

CONSULTRAIN MANAGEMENT SERVICE
Lake Road, Kolkata, West Bengal, India



TROPICAL INSTITUTE OF EARTH AND
ENVIRONMENTAL RESEARCH (TIEER)

Reg. No. S/1L/42578 of 2006-07


Office address: M-10, Bidhannagar, Medinipur-721101, W.B., India

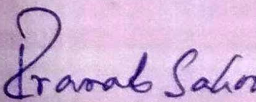


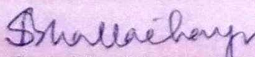
ENERGY AUDIT CERTIFICATE


Academic Year: 2021-2022

This is to certify that Mugberia Gangadhar Mahavidyalaya, Bhupati Nagar, Purba Medinipur, West Bengal has good and healthy eco-friendly environment created for saving Earth and Nature. Tropical Institute of Earth and Environmental Research associated with Consultrain Management Service are satisfied after successful completion of Energy Audit with moral support of Honorable Principal, IQAC Team, Staff and Students for academic year 2021-2022. This efforts taken by Faculty and Students towards environment and sustainable are highly appreciable and commendable.


(Dr. Binoy Kr. Chanda)
President, TIEER
President
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(Dr. Pranab Sahoo)
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Expert & Member,
TIEER
Expert

ENERGY AUDIT

(2022-2023)



**MUGBERIA GANGADHAR MAHAVIDYALAYA,
PURBA MEDINIPUR, WEST BENGAL**

CONSULTRAIN MANAGEMENT SERVICES,
LAKE ROAD, KOLKATA

TROPICAL INSTITUTE OF EARTH &
ENVIRONMENTAL RESEARCH (TIEER),
MIDNAPORE

CONSULTRAIN MANAGEMENT SERVICE
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LIST OF EXPERTS AND SCIENTISTS

The Committee members are listed below:

SL. No.	NAME	DESIGNATION	AREA IN INTEREST
1.	Dr. Binoy Kr. Chanda	President, TIEER & Former IC, VU	Environment Science & Climatology
2.	Dr. Pranab Sahoo	Secretary, TIEER & Assistant Professor and HOD, Dept of Geography, S.B. Mahavidyalaya, Kapgari	Climate Change and Environment Management and Biogeography
3.	Mrs. Sanchita Bhattachariya	Consultant, Consultrain Management services, Kolkata, & Member, TIEER, ISO-9001,14001&50001Cerfied Auditor.	Environment Management
4.	Dr. Sudipta Maiti	Faulty, Dept. of Botany, Raja N.L. Khan Womens' College, Midnapore	Plants Diversity & Carbon stocking, Green Management
5.	Dr.Chandan Karan	Faculty,Dept.ofGeography, S.B. Mahavidyalaya,Kapgari	LanduseSurvey,Ecology andMapDesigner
6.	Dr. Mrinmoy Ghorai	Assistant Professor in Zoology, PanskuraBanomali college.	Fauna & Aqua animals and Biodiversity conservation
7.	Sri Ananda Das	Asst. Teacher & expert	Electro physics
8.	Sri Biplob Nayek	Drone Surveyor	Aerial Photography
9.	Sri Sarat Chatterjee	Surveyor	Water and Air Quality Measurement
10.	Sri Sanjib Mahata	Surveyor&ExpertinRS&GIS	MapDesigner
11.	Sri Soumitra Patra	M.Tech in Agriculture and surveyor	Micro irrigation technology and water management
12.			



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Aerial view of the College Campus



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CHAPTER-1

1.0 INTRODUCTION

Energy Audit is a process of systematic, documented, periodic and objective evaluation of components of Energy sources with the aim of safeguarding the environment and natural resources in its operations. The process starts with systematic identification, quantification, recording, reporting and analysis of components of Energy sources in the university. Energy auditing is a means of assessing environmental performance (Welford, 2002). It is assystematic, documented, periodic, and objective review by regulated entities of facility operations and practices related to meeting environmental requirements (EPA, 2003).



1.2 Objectives of energy auditing:

The objectives of Energy Auditing are to assess a resource and fossil fuel utilization aids effective learning and provides a learning Resource management.

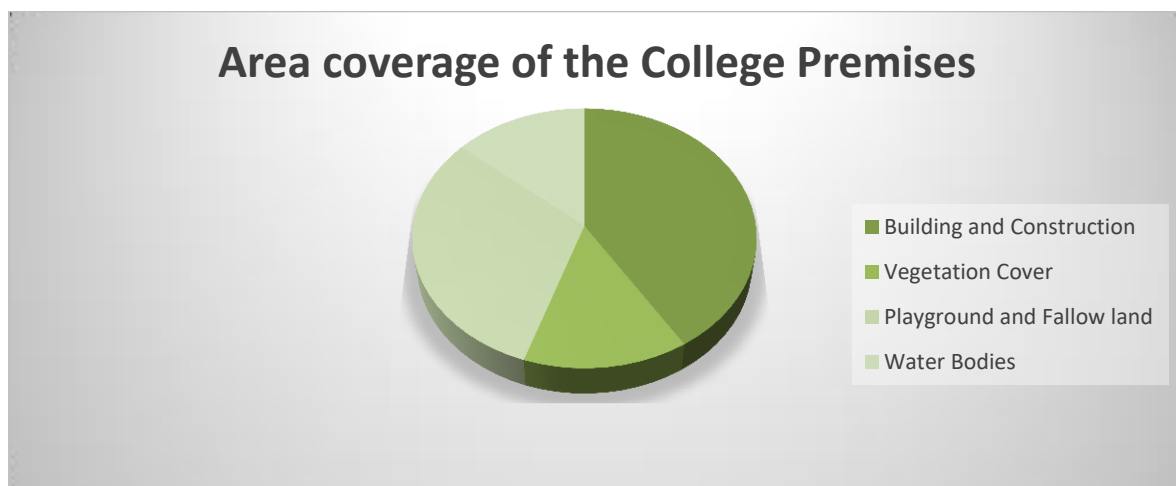
- To study of interrelationship between beneficiary and environment in the University campus
- To Establish to provide basis for improved sustainability
- To Recognize the cost saving methods through energy minimizing and managing
- To Financial savings through a reduction in resource use
- To Develop of ownership, personal and social responsibility for the University and its environment and resource

1.3 Advantages of Energy Audit:

- To develop to more efficient resource management
- To provide basis for improved sustainability
- To create a GHG free campus

Table 1.Area Coverage of the College Campus

Area Coverage of College Premises:	Area in Percentage
Building and Construction	41.00
Vegetation Cover	14.21
Playground and Fallow land	31.00
Water Bodies	13.79



Different Building and Sectors:

Building and Sectors	
Administrative Buildings	Central library
New Building(Academic)	Gymnasium
Science Building(Academic-1)	Girls Hostel
Science Building(Academic-2)	Canteen
Arts Buildings(Academic)	

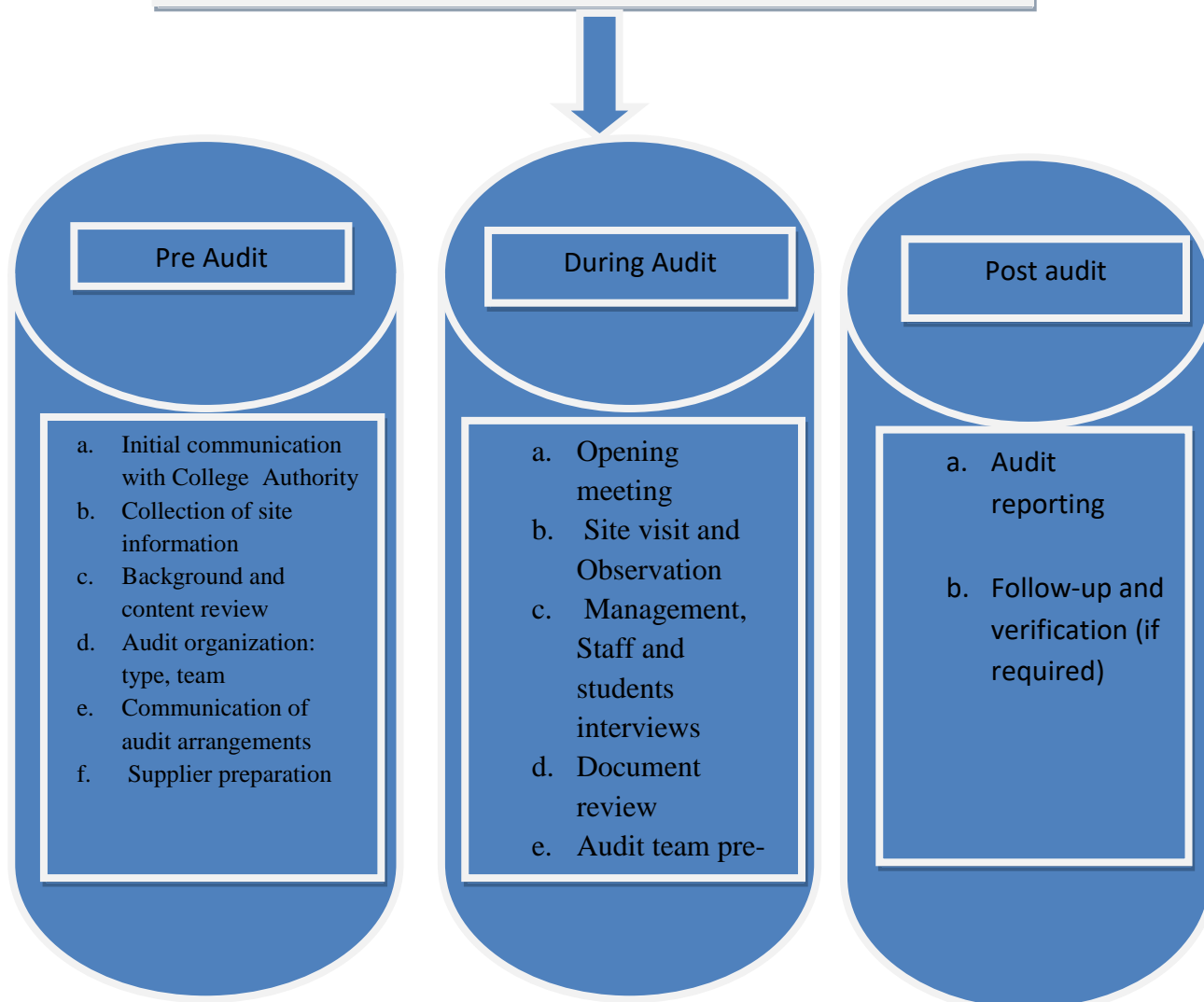


CHAPTER – 2

Methodology and Survey Schedules

The methodology is adopted for this Assessment by collecting the information by Onsite visit, group discussion, Campus survey, Enquiry, Observation, Perception study and opinion also included in the Auditing Report.

Flow Chart of Methodology for Auditing



Schedule of Audit Programming-2022-2023

SL.NO	PURPOSE	DATE	REMARKS
1.	Communication with College authority	11.05.2023	Discussion about term and condition
2.	Opening Meeting	16.05.2023	Submitted the survey schedule
3.	Collection information about the College	17.05.2023	Introduced to Administrative Officer
4.	Campus visit , site enquiry and department survey & observation	23.06.2023	Outdoor observation with Drone camera & Photo camera, Laboratory enquiry
5.	Review data and Assessment	24.06.23 to 29.06.2023	Data generate and drone figures
6.	Closing meeting	30.06.2023	Meeting with IQAC and Report submitted



Schedule Questionnaire for Energy Audit:

Survey Form for data collection

1. List ways that you use energy in your College. (Electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others).
2. Electricity bill amount for the last three year
3. Amount paid for LPG cylinders for last one year
4. Also mention the amount spent for petrol/diesel/ others for generators?

5. Are there any energy saving methods employed in your university? If yes, please specify. If no, suggest some.
6. How much money does your college spend on energy such as electricity, gas, etc. in a month.
7. How many CFL bulbs has your college installed? Mention use (Hours used/day for how many days in a month)
8. Energy used by each bulb per month? (for example- 60 watt bulb x 4 hours x number of bulbs = kwh).
9. How many LED bulbs are used in your college ? Mention the use (Hours used/day for how many days in a month)
10. Energy used by each bulb per month? (kwh).
11. How many incandescent (tungsten) bulbs have your college installed?
12. Mentions use (Hours used/day for how many days in a month)
13. Energy used by each bulb per month? (kwh).
14. How many fans are installed in your college ? Mention use (Hours used/day for how many days in a month)
15. Energy used by each fan per month? (kwh)
16. How many air conditioners are installed in your college Mention use (Hours used/day, for how many day in a month)
17. Energy used by each air conditioner per month? (kwh).
18. How much electrical equipment including weighing balance are installed your college?
19. Mention the use (Hours used/day for how many days in a month)
20. Energy used by each electrical equipment per month? (kwh).
21. How many computers are there in your college? Mention the use (Hours used/day for how many days in a month)
22. Energy used by each computer per month? (kwh)
23. How many photocopiers are installed by your college? Mention use (Hours used/day for how many days in a month).
24. How many cooling apparatuses are in installed in your college? Mention use(Hours used day for how many days in a month)
25. Energy used by each cooling apparatus per month? (kwh)Mention use (Hours used/day for how many days in a month)
26. Energy used by each photocopier per month? (kwh) Mention the use (hours used/day for how many days in a month)how many inverters your college installed? Mentions use (Hours used/day for how many days in a month)
27. Energy used by each inverter per month? (kwh)
28. How many electrical equipment are used in different labs of your college? Mention the use (Hours used/day for how many days in a month)
29. Energy used by each equipment per month? (kwh)
30. How many heaters are used in the canteen of your college? Mention the use (hours used per day for how many days in a month)
31. Energy used by each TV per month? (kwh)
32. Any other item that uses energy (Please write the energy used per month) Mention the use (Hours used per day for how many days in a month)

33. Are any alternative energy sources/nonconventional energy sources employed / installed in your college? (photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.
34. Do you run switch off drills at college?
35. Are your computers and other equipment put on power-saving mode?
36. Does your machinery (TV, AC, Computer, weighing balance, printers, etc.)run on standby mode most of the time? If yes, how many hours?
37. What are the energy conservation methods adapted by your college?
38. How many boards displayed for saving energy awareness?

Chapter 3.0 : AUDIT STAGE

3.1 Campus Survey and Enquiry

The Audit covered the following major areas:

1. Sources of Energy
2. Consumption of Energy
3. Cost of Energy
4. Measurement of Emission of GHGs
5. Energy Efficiency and Energy Management

3.2 Grouping and Strategy

The following groups were formed with specific target areas and end users assigned.

Group 1: Lighting and fans in Main building, Library and canteen

Group 2: Lighting and fans in Departments (all departments, offices, class rooms and labs)

Group 3: Lighting common area – Covering Street lights, corridors, grounds

Group 5: Lighting and fans in Girls Hostels

Group 8: Total room air conditioners in Administrative building, departments and labs.

Group 9: Total Energy audit of Central library and Computer Lab.

Group 10: Enquiry of total energy cost from Power Office

Group 11: Water Pumps in the entire campus

Group 12: Benchmarking of electricity consumption

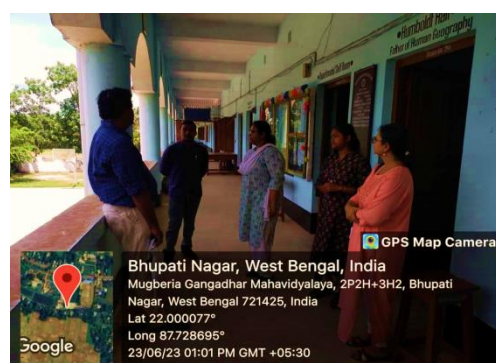
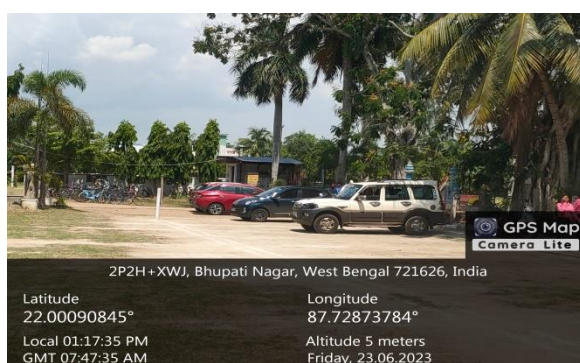
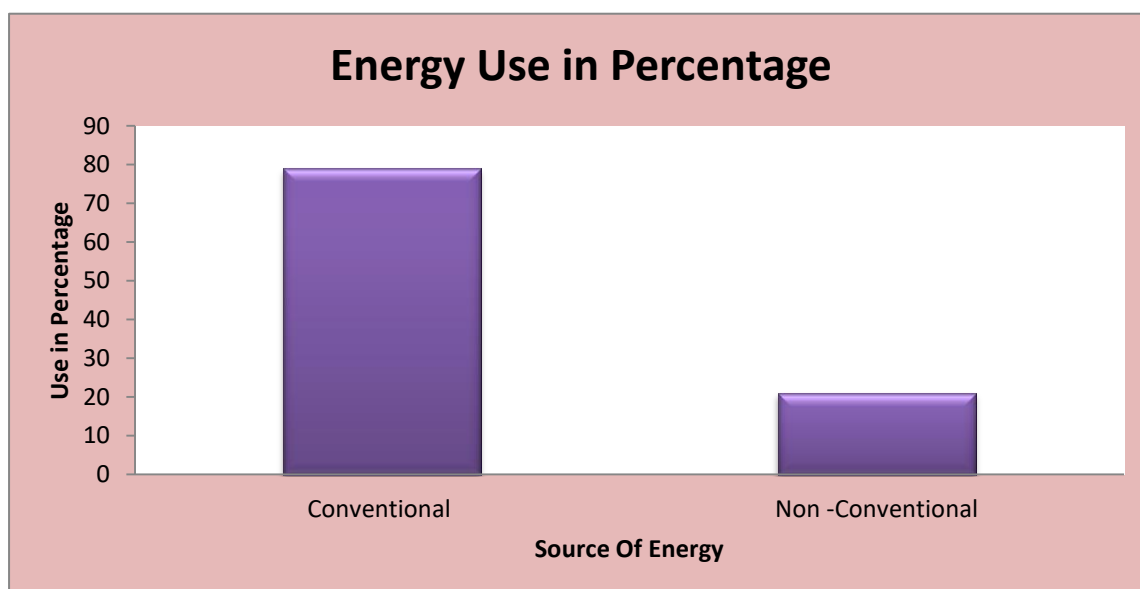
3.3 Source of Energy:

The useable energy is Conventional and Non-Conventional energy(24175unit+6512unit). The used energy is 30687 units costing to Rs. 265587/-. About 21% energy is Non-conventional energy contributed from Solar Power.



Table2. Source of Energy in Percentage:

Source of energy	In Percentage
Conventional	79.00
Non -Conventional	21.00



POWER CONSUMPTION (kWh) OF PARTICULARS:

Sl.no	Particulars	Power consumption per hour
1.	Air Conditionar	1.5kw
2.	Computer	300w
3.	Xerox Machine/Network printer	500w
4.	Inkjet printer	50w
5.	Dot matrix printer	50w
6.	Tube light	40w +20w
7.	Fans	50w
8.	LCD Projector	500w

9.	Water Cooler	200w
11	Spot light(CFL)	25w
12	Electric kettle	850w
13	Refregerator	500w
14	Water pump	1kw

Table 3. Energy Consumption of different items (Kwh/day)

Energy Consumption in different Purpose	In Percentage
light and fans	43.7
AC	19.80
Pump	0.79
Computer and Laboratory	31.60
Others	4.11

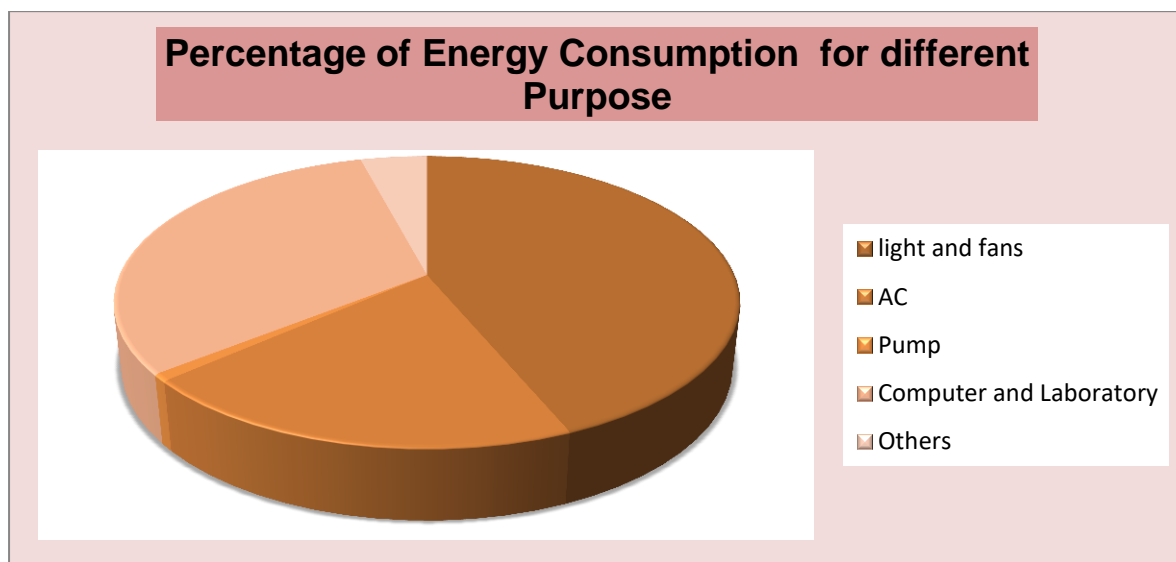


Fig. : Percentage of Energy Consumption in different Purpose

3.5Energy Cost:

- ❖ Electricity Consumption - 30687 Unit, Rs.- 265587 /- Per Year
 - a) Conventional energy- 24175 Unit
 - b) Nonconventional energy- 6512 Unit Less-Rs. 59914 / .Rs. for Paid-Rs.-265587 /
- ❖ Fossil fuel consumption per Year:
 - a. Number of Gas cylinders used for cooking purpose(Hostels& Canteen) – 34 PC

- b. Number of Gas cylinders used in Chemistry Laboratory - 06 PC
- c. Diesel used for green Generator- 90 liter
- ❖ Number of Green Generators - 03
- ❖ Cost of generator fuel – Rs. 1275 /month

Table-6 Amount of CO₂ (ppm) in different location of the College Campus

Different location of the College Premises	Amount of CO ₂ (ppm)
Principal Office	450
Chemistry Lab	465
Zoology Lab	430
Nutrition Lab	410
Computer Lab	480
Physics Lab	450
Library	465
Cycle Stand	390
Play Ground	370
Canteen	430
Hostel	440

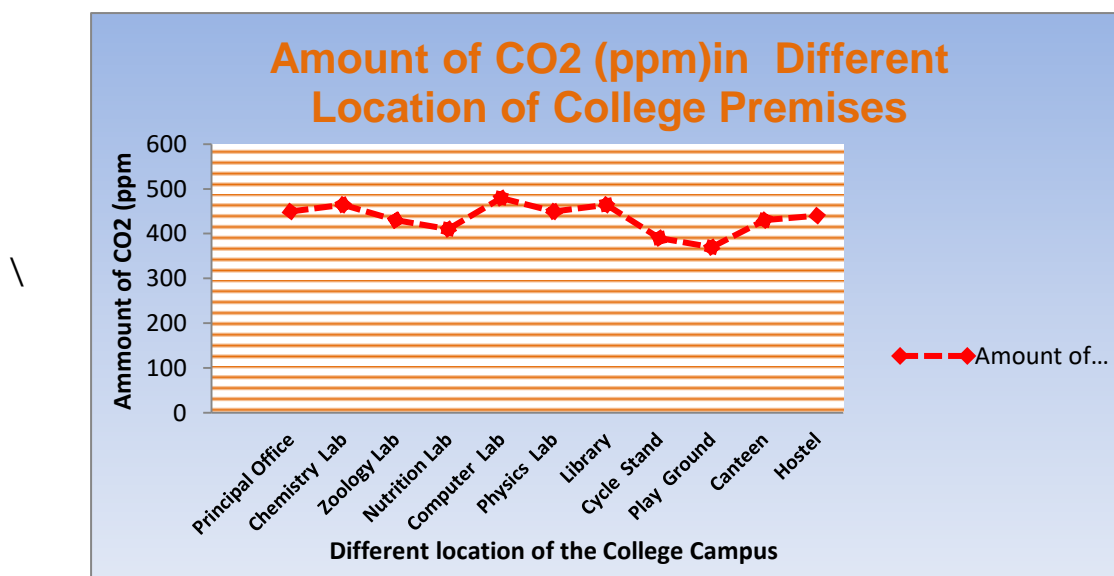


Fig. 5 Amount of CO₂ (ppm) in Different Location of the College Premises

Table-7 Amount of CO₂ (ppm) in the air in different location, (College Campus) session 2022-2023

Amount of CO ₂ (ppm) in the Air in Different places of the College Premises	Amount of CO ₂ (ppm)
Outdoor	392
Indoor (Class room)	420
Indoor (Laboratories)	450

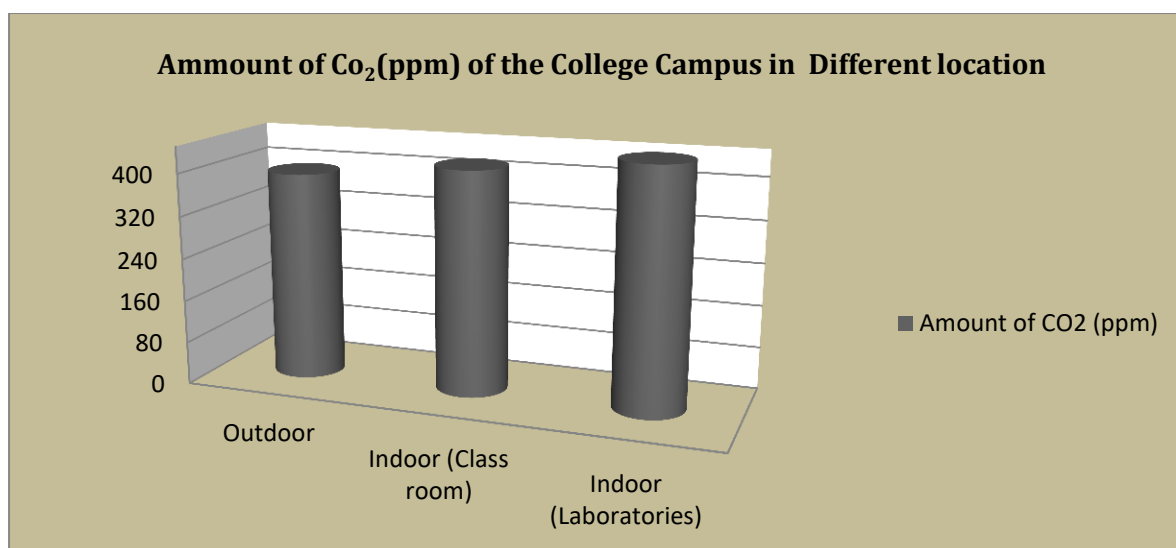


Fig. 6 Amount of CO₂(ppm) of the Air in Different location of the College Premises

CHAPTER : 4.0 POST AUDIT STAGE

4.1 Data analysis and Assessment

Energy Audit and Assessment (Mugberia College)

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (conventional)	79.00 %
2	Source of energy (Non-conventional)	Solar- 21 % (3015W Grid)
3	Total consumption of Electric Power	30687 unit
4	The maximum use of conventional Electric Power	24175 unit
5	Maximum energy consumption in the purpose	Light and fans - 277.76 Unit/Day
6	Energy Consumption in Computer & Lab.	201 unit /Day
7	No. of LPG Gas cylinder for coking purpose	34PC/ Year
8	No. of LPG Gas cylinder used in Laboratories	06pc/Year
9	Amount of diesel used for green generator	90 liter/Year
10	No. of AC and use of energy	132 Kwh/Day

Energy consumption in different purpose, 2022-23		
1.	Lights & Fans	13410.2unit
2.	Air Condition	6076.03 unit

3.	Lifting of water(HP pump)	242.4unit
4.	Computer & Dept. Lab	9697.1unit
5.	Others(CCTV,TV, water cooler & others)	1261.2 unit

4.2 Results and Findings

Power Consumption in different sectors:

Sl.no	Sectors and purpose	Power consumption(%) /day
1.	Computer laboratory	33.00
2.	Administrative Building	17.00
3.	Library	8.00
4.	Canteen	6.00
5.	Hostel	19.00
6.	Class room	12.00
7.	Gymnasium	3.00
8.	Others	2.00

4.3. Energy Cost:

Electricity Consumption - 30687 Unit, Rs.- 265587 /- Per Year

c) Conventional energy- 24175 Unit

d) Nonconventional energy- 6512 Unit Less-Rs. 59914 /- .Rs. for Paid-Rs.- 265587 /-

❖ Fossil fuel consumption per Year:

d. Number of Gas cylinders used for cooking purpose(Hostels& Canteen) – 34 PC

e. Number of Gas cylinders used in Chemistry Laboratory - 06 PC

f. Diesel used for green Generator- 90 liter

❖ Number of Green Generators - 03

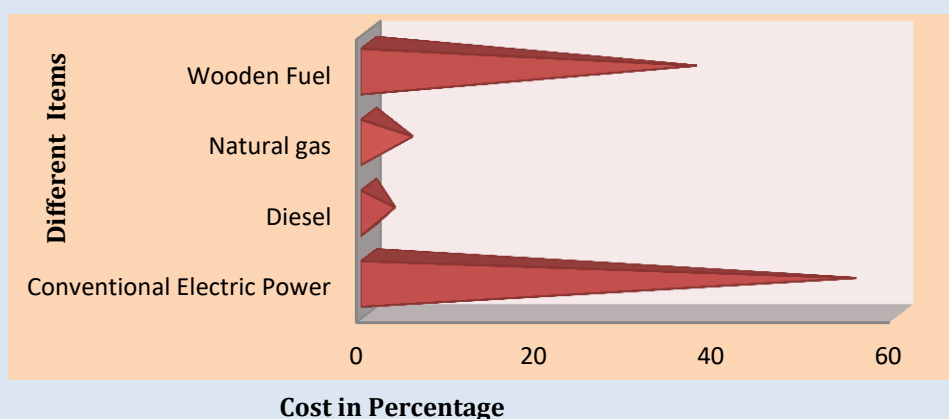
❖ Cost of generator fuel – Rs. 1275 /-month

Cost of Wooden fuel Rs. 21000/-Month

Table 6. Expenditure cost of uses energy

Expenditure cost of uses energy	Cost in Percentage
Conventional Electric Power	55
Diesel	3
Natural gas	5
Wooden Fuel	37

Expenditure cost of uses energy



Energy consumption in different purpose , 2022-23

1	Lights & Fans	13410.2unit
2	Computer & Dept.	6076.03 unit
3	Air Conditions	242.4unit
4	Lifting of water(HP pump) Lab	9697.1unit
5	Others(CCTV,TV, water cooler & others)	1261.2 unit

Routine of Energysave Practices

- Non Air Condition Day in a week (Wednesday),
- Non Motor vehicles Day- (Thursday),
- World Environment Day – June 5,
- Ozone Day – September 16
- Awareness seminars are organized on various environmental problems.

Major Audit Observations		
Sl. No	Sectors/Indicators	weightage
1	Applied of NCE	L
2	Step to LED and CFL Bulb use	M
3	Reduce of AC User	H

4	Awareness	H
5	Management of GHGs	H

* H denote- Taken management policy level above 60%

** M denote- Taken management policy level 40%-60%

*** L denote-Taken management policy level below 40%

4.5 Energy Conservation Proposals :

Providing Energy Saver Circuit to the Air Conditioners: The energy saver circuits for the air conditioners, intelligently reduces the operating hours of the compressors either by timing or temperature difference logic without affecting the human comfort. This can save around 15% to 30% of the electricity depending on the weather conditions and temperature settings. There are total 7 split type air conditioners. It is Recommended that the old air conditioners are being replaced with new energy efficient BEE STAR labeled (3 Star and above) air conditioners in a phased manner. Considering the average compressor ON Time = 5 h/day

Proposal for Air- Conditioners to Energy Save

- Kwh/day/air conditioner Yearly operating days = 160 days/year/air conditioner
- Yearly electricity consumption = 6076.03 unit /year for air conditioner
- Considering a saving of 15%,total annual savings = 15% x 6076.03 unit 911.4/year for air conditioners, cost of electricity = Rs.8202.64/
- Yearly savings = Rs.8202.64/year from air conditioners

5. Conclusion and Recommendations

General Recommendations:

- All computers to have power saving settings to turn off monitors and hard discs, say after 10 minutes/30 minutes.
- All Class Rooms and labs to have Display Messages regarding optimum use of electrical appliances in the room like lights, fans, computers and projectors
- Most of the time, all the tube lights in a class room are kept **on**, even though, there is sufficient light level near the window opening.
- In such cases, the light row near the window may be kept **off**.
- All projectors to be kept OFF or in idle mode if there will be no presentation slides.

Recommendations for Energy Saving

- ✓ Installation of more solar panels and other renewable energy sources.
- ✓ More energy efficient fans, tubes and bulb should be replaced.
- ✓ Conduct more save energy awareness programs for students and staff.
- ✓ Replace old computers and TVs with LED monitors.
- ✓ Observe a power saving day every year.
- ✓ Automatic power switch off systems may be introduced.

Acknowledgements:-

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