ENERGY AUDIT

(2022-2023)

GOVERNMENT GENERAL DEGREE COLLEGE KHARAGPUR-II, WEST BENGAL

CONSULTRAIN MANAGEMENT SERVICES,
LAKE ROAD, KOLKATA

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

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

TROPICAL INSTITUTE OF EARTH AND ENVIRONMENTAL RESEARCH (TIEER)
Reg. No. S/IL/42578 of 2006-07
Office address: M-10, Budhannagar, Medinipur-721101, W.B., India

ENERGY AUDIT CERTIFICATE

Academic Year: 2022-2023

This is to certify that Government General Degree College, Kharagpur-II, Ambigeria, Madpur, Paschim 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 rapid Energy Audit with moral support of Honorable Principal, IQAC Team, Staff and Students for academic year 2022-2023. This efforts taken by Faculties and Students towards environment and sustainable are highly appreciable and commendable.

(Dr. Binoy Kr. Chanda)	(Dr. Pranab Sahoo)	(Mrs. Sanchita Bhattachariya)	(Mr. Ananda Kr. Das)
President, TIEER	Asst. Professor & Secretary, TIEER	ISO-Auditor& CEO, CMS	Expert & Member, TIEER

[redacted]

Principal / Officer-in-charge
Government of West Bengal
Govt. General Degree College at Kharagpur-II
Paschim Medinipur-721149, West Bengal

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. Pijush Kanti tripathy	Associate Professor, Dept. of Geography, Haldia Govt. College	Ecology and Environment management
5.	Dr. Sudipta Maiti	Faulty, Dept. of Botany, Raja N.L. Khan Womens' College, Midnapore	Plants Diversity & Carbon stocking, Green Management
6.	Dr. Mrinmoy Ghorai	Assistant Professor in Zoology, Panskura Banomali college.	Fauna & Aqua animals and Biodiversity conservation
7.	Dr. Chandan Karan	Faculty, Dept. of Geography, S.B. Mahavidyalaya, Kapgari	Land use Survey, Technician for Lab test. and Map Designer
8.	Sri Ananda Das	Asst. Teacher & expert	Electro physics
9.	Dr. Sumita Swar	Faulty, Dept. of Environment, New Alipure College	Water and Waste Management
10.	Sri Sarat Chatterjee	Surveyor & Assistant Researcher	Water and Air Quality Measurement
11.	Sri Sanjib Mahata	Surveyor & Expert in RS &GIS	Map Designer
12.	Sri Soumitra Patra	M.Tech in Agriculture and expert	Water conservation and Micro irrigation technology

Front view of the College Campus

CONTENTS :

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 college. Energy auditing is a means of assessing environmental performance (Welford, 2002). It is as systematic, documented, periodic, and objective review by regulated entities of facility operations and practices related to meeting environmental requirements (EPA, 2003).

Meeting with Hon'ble Principal

1.1 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

1.2 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	7
Playground and Fallow land	65
Vegetation Cover	19
Water Bodies	9

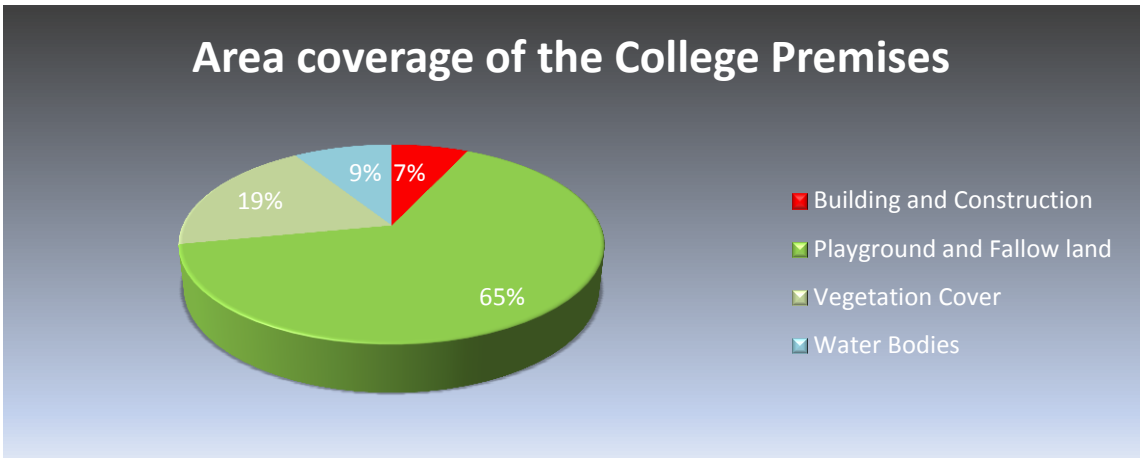
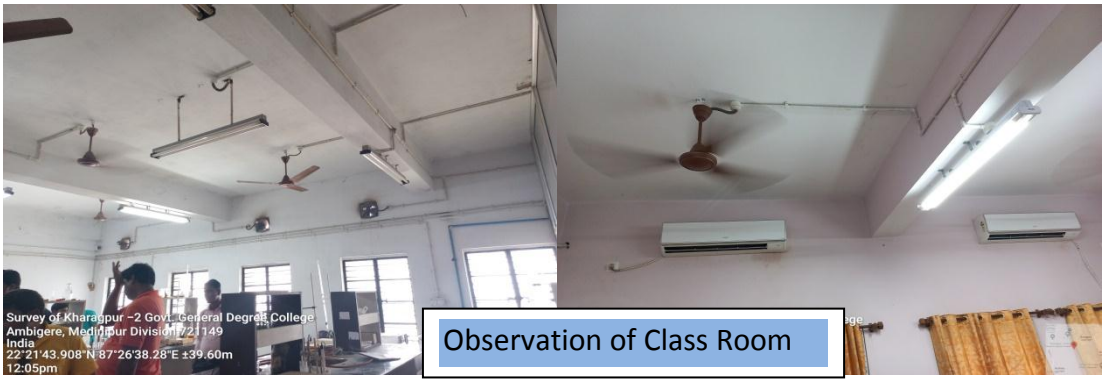


Fig. 1 Area Coverage of College Premises

Different Building and Sectors:

Building and Sectors	
Administrative Buildings	**Library**
	Gymnasium
	Seminar Hall

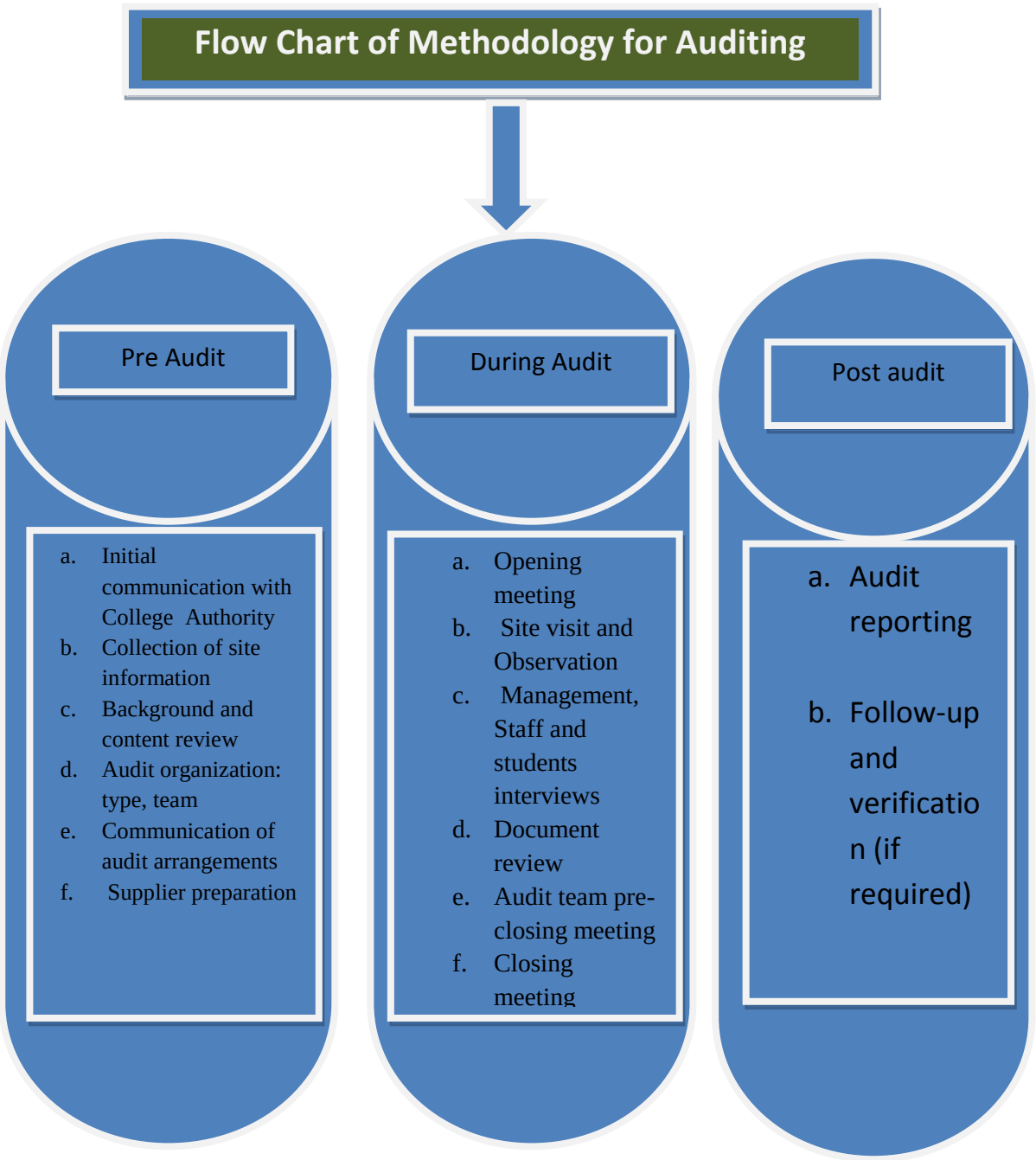


Observation of Class Room

CHAPTER – 2

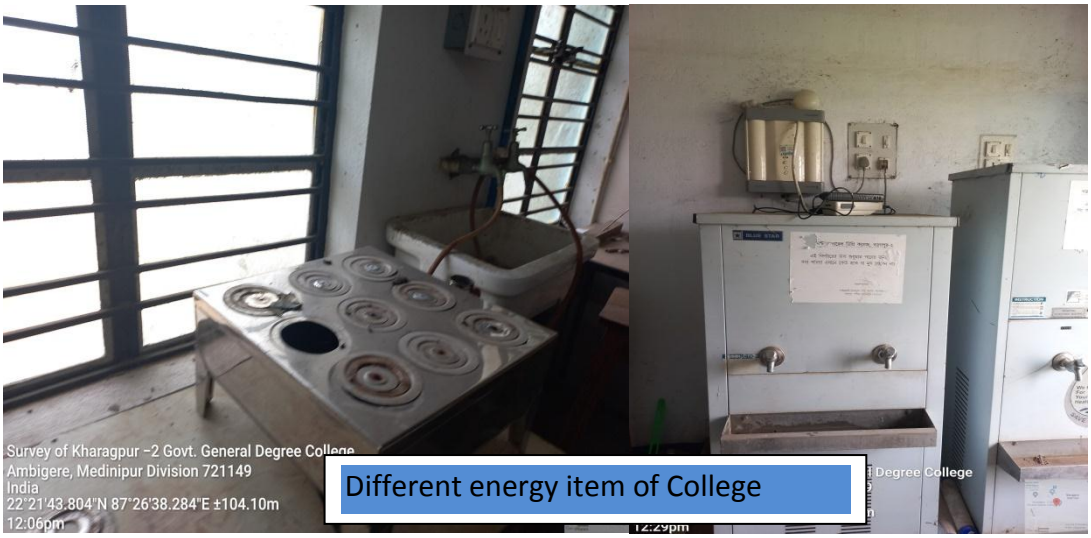
Methodology and Survey Schedules

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.



Site Visit :

a. College and its premises were visited and analyzed by the audit-team.
b. All Departments, office rooms, , Staff Quarter and parking grounds were also visited to collect data.
c. Number and type of vehicles used by the stakeholders were counted and fuel consumption for each vehicle was verified with the user.
d. Number of LPG cylinders used in labs, canteen and hostel kitchen were also counted.



Different energy item of College

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 Observation 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 GHG_S
5. Energy Efficiency and Energy Management

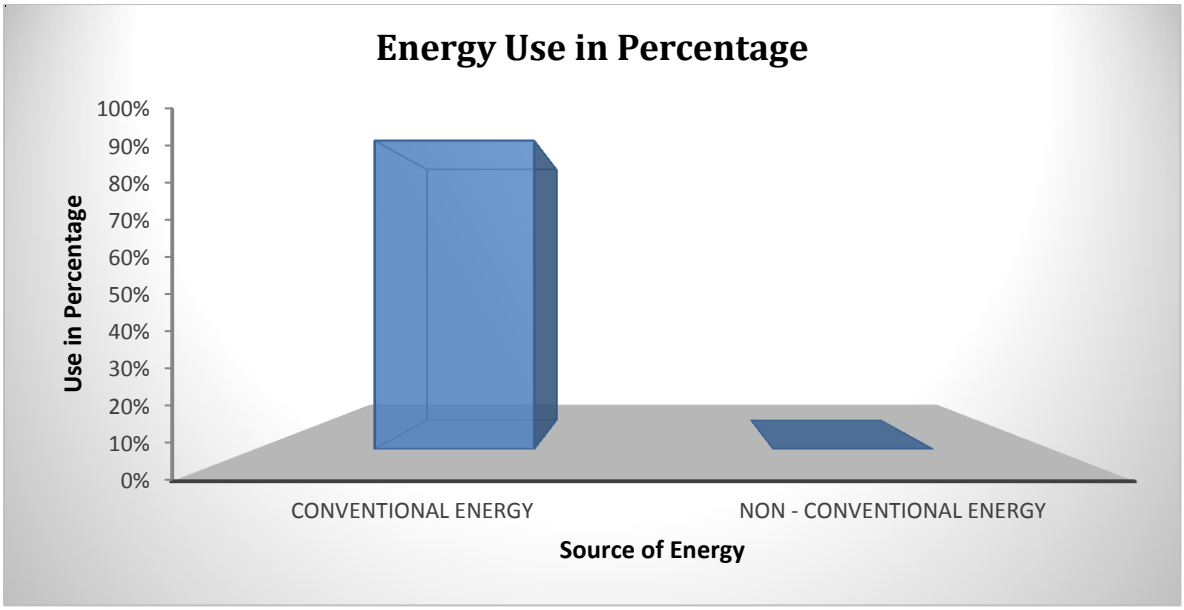
3.2 Grouping and Strategy

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 Different Sources of Energy Enquiry :

Electricity Consumption - 52764 Unit, Rs.- 699206/- Per Year /.
Table2. Source of Energy in Percentage:

Source of energy	In Percentage
Conventional	100
Non -Conventional	0



Parking Zone & Conventional Energy Observation

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 Coolar	200w
11	Spot light(CFL)	25w
12	Electric ketle	850w
13	Refregerator	500w
14	Water pump	1kw

Table 3. Energy Consumption of different items

Energy Consumption in different Purpose	In Percentage
light and fans	49
AC	16
Pump	3
Computer and Laboratory	27
Others	5

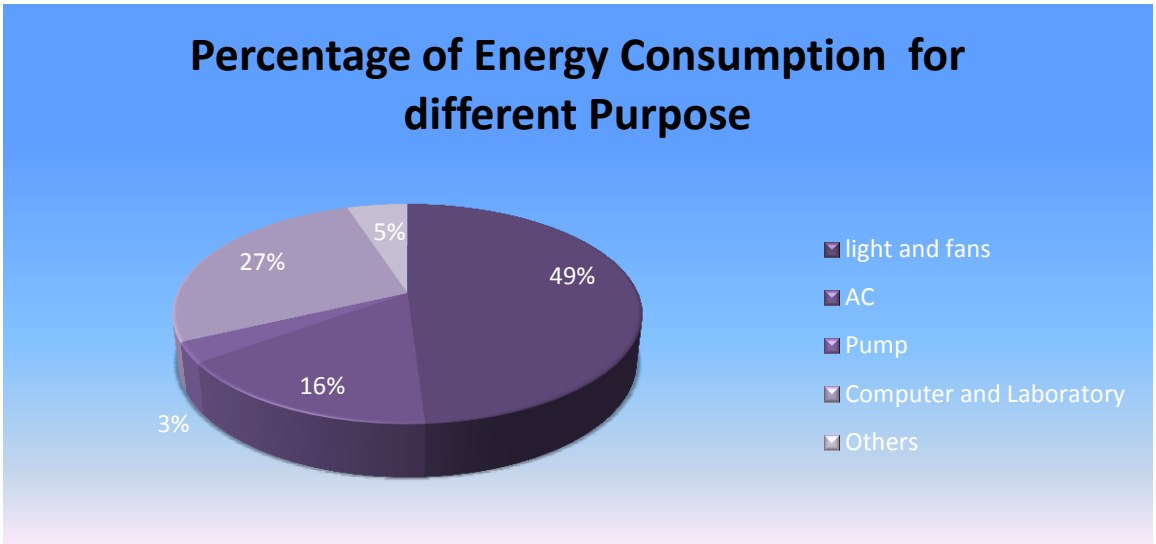


Fig. : Percentage of Energy Consumption in different Purpose

3.4 Cost of Energy :

- Electricity Consumption - 52764 Unit, Rs.- 699206/- Per Year
  - Fossil fuel consumption per Year:
    a. Number of Gas cylinders used for cooking purpose(Canteen) – 01 PC
    b. Number of Gas cylinders used in Chemistry Laboratory - 01 PC
    c. Diesel used for green Generator- 50 liter
  - Number of Green Generators - 01
  - Cost of generator fuel – Rs. 4500/year


Pumping Meter Observation

Table-4 Amount of CO_2 (ppm) in different location of the College Campus

Different location of the College Premises	Amount of CO2 (ppm)
Principal Office	460
Administrative Office	440
Head Clark office	420
Quarter	400
Canteen	430
Chemistry Lab	440
Computer Lab	460
Play Ground	400
Outdoor	400

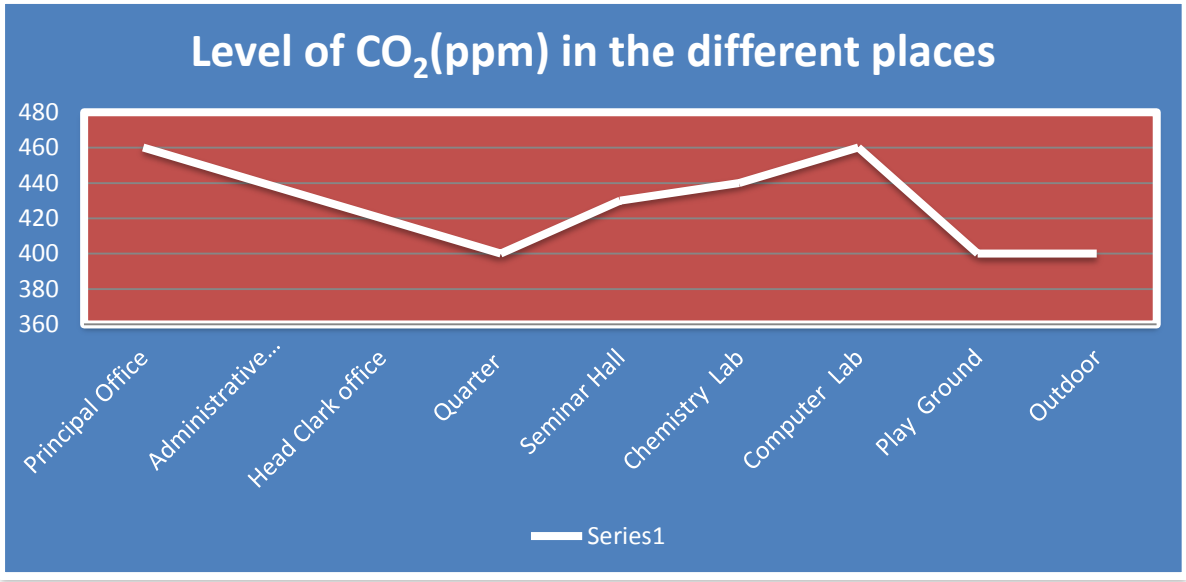


Fig. Amount of CO2 (ppm)in Different Location of the College Premises

Table-5 Amount of CO_2 (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 ofCO_2 (ppm)
Outdoor	400
Indoor (Class room)	420
Indoor (Laboratories)	430

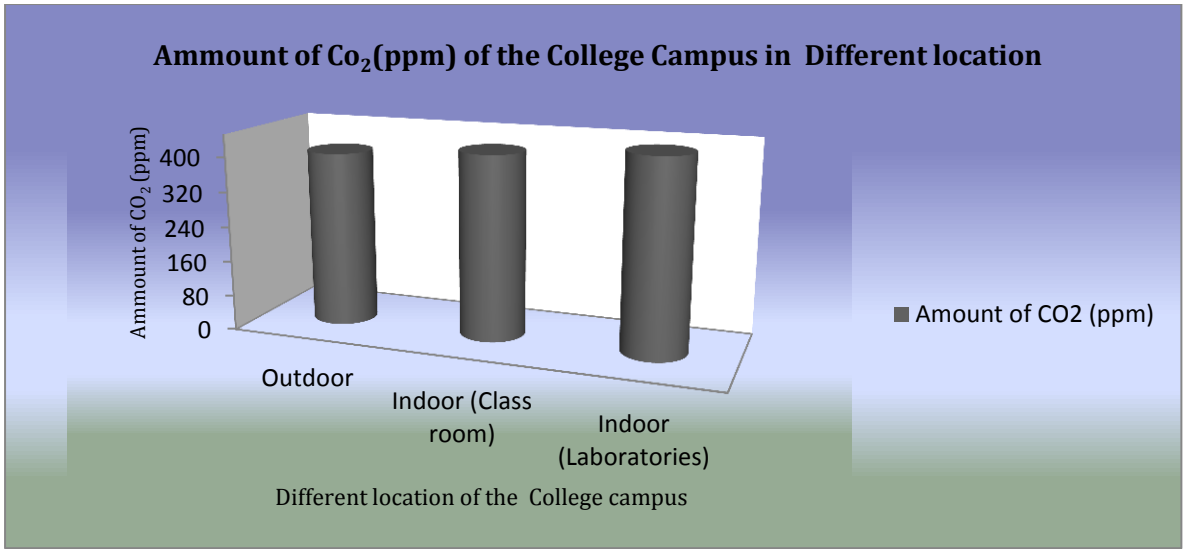


Fig. Amount of CO_2(ppm) of the Air in Different location of the College Premises

CHAPTER : 4.0 POST AUDIT STAGE

4.1 Data analysis and Assessment

Energy Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (conventional)	100 %
2	Total consumption of Electric Power	52764 unit
3	Maximum energy consumption in the purpose	Light and fans - 25854 Unit/year
4	Energy Consumption in Computer & Lab.	14246 unit /year
5	No. of LPG Gas cylinder for cooking purpose	01PC/ Year
6	No. of LPG Gas cylinder used in Laboratories	01pc/Year
7	Amount of diesel used for green generator	50 liter/Year
8	No. of AC and use of energy	8442unit /year
9	Source of energy (conventional)	100 %
10	Total consumption of Electric Power	52764 unit

4.2 Results and Findings

Power Consumption in different sectors:

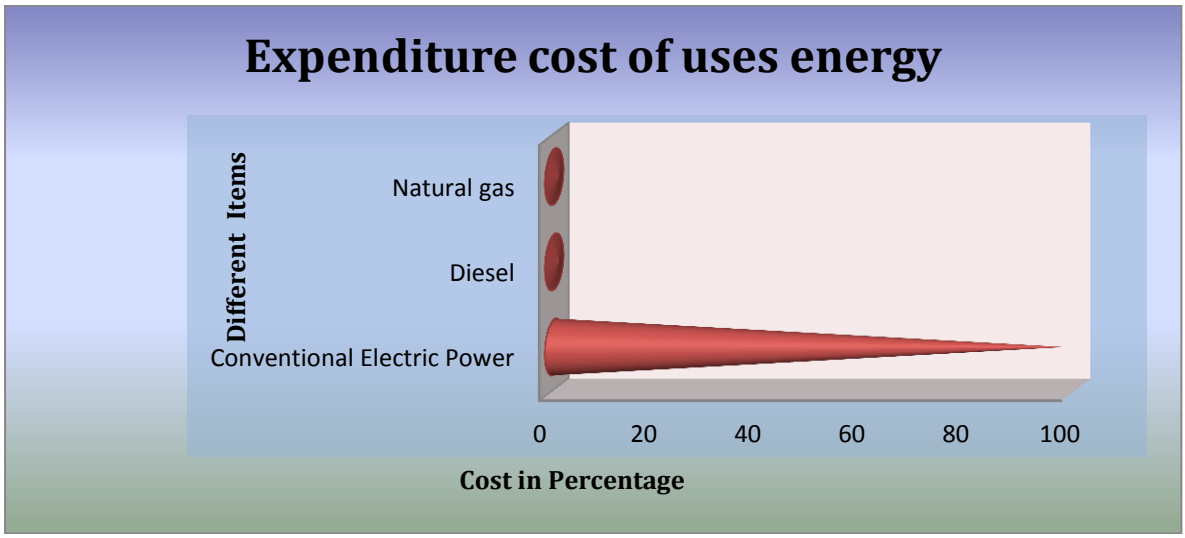
Sl.no	Sectors and purpose	Power consumption(%)/day
1.	Computer laboratory	27
2.	Administrative Building	12
3.	Library	8
4.	Class room	49
5.	Gymnasium	2
6.	Others	2

4.3. Energy Cost:

- Electricity Consumption - 52764 Unit, Rs.- 699206/- Per Year
  - Fossil fuel consumption per Year:
    - d. Number of Gas cylinders used for cooking purpose(Canteen) – 01 PC
    - e. Number of Gas cylinders used in Chemistry Laboratory - 01 PC
    - f. Diesel used for green Generator- 50 liter
  - Number of Green Generators - 01
  - Cost of generator fuel – Rs. 4500/year

Table 6. Expenditure cost of uses energy

Expenditure cost of uses energy	Cost in Percentage
Conventional Electric Power	98
Diesel	1
Natural gas	1



Energy consumption in different purpose , 2022-23		
1	Lights & Fans	25854.36unit
2	Computer & Dept.	14246.28unit
3	Air Conditions	8442.24unit
4	Lifting of water(HP pump) Lab	1582.92unit
5	Others(CCTV,TV, water cooler & others)	2638.2unit

Routine of Energy save Practices

-),
- 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	M
4	Awareness	M
5	Management of GHG_S	M

* H denote- Taken management policy level above 60%

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

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

4.4 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 = 8442.24unit/year for air conditioner
- Considering a saving of 15%,totel annual savings = 15% x 8442.24 unit 1266.336 unit/year for air conditioners, cost of electricity = Rs.16462.37/-
- Yearly savings = Rs.16462.37/year from air conditioners

Conclusion and Recommendations

General Recommendations:

- All computers to have power saving settings to turn off monitors and hard discs, say after10 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:-

TIEER and CMS are thankful to the Honorable Principal and IQAC of the Government General Degree College at Kharagpur-II for entrusting processes of Energy auditing with us. We thank all the participants of the auditing team especially IQAC Officers, HOD, faculty and non-teaching staff , students, also others stakeholders who took pain along with us together data through survey. We also thank the office staff who helped us during the document verification.