

ENERGY AUDIT REPORT (2022-2023)



**JHARGRAM RAJ COLLEGE
JHARGRAM, WEST BENGAL**

**CONSULTRAIN MANAGEMENT SERVICES,
LAKE ROAD, KOLKATA**

**TROPICAL INSTITUTE OF EARTH AND
ENVIRONMENTAL RESEARCH (TIEER),
MEDINIPUR**

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



TROPICAL INSTITUTE OF EARTH AND
ENVIRONMENTAL RESEARCH (TIEER)

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ENERGY AUDIT CERTIFICATE

Academic Year: 2022-2023

This is to certify that Jhargram Raj College, Jhargram, 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)
President, TIEER

(Dr. Pranab Sahoo)
Asst. Professor &
Secretary, TIEER

(Mrs. Sanchita Bhattachariya)
ISO-Auditor & CEO, CMS

(Mr. Ananda Kr. Das)
Expert & Member,
TIEER

ACKNOWLEDGEMENT

We, The Energy Audit Team thank the management of Jhargram Raj College, Jhargram, West Bengal for assigning us such an important work on Energy Audit. We appreciate the cooperation to our team for the assigned study, giving us necessary inputs to carry out audit activities.

Our special thanks to:

- ❖ Principal of the College*
- ❖ IQAC Members*
- ❖ Teaching & supporting staff*

ENERGY AUDIT : 2022-23

This Audit has been conducted by a Committee constituted by the Experts & Scientists from different reputed Institutes. The Committee developed a questionnaire for audit based on the regulatory & statutory requirements of Central as well State. The basic data was gathered & compiled, which the committee analyzed. By and large, the audit reveals a healthy environment inside the Jhargram Raj College campus. The committee has suggested short term as well as long-term suggestions for improved environmental conditions about energy efficiency to a higher levels and authorities and all stakeholders of the College conforms that they will give due attention and utilize opportunities for identified improvements. The Committee members are listed below:

LIST OF EXPERTS AND SCIENTISTS

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. of Geography, S.B. Mahavidyalaya, Kapgari	Land use Survey, Ecology and Map Designer
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 Sarat Chatterjee	Surveyor	Water and Air Quality Measurement
9.	Sri Sanjib Mahata	Surveyor & Expert in RS &GIS	Map Designer
10.	Sri Soumitra Patra	M.Tech in Agriculture and surveyor	Micro irrigation technology and water management
11.	Mr. Prasun Sahoo	B.Tech, Electrical Engineer	Electric management service

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CHAPTER-1.0 INTRODUCTION

1.1 INTRODUCTION OF THE ENERGY AUDIT

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).



Entrance of Jhargram Raj College premises



1.2 OBJECTIVES AND VIEWS 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.

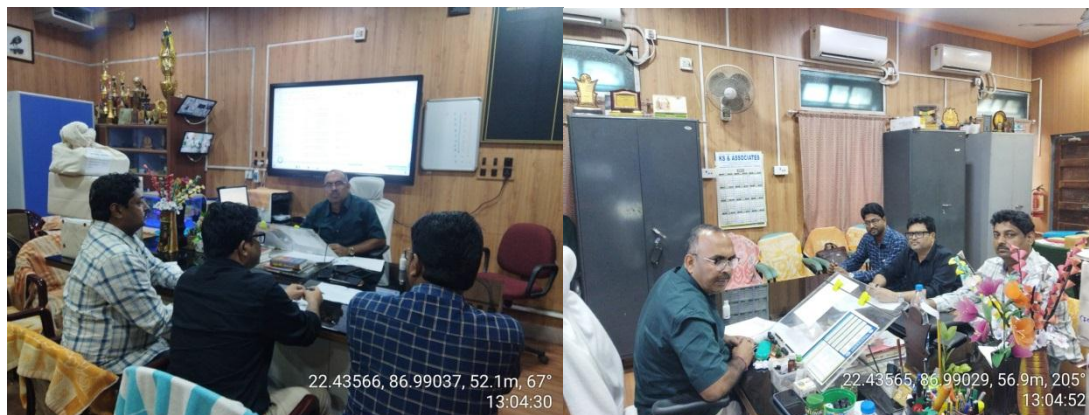
- To study of interrelationship between beneficiary and environment in the College campus
- To Establish to provide basis for improved sustainability
- To Recognize the cost saving methods through energy minimizing and managing
- To Financial savings through a reduction in resource use
- To Develop of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

1.3 ADVANTAGES AND FAVOR OF ENERGY AUDIT:

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

Campus Area and Infrastructure:

Total area of the college campus – 20 acres,
Building area: 1.45 acres,
Green & Vegetated area: 15.95 acres.
Play Ground & Vacant land area: 2.40 acre
Water Bodies area: 0.02 acre
Departments: 15 (Post Graduate & Under Graduate)
Laboratories: 24
Students: 2906
Teaching & Non-teaching staff: 102



Meeting with Hon'ble Principal

About the College :

Jhargram Raj College is situated at the town of Jhargram, the District Head Quarters of the newly created District of Jhargram. The area is a place of natural beauty. The college is set in a campus of 57.76 acres of land amid the serene and verdant forests of primordial trees such as Mahua, Sal, Piasal etc. It has registered a spectacular growth over the years since its inception. Before the partition of 1947, the only agricultural college of the then undivided Bengal was in Dhaka which after partition became the capital of the then East Pakistan. The need for an agricultural college in West Bengal was felt and discussed in academic as well as administrative spheres of the state. In 1949, the young Raja of Jhargram, Raja Sir Narasingha Malla Ugal Sanda Deb, OBE, KBE, at the request of Pramathanath Banerjee, the then Vice Chancellor of Calcutta University, made a request of Rupees One Lakh in cash and 317 acres of land for the first agricultural college of West Bengal at Jhargram. The Raja was once a pupil of Professor Pramathanath Banerjee at Presidency College. Thus, a teacher-student endeavor resulted in the establishment of the college in Jhargram with a view to spread education in a backward and predominantly tribal area. The Khaira Professor of Agriculture Dr Pabitra Kumar Sen who was the first principal of the college, helped with the Khaira Endowment Fund.

The building was started to be raised in 1951 and Jhargram Agricultural College was promoted to the degree standard with a two-years' B.Sc. course. However, Calcutta

University could not meet the financial requirements for long and in 1953 the college was handed over to the Government of West Bengal with the teaching of Agriculture retained only up to the I.Sc. standard and teaching of B.Sc. in Agriculture was taken over by the Government Agricultural College at Tollygunge, Calcutta. The land donated by the Raja of Jhargram became government land and much of it was put to use for various government purposes. The college retained about 57.76 acres of land.

Since its inception, as a premier college of the Jungle Mahal, the mission of the college has been the empowerment of the under-privileged. Founded on the 1st of July in 1949 as Jhargram Agricultural College, Jhargram Raj College grew into a hallowed centre of higher learning, offering to the undergraduate students a whole array of subjects from three disciplines of Arts, Commerce and Science. Initially affiliated to the University of Calcutta, the college came under affiliation of Vidyasagar University in 1985. In 1999, the college celebrated the completion of 50 years of its glorious existence. In 2005, the college introduced its first Postgraduate course in Chemistry. Gradually, Postgraduate courses in Zoology and Bengali also came into being from 2006 and 2008, respectively. Different minor and major research projects funded by different government agencies are carried out by the faculty members of various departments of the college. The faculties regularly participate in seminars, workshops etc. and their research papers are regularly published in reputed journals and periodicals. These activities lead to involve and motivate the students, especially those who are pursuing postgraduate courses in this college, to a research career. In its sixty-eight years of existence, the college has witnessed the changes with time and it has been prepared accordingly to cope with the changes and offer better education to its students. Many of the alumni of the college are at the top positions of various government and non-government organisations. Many are reputed academicians. Many have made names in the field of art, music, literature etc. While the college takes pride in them, it busies itself with the duty of grooming the present students and looks forward to a brighter future for the coming generations.

General Information :

Total area of the college campus – 20 acres,
Building area: 1.45 acres,
Green & Vegetated area: 15.95 acres.
Play Ground & Vacant land area: 2.40 acre
Water Bodies area: 0.02acre
Departments: 15 (Post Graduate & Under Graduate)
Laboratories: 24
Students: 2906
Teaching & Non-teaching staff:102
Others stakeholder: 25
Total Stake holders: 3033
Auditorium /Seminar hall:01
Hostels: 03
Hostel students: 142
Staff Quarters-12

Table 1 Area Coverage of the College Campus

Area Coverage of College Premises:	Area in Percentage
Building and Construction	7.25
Vegetation Cover	79.73
Playground and Fallow land	12.00
Water Bodies	0.02

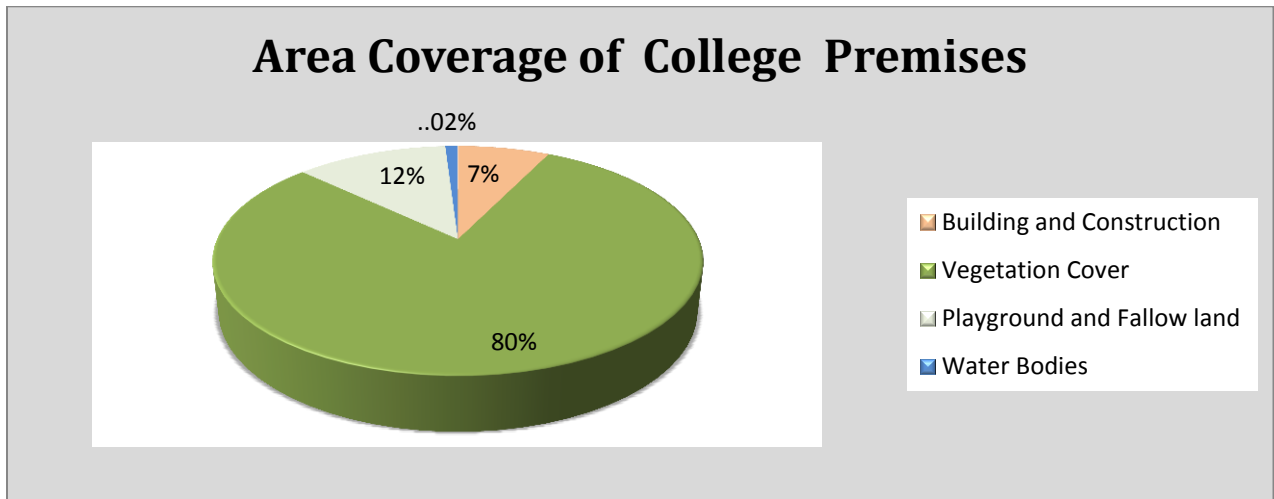


Fig. 1 Area Coverage of College Premises



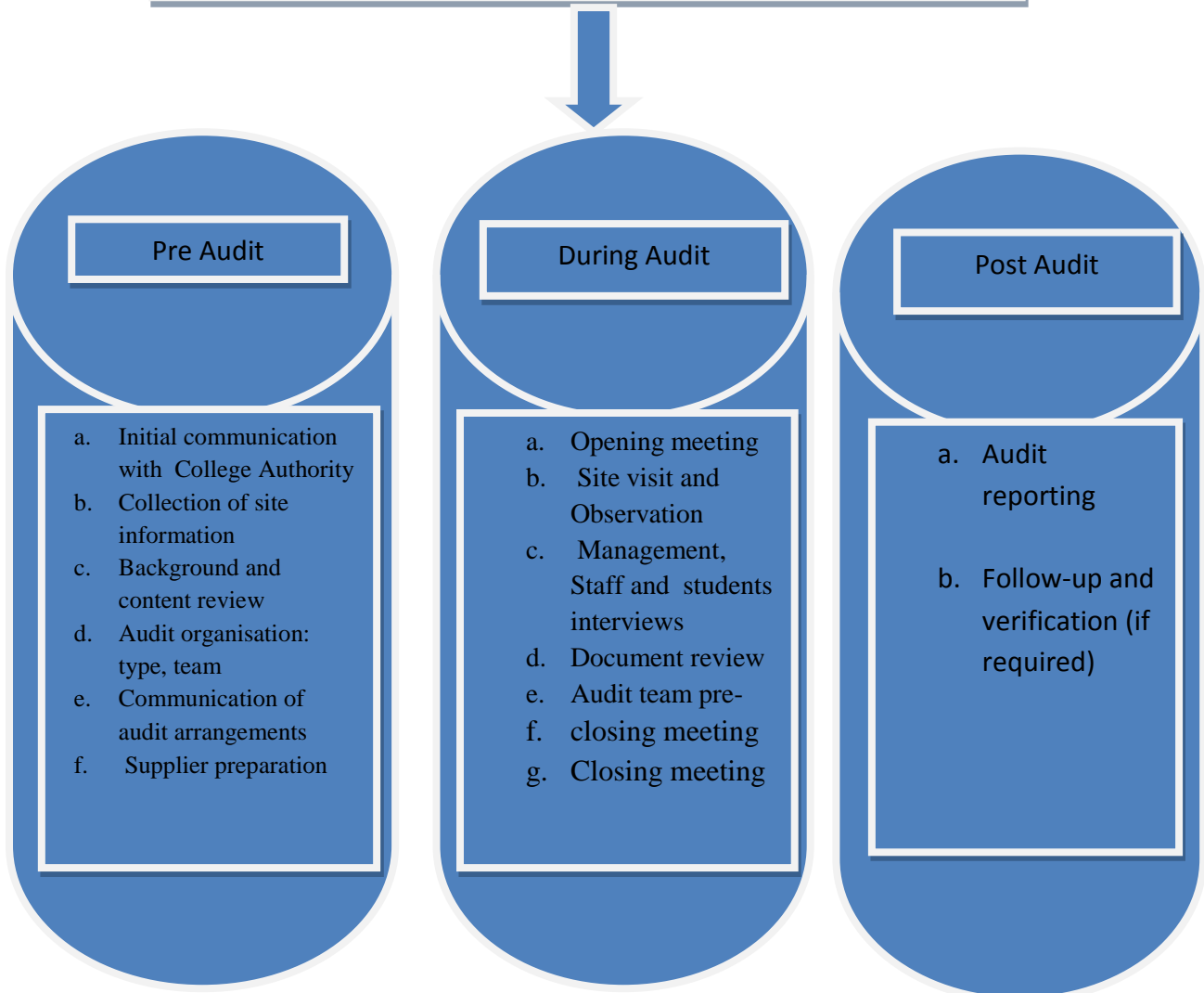
Canteen



Ladies Hostel

CHAPTER – 2.0 METHODOLOGY AND SURVEY SCHEDULES

Flow Chart of Methodology for Auditing



2.1 ADVANTAGES OF ENERGY AUDIT:

- To develop to more efficient resource management
- To provide basis for improved sustainability
- To create a GHG free campus
- Recognize the cost saving methods through Energy minimizing and Managing
- Energy auditing should become a valuable tool in the management and monitoring of environmental and sustainable development Programs of the College

2.2 SITE VISIT :

College and its premises were visited and analyzed by the audit-teams several times to gather information. Campus trees were counted and identified. Medicinal garden, play grounds, canteen, library, All Department, office rooms, Hostels, Guest House, Staff Quarter and parking grounds were also visited to collect data. Number and type of vehicles used by the stakeholders were counted and fuel consumption for each vehicle was verified with the user. Number of LPG cylinders used in labs, canteen and hostel kitchen were also counted. Leakage of a few water taps and over flow tanks were noticed during the site inspection.

2.3 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 College? 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 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? Mention 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

Energy audit forms part of a resource management process. Although they are individual events, the real value of energy audits is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy, pollution and also economic efficiency. All these indicators are assessed in process of Energy Auditing of educational institute". Eco-campus focuses on the reduction of contribution to emissions, procure a cost effective and secure supply of energy, encourage and enhance energy use conservation, promotes personal action, reduce the institute's energy and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

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

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 4: Lighting and fans in boys Hostels

Group 5: Lighting and fans in Girls Hostels, Canteen and Staff Quarters

Group 10: Enquiry of total energy cost from the Office

Group 11: Water Pumps in the entire campus & Benchmarking of electricity consumption

The groups are allowed the use of various measuring instruments to assist in the auditing activity. Also, cooperation of the Electrical Maintenance Section was sought to collect past data and for taking measurements.



Campus Observation and Enquiry

3.3 Energy Efficiency and Energy Management:

a	Energy sources	Sources of Energy: Conventional Electricity, LPG Gases, Diesel, Petrol and Non –conventional Solar energy
b.	Energy consumption	The useable energy is Conventional and Non-Conventional energy. The used Electricity energy is 97016 units which costing is Rs.509334/-. About 5% energy is Non-conventional energy which is contributed from Solar Power. The Maximum energy is consumed for Light & Fan and Computer Section amounting to 68% of total consumption.
c.	Usage of LPG	It has been observed that LPG gas cylinders are used in Hostel, Canteen & Laboratories (310PC/year) for cooking and other purpose. There are Green generators used in the premises.

Table-4 Source of Energy in Percentage

Source of Energy	In Percentage
Conventional	95
Non -Conventional	5

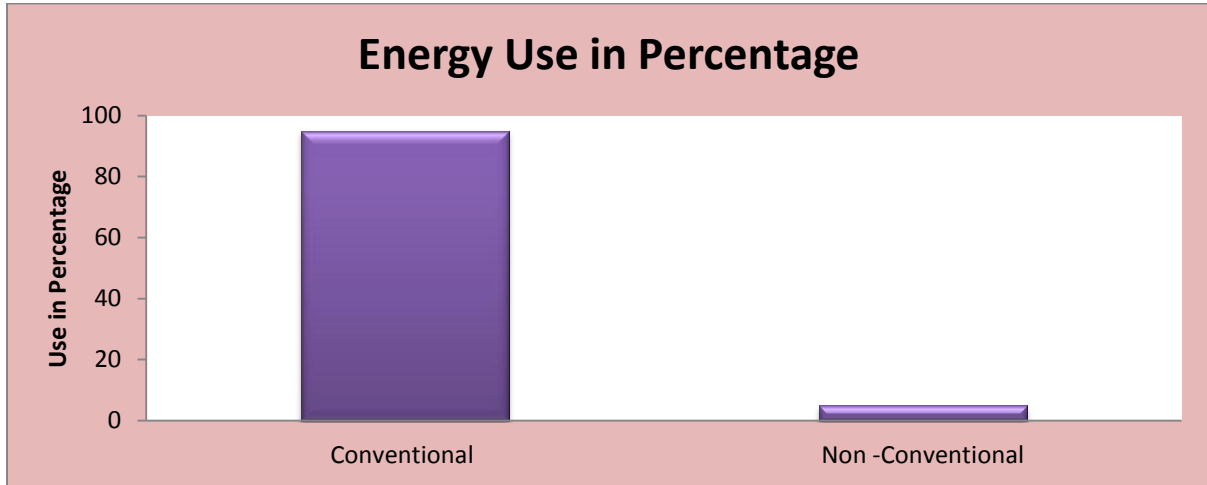


Fig. 3 Use of Energy in Percentage



Source of Convectional Energy



Source of Non Convectional Energy

Table-5 Energy Consumption in different Purpose in Percentage

Energy Consumption in different Purpose	In Percentage
Light and Fans	48
Computer and Laptop	20
AC	16
Pump	7
Others	9

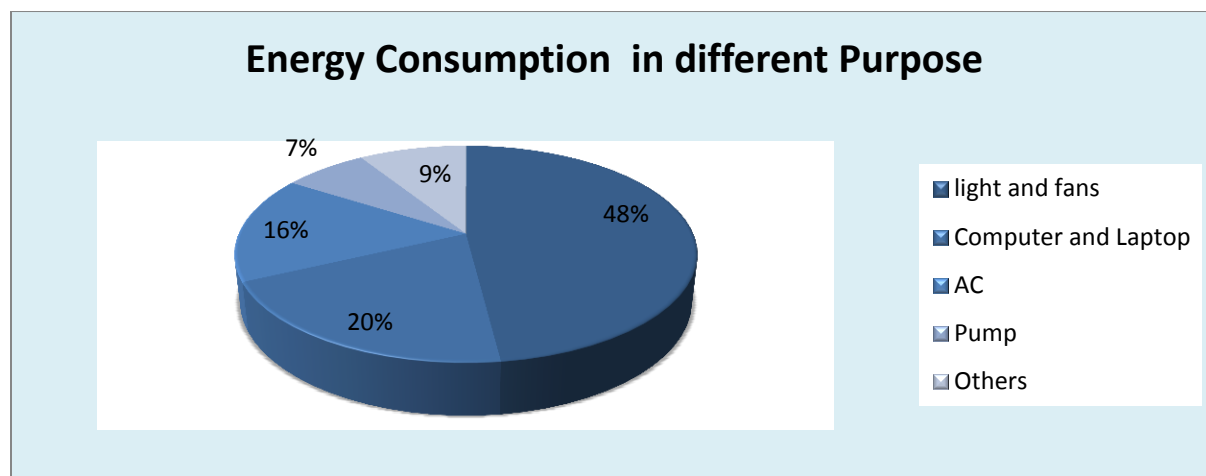


Fig. 4 Percentage of Energy Consumption in different Purpose

3.3 ENQUIRY OF DIFFERENT SOURCES OF ENERGY :

Recommendations:

- I. a) Installation of automatic lights with sensors can be considered.
- II. b) Standard Operation Procedures (SOPs) should be prepared and followed for green purchasing wherein equipment's with star rating; those using eco-friendly materials; those with safe disposal policy or return to supplier after unused, can be considered.
- III. c) Notices/ signage can be put up/ displayed near switches and on notice boards, informing students and staff to switch off all Departments & Sectors when not in use.
- IV. d) Use of large percentage renewable energy should be considered.
- V.

b. Energy-

- a) ❖ Electricity Consumption – 97016 Unit (Conventional). Rs.576000/- Per Year
- b) Conventional energy- 59077 Unit
- c) Nonconventional energy-9600Unit (Production Capacity)
- d) Payable cost of electricity – Rs.576000/- Per Year
- ❖ Fossil fuel consumption per Year:
 - a. Number of Gas cylinders used for cooking purpose(Hostels& Canteen) – 294PC
 - b. Number of Gas cylinders used in Chemistry Laboratory - 16PC
 - c. Diesel used for green Generator- 100 liter
- ❖ Number of Green Generators - 2 Unit
- ❖ Cost of fuel for Generator – Rs. 9000/-year

Energy consumption in different purpose, 2022-23		
1.	Lights & Fans	46567.68 unit
2.	Air Condition	15522.56 unit
3.	Lifting of water(HP pump)	6791.12unit
4.	Computer & Dept. Lab	19403.2 unit
5.	Others(CCTV,TV, water cooler & others)	8731.44 unit



Lifting of water(HP pump)



Street Lights

CHAPTER 4.0 POST AUDIT STAGE

4.1 ENERGY COST SUMMARY

- ❖ Electricity Consumption – 97016 Unit Unit (Conventional). Rs.576000/- Per Year
 - a) Conventional energy- 59077 Unit
 - b) Nonconventional energy-9600Unit (Production Capacity)
 - c) Payable cost of electricity – Rs.576000/- Per Year
- ❖ Fossil fuel consumption per Year:
 - d) Number of Gas cylinders used for cooking purpose(Hostels& Canteen) – 294PC
 - e) Number of Gas cylinders used in Chemistry Laboratory - 16PC
 - f) Diesel used for green Generator- 100 liter
- ❖ Number of Green Generators - 2 Unit
- ❖ Cost of fuel for Generator purpose – Rs. 9000/-year

4.2 CONCLUSION AND RECOMMENDATIONS

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

4.3 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, 5h/day

Proposal for Air Conditioner-

- kWh/day/ air conditioner Yearly operating days = 160 days/year/ air conditioner
- Yearly electricity consumption = 97016 Unit (Conventional). Rs.734854/- Per Year
- Air Condition= 36000 unit/ year
- Considering a saving of 15%, total annual savings = 15% X 36000 unit/ year = 5400 kWh/year/ air conditioner which Cost of electricity is about Rs. 40878/-/year
- Yearly savings = Rs. 40878/-/year for air conditioners
