ENERGY AUDIT REPORT (2022-2023)

JHARGRAM RAJ COLLEGE (GIRLS' WING) JHARGRAM, WEST BENGAL

CONSULTRAIN MANAGEMENT SERVICES, LAKE ROAD, KOLKATA

TROPICAL INSTITUTE OF EARTH AND ENVIRONMENTRAL RESEARCH (TIEER), MEDINIPUR

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

TROPICAL INSTITUTE OF EARTH AND ENVIRONMENTAL RESEARCH (TIEER)
Reg. No. 2/1L/42578 of 2006-07
Office address: M-10, Bidhannagar, Medinipur-721101, W.B., India

ENERGY AUDIT CERTIFICATE

Academic Year: 2022-2023

This is to certify that Jhargram Raj College(Girls' Wing), 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)	(Dr. Pranab Sahoo)	(Mrs. Sanchita Bhattachariya)	(Mr. Ananda Kr. Das)
President, TIEER	Asst. Professor & Secretary, TIEER	ISO-Auditor& CEO, CMS	Expert & Member, TIEER

ACKNOWLEDGEMENT

We, The Energy Audit Team thank the management of Jhargram Raj College (Girls' Wing), *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 (Girls' Wing) 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.	Mrs Sumita Swar	Surveyor and Expert ENVS	Waste and Environment Management

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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 university. 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(Girls' Wing) 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 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 AND FAVOR OF ENERGY AUDIT:

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

Meeting with Hon'ble Principal & IQAC Team

Campus Area and Infrastructure:

About the College :

Jhargram Raj College (Girls' Wing) 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 5 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. Jhargram Raj College (Girls' Wing) is situated in the town of Jhargram, the District Head Quarters of Jhargram. It takes about 15 minutes from Jhargram Rail Station. Government and private buses are also available from the nearby towns like Kharagpur and Midnapore. It is about 22 Km by road from Mumbai Kolkata national highway.Jhargram Raj College (Girls' Wing) started its journey in 2014 in the backyard of Jhargram Raj College and for the first 3-4 years it was recognized as nothing more than an annexed part of Jhargram Raj College. Some of it was justified because administrative operations were carried out mostly from Jhargram Raj College. The institution, however, started getting recognized and lauded for some of the infrastructural facilities that were being developed and the various activities that were being conducted in the premises. An auditorium with a seating capacity of over 150, housing state-of-the-art screening facilities and CCTV surveillance got JRC Girls' Wing on the map. Prestigious establishments like the Archaeological Survey of India, along with others, preferred and chose this particular venue to host their regional programmes with the aid of the faculty members of the college. This gave greater exposure to the students from remote margins of the Jungle Mahal area enabling them to be a part of such activities and interactions. In the following years, the college attained incremental independence and, finally, is a completely self-sufficient institution on its own credit with the resources to offer complete support to its staff and students at present. With time, an increasing number of seminars, talks, workshops, film screenings, legal interactive sessions were organized for the students. The infrastructure has kept on getting more advanced adding lifts, labs, games rooms along with a steady improvement of the academic quotient and cultural activities of the college. More Honours departments were added to both the Science and the Arts faculties along with and overhaul of the intake capacity of the students. More facilities like a cycle stand, rainwater harvesting systems, women's hostels are underway. Afforestation programmes are religiously carried out every few months or as and when required. As part of its community care projects, the college has also adopted a remote lodha-sabar village, taken its tiny tots under the wing of the faculty members who have vowed to take care of their educational needs. Students are encouraged to actively participate in all of the above so that they can inculcate the spirit of social consciousness, environmental awareness along with a holistic evolution of their personalities. The institution has tried to uplift and will continue to strive to care for its ecological and social ecosystem as long as it exists and develop sustainably for a better and brighter future.

Aerial views of Jhargram Raj College (Girls' Wing)

Surrounding environment of Jhargram Raj College (Girls' Wing)

Vision & Mission of the College :

We, as citizens of this country, are all concerned about development and to be more specific human development. Each one of us wants all kinds of opportunities and freedoms to live a kind of life that we value. The process of development should at least create an environment for us to develop our full potential and to have a reasonable chance of leading productive and creative lives. This college by providing the girls of the area with an opportunity of education open the door to this possibility. The vision is to boost their capabilities so that they can take control of their own lives. This is essential to enable them to make proper use of the opportunities they get. The college with all its infrastructure along with scholarships provided by the government creates the opportunity while the faculty members hailing from myriad backgrounds tend to take extra care in encouraging the students to make good use of these to become empowered individuals. We all know that women have achieved their right to education after a long struggle and our mission is to preserve and develop the fruits of that struggle. We also know that women empowerment, both psychological and financial, is the only way to prevent a large number of crimes against women. Our mission therefore is not just to impart formal education but also to raise consciousness among the girls about their position in society and how to change it for the better. Societal change is incremental. Our vision, therefore since the inception, has been to create a new generation of women in the area who are progressive, confident, empowered, who believe in gender equality and know how to claim their rights amidst adversities.

General Information :

Total area of the college campus – 5 acres,
Building area: 2.3 acres,
Green & Vegetated area: 1.7 acres.
Play Ground & Vacant land area: 0.99 acre
Water Bodies area: .01 acre
Departments: 10 (Under Graduate)
Laboratories: 3
Students: 1227
Teaching & Non-teaching staff: 31
Others stakeholder: 5
Total Stake holders: 1263
Auditorium /Seminar hall: 01
Hostels: Nil
Hostel students: Nil
Staff Quarters- Nil

Table 1 Area Coverage of the College Campus

Area Coverage of College Premises:	Area in acres
Building and Construction	2.3
Green & Vegetation Cover	1.7
Playground and Fallow land	0.99
Water Bodies	0.01

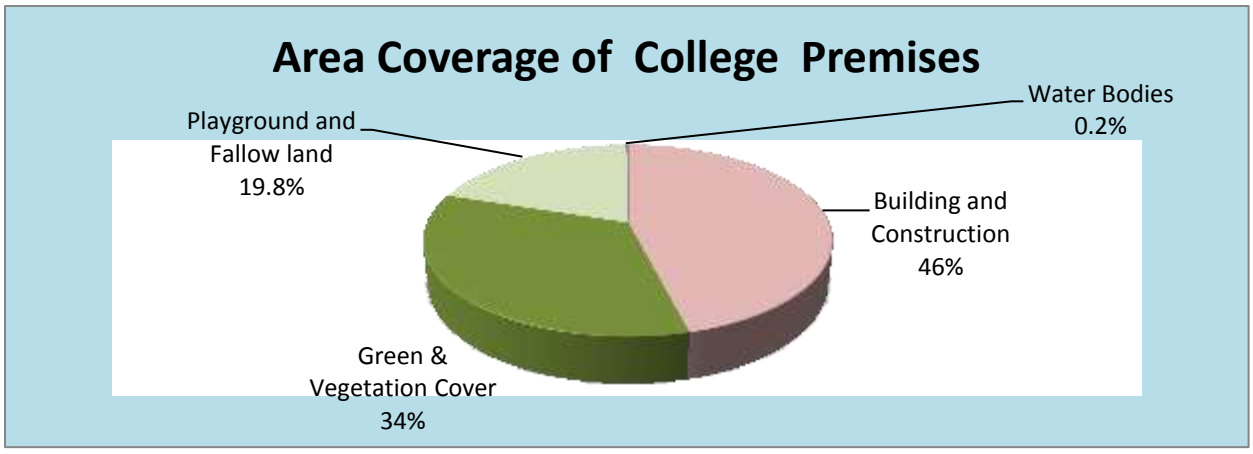
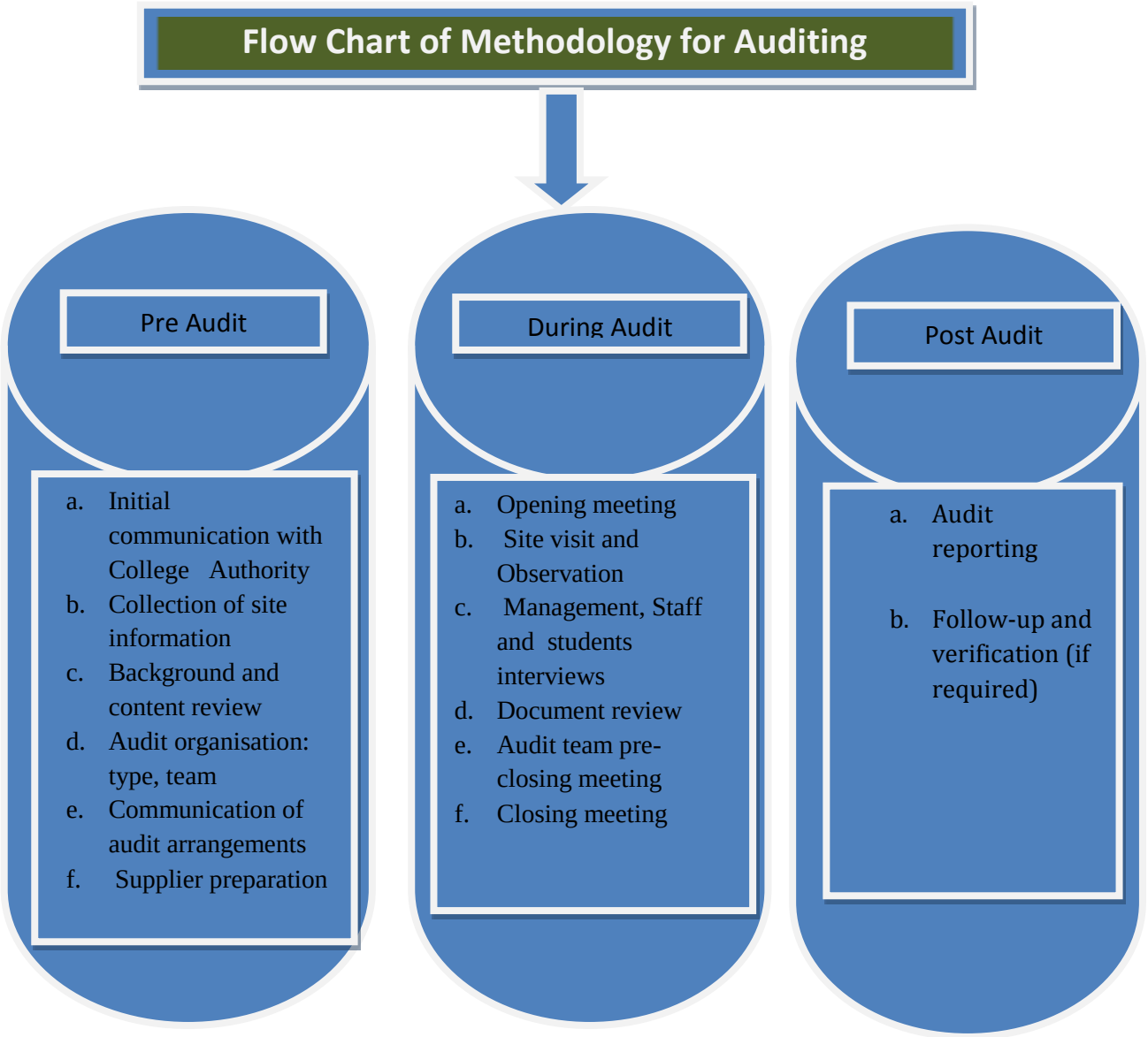


Fig. 1 Area Coverage of College Premises

CHAPTER – 2.0 METHODOLOGY AND SURVEY SCHEDULES



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, All Department, office rooms 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. 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 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(l-lours 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?

Site visit; Source of Conventional energy

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 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 Administrative building
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: Room air conditioners in Principal Chamber, departments and labs
Group 5: Enquiry of total energy cost from Power Office
Group 6: Water Pumps in the entire campus

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.

Uses of Conventional energy in Smart class room

Uses of Conventional energy in Lab

3.3 Energy Efficiency and Energy Management:

a	Energy sources	Sources of Energy: Conventional Electricity & Diesel
b.	Energy consumption	The useable energy is Conventional. The used Electricity energy is 30661 units which costing is Rs.2.44Lakh/-, The Maximum energy is consumed for Light & Fan and Computer Section amounting to 64% of total consumption.

Table-2 Source of Energy in Percentage

Source of Energy	In Percentage
Conventional	100
Non -Conventional	0

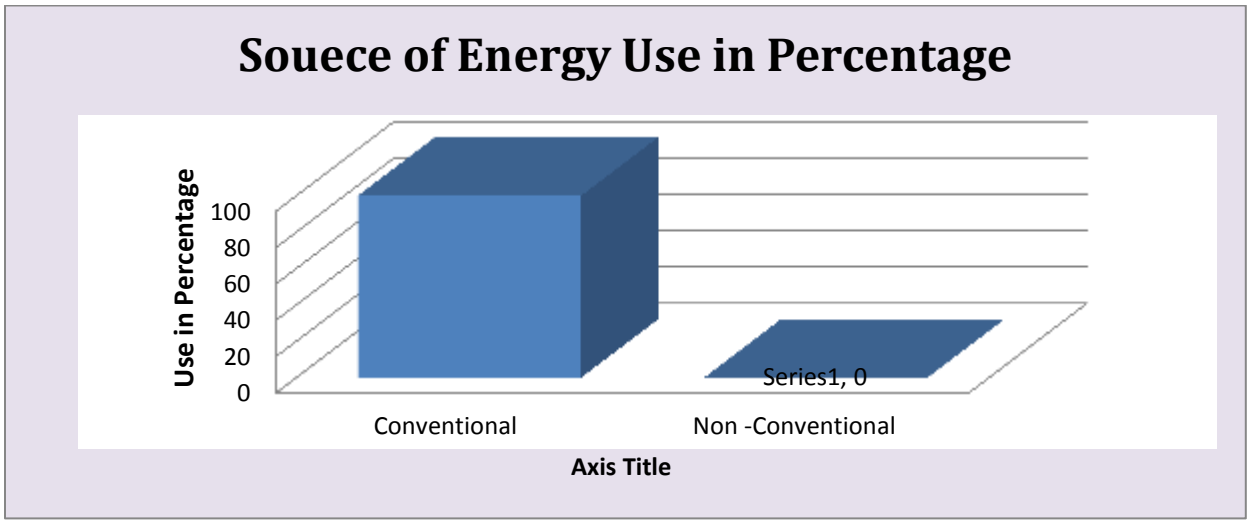


Fig. 2 Use of Energy in Percentage

Table-3 Energy Consumption in different Purpose in Percentage

Energy Consumption in different Purpose	In Percentage
Light and Fans	42
Computer and Laptop	22
Street light	14
AC	11
Pump	7
Others	4

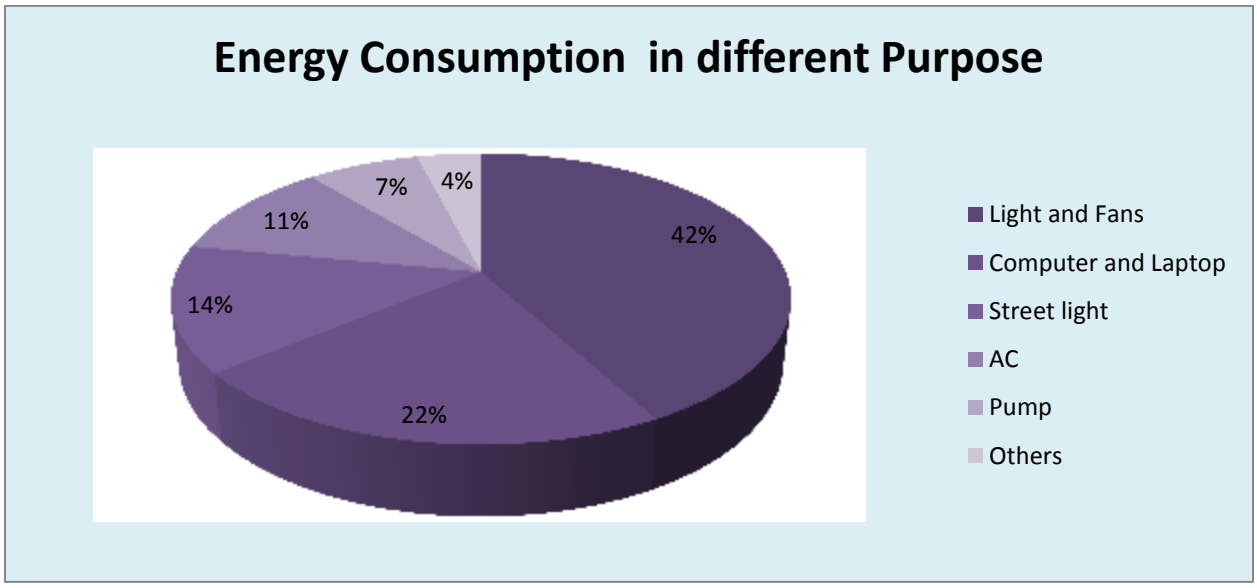


Fig. 3 Percentage of Energy Consumption in different Purpose

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.

b. Energy-

a) ❖Electricity Consumption – 30661 Unit (Conventional). Rs. 2.44 Lakh Per Year

b) Conventional energy- 30661 Unit

c) Payable cost of electricity – 2.44 Lakh Per Year

❖ Fossil fuel consumption per Year: 50 Liter

❖Number of Green Generators - 1Unit

❖Cost of fuel for Generator – Rs. 4500/- Year

Energy Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (Conventional)	100%
2	Total consumption of Electric Power	30661 Unit
3	The maximum use of Electric Power	Conventional - 100%
4	Maximum energy consumption in the purpose	Light & Fan- 47768 unit
5	Energy Consumption in Computer & Lab.	6745.42 unit
6	Amount of diesel used for green generator	50 liter
7	No. of Computers and use of energy	18 (26.91 Unit/Day)
8	No. of AC and use of energy	7(52.5 Unit/Day)

Energy consumption in different purpose, 2022-23		
1.	Lights & Fans	12877.62unit
2.	Air Condition	3372.71 unit
3.	Lifting of water(HP pump)	2146.27 unit
4.	Computer & Dept. Lab	6745.42 unit
5.	Street light	4292.54 unit
6.	Others(CCTV,TV, water cooler & others)	1226.44 unit

CHAPTER 4.0 POST AUDIT STAGE

4.1 ENERGY COST SUMMARY

❖ ❖Electricity Consumption – 30661 Unit (Conventional). Rs. 2.44 Lakh Per Year

a) Conventional energy- 59077 Unit
b) Conventional energy- 30661 Unit
c) Payable cost of electricity – 2.44 Lakh Per Year

❖ Fossil fuel consumption per Year: 50 liter

❖Number of Green Generators - 1 Unit

❖Cost of fuel for Generator – Rs. 4500/- 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 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.
- 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. 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-

- Air conditioner Yearly operating days = 160 days/year/ air conditioner
- Yearly electricity consumption = 30661 Unit (Conventional). Rs. 2.44 Lakh /Year
- Air Condition= 3372.71 unit/ year
- Considering a saving of 15%, total annual savings = 15% X 3372.71 unit/ year = 505.91 kWh/year/ air conditioner Cost of electricity = Rs. 3830/-/year
- Yearly savings = Rs. 3830/-/year air conditioner

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