Biogas ²	• 1,91,200kcal/m ³
• Biogas equivalent to LPG(kg)³	• 15.3kg/Day

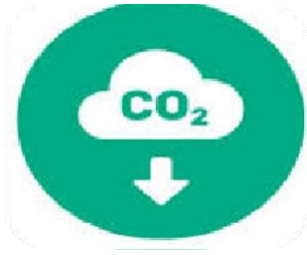
• Assuming 250 operating days / annum	• 3,825kg/Annum
Equivalent to 200 nos of 19 kg cylinder / annum (Energy saved)	

¹Since there is no gas flow measuring meter; an assumption of 80% capacity utilization is taken for the

Energy calculation

2–Calorific value of biogas is about 4,780kcal/m³ (i.e., 20 MJ/m³)

3–Calorific value of LPG is 12,500 kcal/kg



Annual savings of LPG is around 2,325kg which reduces 7.5 Tons of CO₂ Emission / Annum.

2.2: Recommendations for 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 work space can help remove at least three household toxins (think benzene, formaldehyde, and trichloroethylene, which are carcinogenic chemicals commonly found in stagnant indoor environments).

2.2 : Bio – Diversity in the Campus:

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

2.3 : Recommendations to maintain Bio-Diversity:

- **Bird Sighting and Survey:** Conduct a dedicated bird sighting and identify the list of birds both residing birds and migratory birds available in the college campus
- Prepare the list of birds with their local name, scientific name, their average life time, nesting facility created by the bird and photo of the bird. Show case the result to all the stake holder and inculcate a habit of friendly environment
- Discuss with the ornithologists and facilitate the environment with more birds coming to the campus and especially migratory birds.

- **Reptile & Amphibian survey:** Similar to bird survey; conduct a survey to list the amphibians available in the campus
- Amphibian and reptile surveys are often performed as part of the Green Audit process or terrestrial survey. These surveys are effective at detecting the presence of even the most elusive species.
- Since **Bharath College of Science and Management campus has an excellent pond;** it is highly recommend conducting the frog and toad survey around the pond and identifying the species.

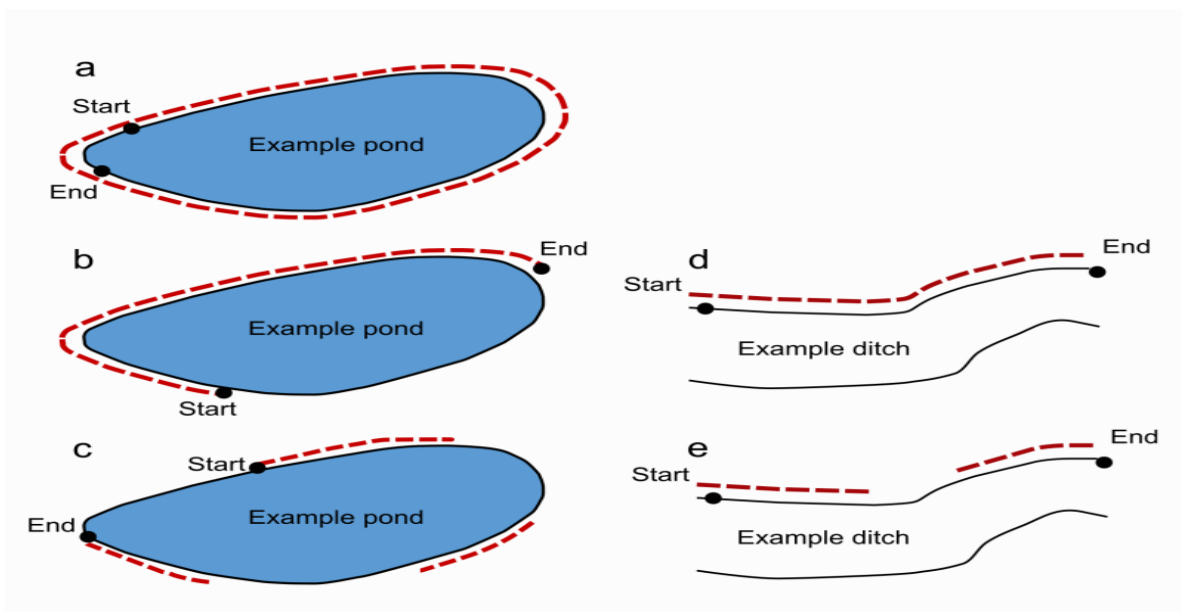


Fig.7: Diagram illustrating approaches to conduct the survey at a water body



3. AUDIT SUMMARY & CONCLUSION



SUMMARY OF THE AUDIT PROCESS:

In order to make the **Bharath College of Science and Management** campus 100 % energy efficient; Environmental sustainability and lush Greenery; the audit team recommends implementing the following measures:

I. Energy Conservation & Management – Electrical Energy:

- Plan to install a minimum of 10 kW (up to 25 kW) Roof top solar PV system
- In a phased manner, ceiling fans must be changed from conventional fans into BLDC fans. Also change FTL into LED with adequate illumination levels
- Implement Energy Management System (EMS) to accurately measure & monitor energy flow
- Prepare a policy plan to convert the distributed UPS layout into centralized UPS and save energy. This step also saves the maintenance time due to reduction in number of batteries
- Implement automatic street light controller to turn on and off based on different time in a day. Use astrological timer for better results and energy savings
- Diesel flow meter must be fitted with each DG and calculate the UPL accurately
- Prepare suitable formats for all energy consumption and regularly follow the records. At regular intervals conduct internal audits to assess the effectiveness of the practice. Make proper corrections; if it deviates from the standard operating procedure
- Regularly conduct i) Illumination study, ii) Thermal comfort study, iii) Flue gas study on DG, and Boiler, iv) Water quality assessment (for all types of water utilized) and v) Indoor and ambient air quality study

II. Energy Conservation & Management – Thermal Energy:

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

III. Water Conservation & Management:

- Construct a suitable capacity of Sewage Treatment Plant (STP) for proper liquid waste management
- To check the quantity of water utilized by each buildings 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 environmental friendly
- Paste water and energy saving slogans at appropriate places
- Generate your own power and water for regular activities and move towards Net Zero Energy and Net Zero Water Building
- Retrofit aerator based water taps for good water savings. For hand washing applications, all the pipes must be fitted with aerators
- 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/Salt sand safe disposal through 3rd party
- Water treatment log (for RO plant) must be maintained indicating the water inlet, treated and outlet water quantity
- Install sensor based water controller in each Over Head Tanks and reduce the water waste and power required to operate the pump
- Energy required to process the water treatment must be calculated
- Overall cost of treated water by accounting i) consumables, ii) manpower iii) energy and iv) other conventional expenses
- Use the treated water at the maximum in whatever possible areas and try to minimize the fresh water intake (from any source)
- Set a policy and fix a target for usage of treated water; ensure that the plan is being executed without any deviation. Increase the % of usage of treated water year by year
- With the advent of smart technologies, it is possible to have centralized monitoring in real-time using Internet of Things (IoT), Geographic Information System (GIS) software, etc. as per **Jal Jeevan Mission**, Department of Drinking Water & Sanitation **Ministry of Jal Shakti**
- Awareness campus must be conducted to all the stakeholders at regular interval. Through this initiative; Painting, Photography, Slogan and Poster making contest are conducted to create consciousness among the students and faculties

IV. Waste Management:

- Cotton, Syringe, Needles are to be kept separately as these are treated as Bio-Medical wastes
- **Dust bins** must be placed to collect these bio-medical wastes
- After COVID; mask, sanitizer bottles, gloves and other medical items must be trashed only through the yellow bins
- This must be informed to all the students and stakeholders. Suitable steps have to be taken to disseminate this information
- All the solid wastes are to be properly stored in a separate place and should be maintained as a record mentioning its quantity
- Food waste must be weighted and marked in a record before keeping into the digester unit. This must be checked with the amount of gas generated using suitable calculation and check with the designed output
- Any waste items given to trust office or to the 3rd party must have a record of the respective department
- **Reduction of Paper:** Work out a policy to move towards paperless office. Present system of paper usage may be reviewed and wherever possible; digitalize the activities and reduce the paper
- Use bar code scanning to identify the location, row and seat number of candidates during examination and avoid paper information pasted in the notice board
- Publish the internal marks, model examination marks through student ERP.
- Make attendance report, feedback, payments, salary slip in digital platform and if necessary take prints (only office copy)
- Adopt College Management System (CMS) and try to automate
- Automation saves energy, saves man power, saves paper, leads to better transparency, efficient manpower utilization and thus saves cost

V. Impart Training to Faculty and Technical Staffs:

- ❖ **Energy Conservation and Management**
- ❖ **Environmental impact and assessment**
- ❖ **Fire and Safety (Operation and Handling)**

- ❖ **Electrical maintenance, AC, Battery Maintenance & Safety**
- ❖ **Emergency Preparedness**
- ❖ **E- Waste, Chemicals Handling & Solid Waste Management**
- ❖ **Training for Transport employees)**
- ❖ **Training for Faculty and Student son Vehicle Operation**
- ❖ **Training for Kitchen Employees**
- ❖ **General Medical Camps for Employees**
- ❖ **Training on Stress Management and Yoga**

VI. Way Forward towards Energy & Environmental Sustainability:

- Prepare an exclusive **Energy and Environment Policy** based on the energy and environment practices followed in the campus. This must reflect the i) Present energy consumption& generation, ii) Projection of energy need, iii) Commitment by the college to conserve energy (in terms of percentage), iv) Roadmap to achieve the commitment, v) Facilities needed to achieve the same, vi) Roles and responsibilities of all stakeholders, vii) Interim and final review mechanism, viii) Corrective measures, if the results deviates from the committed value and ix) Benchmarking, Case study preparation, Knowledge sharing and rewards
- Implement ENCON sand best operating practices proposed in the audit report and measure the results
- Adopt effective Waste Management Policy and reduce the food print of waste generation (Net zero waste campus)
- Practice appropriate ISO standards for System Management. The audit team highly recommend to follow
 - i) ISO-9001 (Quality Management System), ISO-14001 (Environmental Management System) and ISO- 50001 (Energy Management System)**
- Working towards Net Zero Energy and Net Zero Water Campus and achieve **Gold rated Global Leadership campus(as per IGBC rating) and/or 4-star rated campus**

COMPLETION OF THE REPORT

This report is prepared as a part of the Energy, Environment and Green Audit process conducted at **Bharath College of Science and Management**, Thanjavur-613 005, Thanjavur District, Tamil Nadu, India by **YoJo Network and Training Center, Kumbakonam 612 001, Thanjavur Dt, Tamilnadu.**

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