

ENERGY AUDIT

(2022-2023)



**SEVA BHARATI MAHAVIDYALAYA,
KAPGARI, JHARGRAM, WEST BENGAL**

CONSULTRAIN MANAGEMENT SERVICES,
LAKE ROAD, KOLKATA

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

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CONSULTRAIN MANAGEMENT SERVICE
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ENERGY AUDIT CERTIFICATE

Academic Year: 2022-2023

This is to certify that Seva Bharati Mahavidyalaya, Kargai, 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

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

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



Front view of the College Campus



Survey of Seva Bharati Mahavidyalaya
Kargari, Medinipur Division 721505
India

Indoor plants observation and counting

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General Information of the College

Sl.No	Subject / Parameter of Quantity & Quality	Quantity & Quality
1.	College name	SEVA BHARATI MAHAVIDYALAYA
2.	Total area Coverage (acre)	About 11.4 acre
3.	Building / Construction area	2.40 acre
4.	Playground / vacant land	6.00 acre
5.	Green & vegetated area	2.80 acre
6.	Surface water bodies(ponds)	0.20 acre
7.	Total Students	1760
8.	Total Teaching faculties	70
9.	Total non-teaching staff	29
10.	Other stake holders	25
11.	Departments (PG&UG))	19 (UG-17,PG-NSOU, BPED-1)
12.	Laboratories	06
13.	Classrooms	20
14.	Auditorium/seminar hall	02
15.	Digital classrooms/smart classroom	02
16.	Playground	05
17.	Gymnasium hall	01
18.	Water bodies/ponds	01(0.20acre)
19.	Hostels	04
20.	Staff Quarters	01
21.	Hostel Students	220 (capacity-320)
22.	No. of Staff Stay in Quarters	04
23.	Source of water	Underground
24.	Capacity of Water Tanks	20,000 litre
25.	Lifting Amount of Water (day)	55,000 litre
26.	Source of energy	Electricity & solar
27.	Solar Power Unit	05(Street light)
28.	Total Unit of Electric Power(Year)	43,000unit
29.	Total cost of electricity (year)	Rs.301000
30.	Total No. of fans, lights, AC,	Fans:320, Light-420, AC-NIL
31.	Refrigerator, Xerox, Printer,	02 +02+06
32.	computers	15
33.	Street light/ Halogen	12
34.	Printer- , Water Cooler- .	06 +01
35.	No. of Green Generators	01
36.	No. of Water Pumps	06
37.	No. of Canteen.	01
38.	No. of Rain Water Harvesting	01 (ongoing project)
39.	No. of water quality observation unit	01(ongoing project)
40.	No of Water Reuse unit	02
41.	No. of Medicinal Plants Garden	01
42.	No of Private car /Bike (Day)	08/35
43.	No. of Bio fertilizer Unit	04
44.	No. of Using of Gas cylinder/year	10
45.	Use of wooden fuel/Months	110 Quintal

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).



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

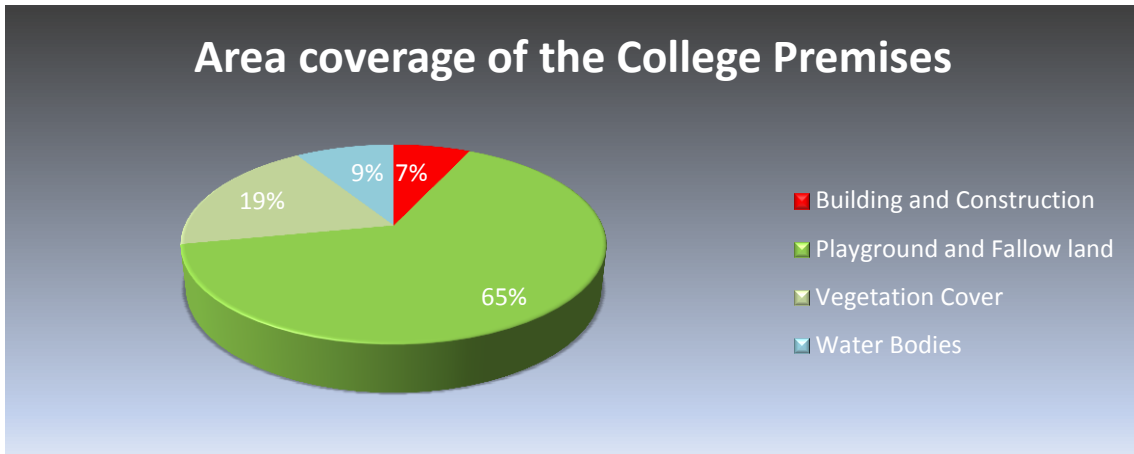


Fig. 1 Area Coverage of College Premises

Different Building and Sectors:

Building and Sectors	
Administrative Buildings	Library
Hostels	Gymnasium
Quarter	Seminar Hall

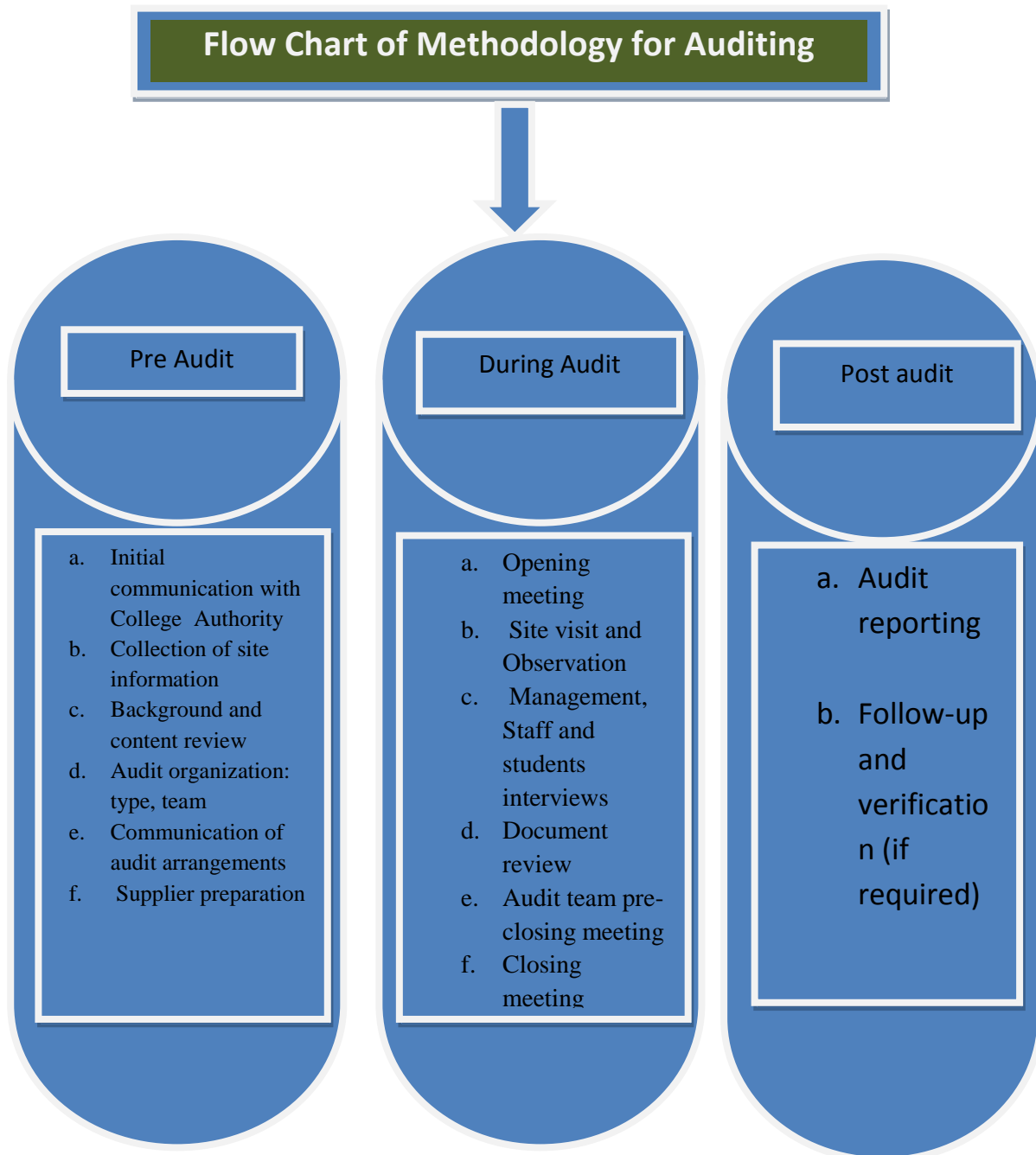


Observation of smart class and Seminar Hall

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. University and its premises were visited and analyzed by the audit-team.
- b. All Departments, office rooms, Hostels, DDE Building, Guest House, 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.



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 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 4: Lighting and fans in Quarters & Hostels

Group 5: Total room air conditioners in Administrative building, departments and labs.

Group 6: Energy audit of Central library and Computer Lab.

Group 7: Enquiry of total energy cost from Power Office

Group 8: Water Pumps in the entire campus

Group 9: Benchmarking of electricity consumption

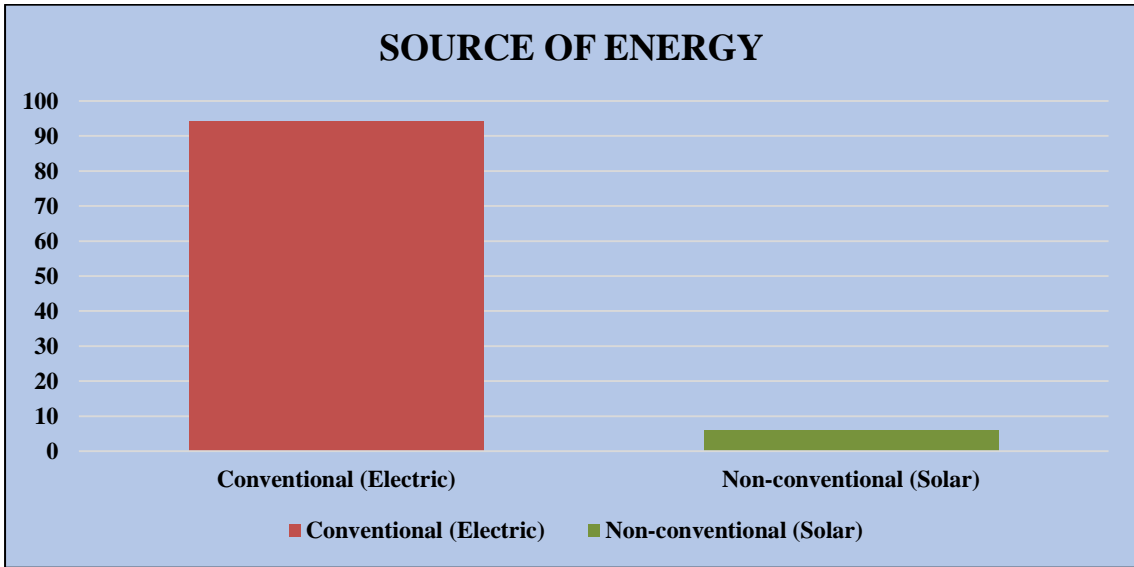
3.3 Energy Efficiency and Energy Management:

a	Energy sources	Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. An old incandescent Tube uses approximately 40W while an energy efficient light emitting diode (LED) uses only less than 24 W.
b.	Energy consumption	The useable energy is Conventional energy. The used Electricity energy is 43000 units which costing is Rs.30100/- Per Year. The Maximum energy is consumed for Light & Fan purpose which is 59 % of total consumption.
c.	Usage of LPG	It has been observed that LPG Ten gas cylinders are used in Canteen, Laboratories, cooking and other purposes. There are Green generators used in the premises.



Source of Conventional Energy

SOURCE OF ENERGY	
Source of Energy	Energy of Percentage (%)
Conventional (Electric)	94
Non-conventional (Solar)	6



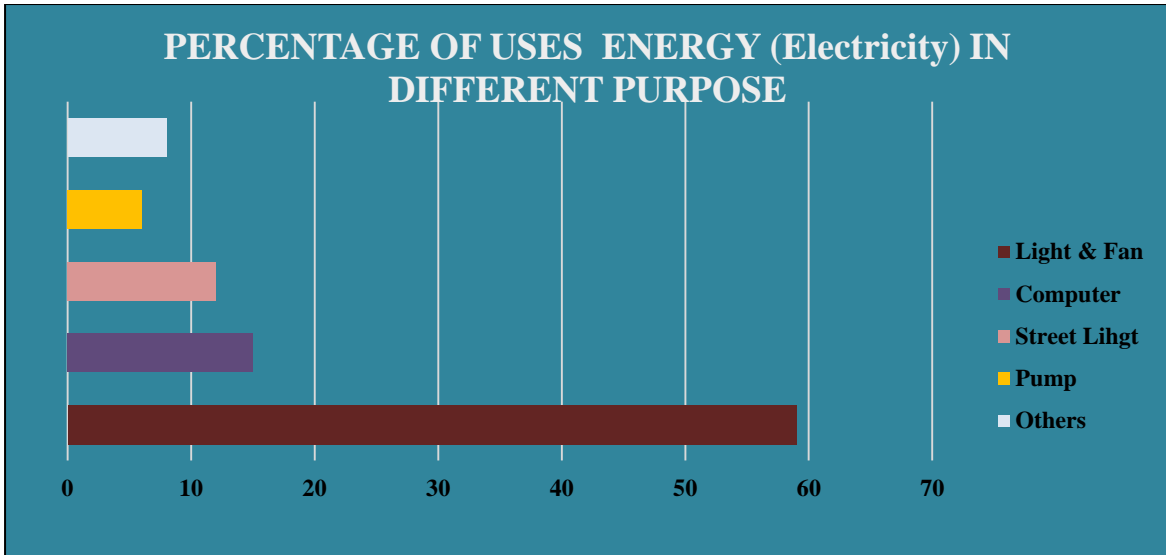
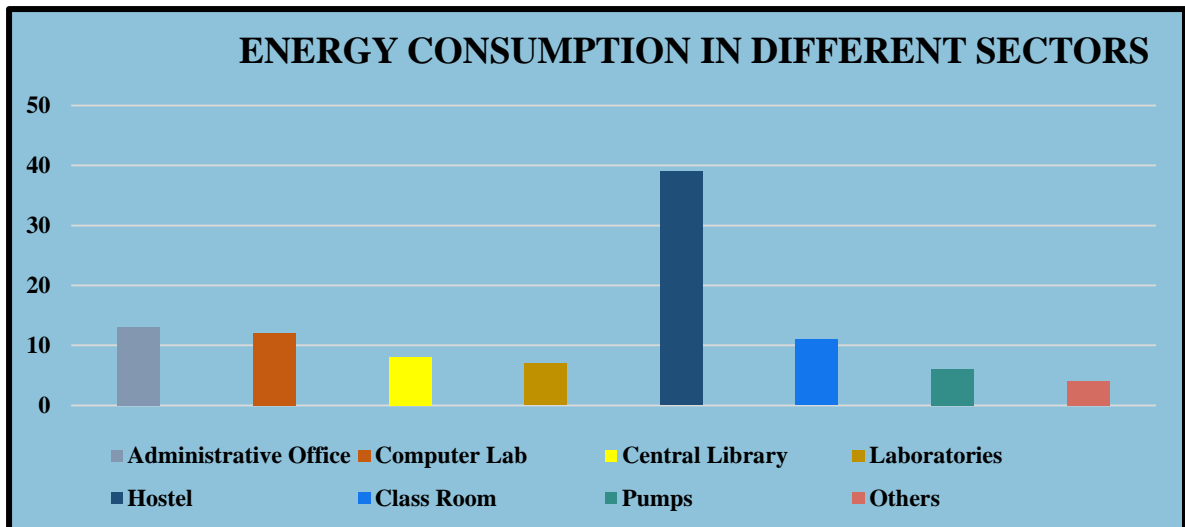


Fig. 4 Percentage of Energy Consumption in different Purpose

Observation and Recommendations:

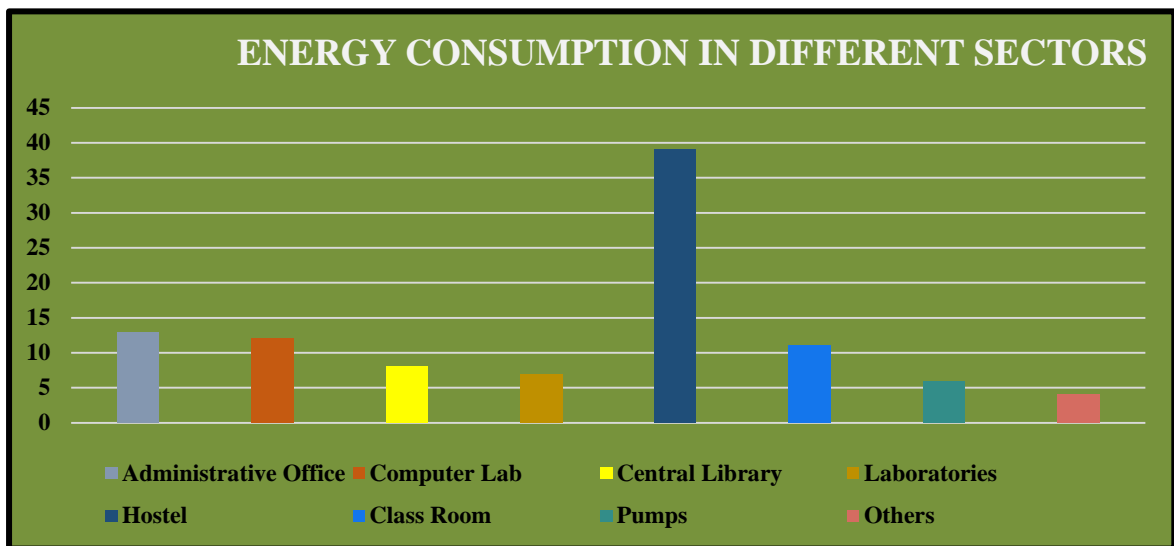
- a) Every classroom and lab with central switch board should have a diagram linking place of tube light, fan etc. with corresponding switch. This will ensure that correct fitting is switched on/ off and can save time & unnecessary operation.
- b) Installation of automatic lights with sensors can be considered.



- c) 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.
- d) For purchasing new electronic appliances, star rating provided by Bureau of Energy Efficiency (BEE) should be considered. The equipment which has maximum star ratings could be purchased, which will consume less energy, ensure environmental sustainability and also operate at low cost.
- e) Usage of light reflectors is recommended as the reflectors can spread light to relatively large areas.

- f) 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.
- g) Use of large percentage renewable energy should be considered.

ENERGY CONSUMPTION IN DIFFERENT SECTORS	
Use of Sectors	Energy Consumption in Percentage (%)
Administrative Office	13
Computer Lab	12
Central Library	8
Laboratories	7
Hostel	39
Class Room	11
Pumps	6
Others	4



POWER CONSUMPTION (W/ 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 kettle	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

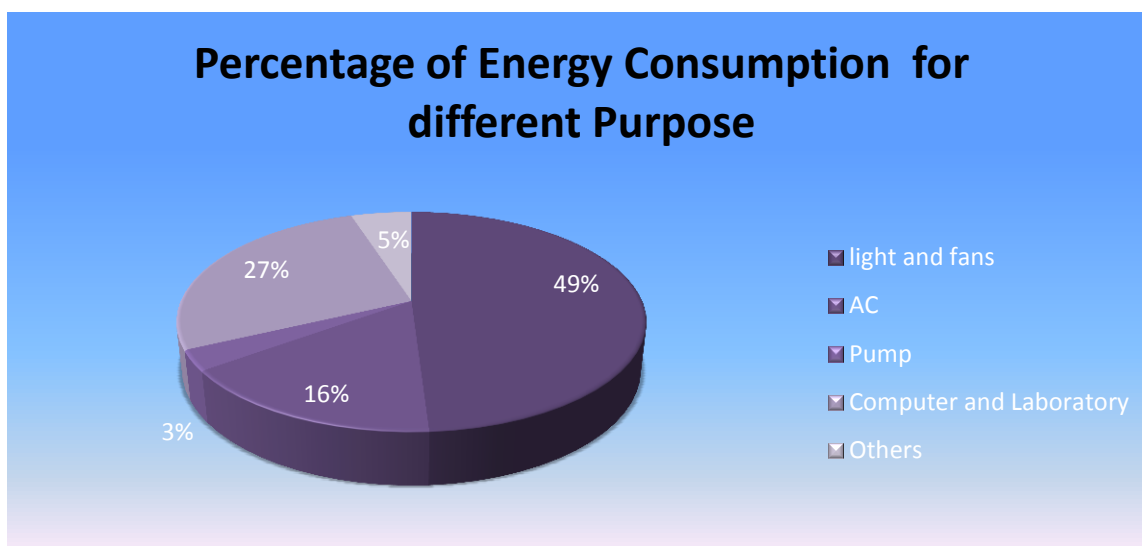


Fig. : Percentage of Energy Consumption in different Purpose

b. Energy

- ❖ Electricity Consumption - 43000 Unit, Rs.- 301000/- Per Year
- ❖ Fossil fuel consumption :

- a. Number of Gas cylinders used for canteen & laboratories purpose - 10 PC /year
- b. Diesel used for green Generator- 60 liter/month
- ❖ Number of Green Generators - 01
- ❖ Cost of fuel for generator purpose – Rs. 5400/month

Energy Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (conventional)	94 %
3	Total consumption of Electric Power	43000 unit
4	The maximum use of conventional Electric Power	94%
5	Maximum energy consumption in the purpose	Light and fans - 25370 Unit/year
6	Energy Consumption in Computer & Lab.	6450 unit /year
7	No. of LPG Gas cylinder for cooking & Laboratories purpose	10PC/ Year
9	Amount of diesel used for green generator	420 liter/Year

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

LEVEL OF CO ₂ IN DIFFERENT PLACES	
Places	Dimension (ppm)
Principal Chamber	440
Office	430
Physics Lab	410
Botany Lab	415
Geography Lab	410
Computer Lab	430
Central Library	420
Seminar Hall	410
Boy's Hostel	420
Girls Hostel	430
Tribal Hostel	420
B.P.Ed Hostel	420
Cycle Stand	410
Canteen	420
Gymnasium	430
Staff Room	420

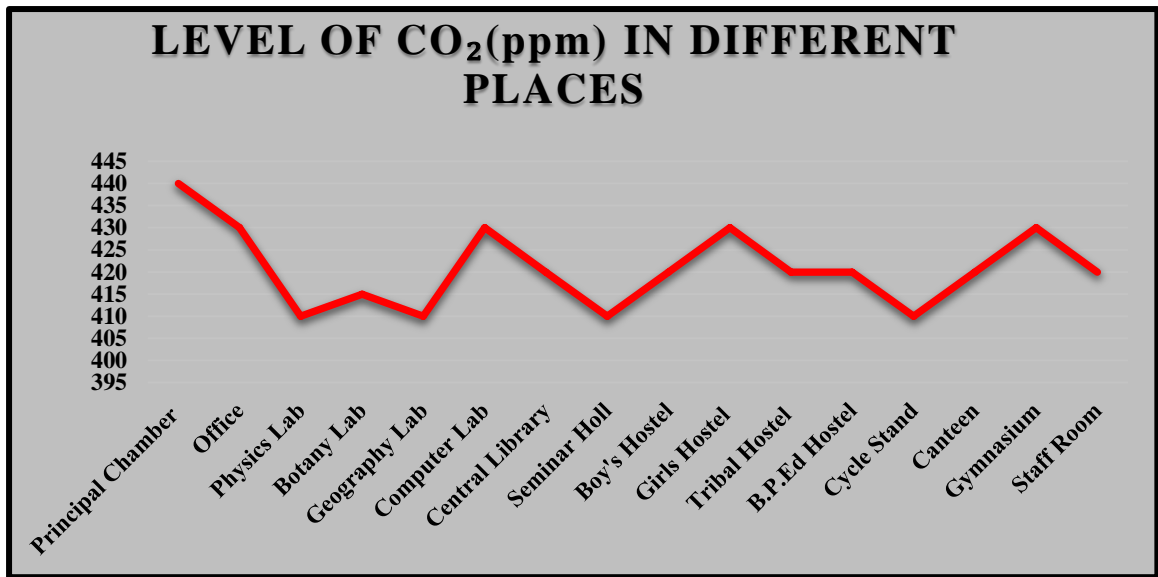
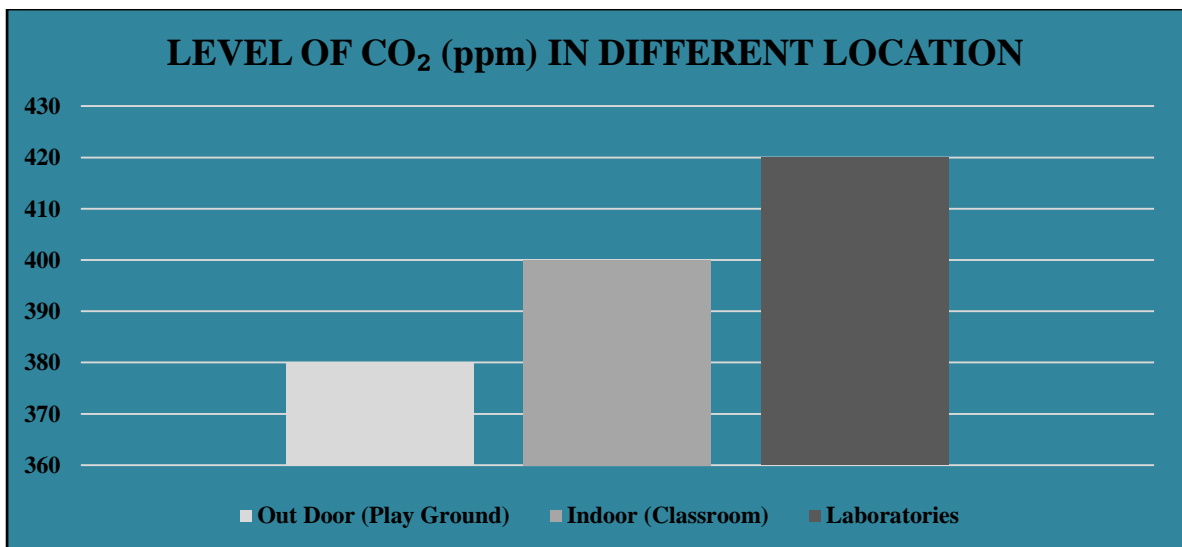


Fig. Amount of CO₂ (ppm) in Different Location of the College Premises

Table-5 Amount of CO₂ (ppm) in the air in different location,(College Campus) session 2022-2023

LEVEL OF CO ₂ IN DIFFERENT LOCATION (ppm)	
Location	Amount of CO ₂ (ppm)
Out Door (Play Ground)	380
Indoor (Classroom)	400
Laboratories	420



CHAPTER : 4.0 POST AUDIT STAGE

4.1 Data analysis and Assessment

Energy Audit and Assessment

Energy Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (conventional)	94 %
2	Source of Energy(Nonconventional)	06
3	Total consumption of Electric Power	43000 unit
4	The maximum use of conventional Electric Power	94%
5	Maximum energy consumption in the purpose	Light and fans - 25370 Unit/year
6	Energy Consumption in Computer & Lab.	6450 unit /year
7	No. of LPG Gas cylinder for cooking & Laboratories purpose	10PC/ Year
9	Amount of diesel used for green generator	420 liter/Year

4.2 Results and Findings

Power Consumption in different sectors:

ENERGY CONSUMPTION IN DIFFERENT SECTORS	
Use of Sectors	Energy Consumption in Percentage (%)
Administrative Office	13
Computer Lab	12
Central Library	8
Laboratories	7
Hostel	39
Class Room	11
Pumps	6
Others	4

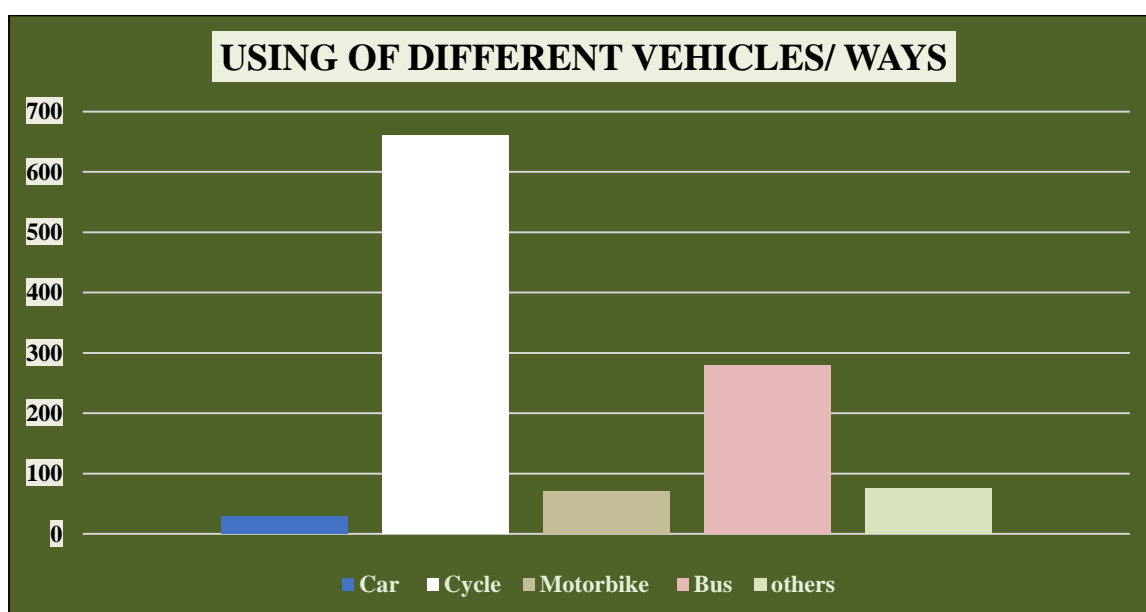
4.3. Energy Cost:

Energy

- ❖ Electricity Consumption - 43000 Unit, Rs.- 301000/- Per Year
- ❖ Fossil fuel consumption :
 - c. Number of Gas cylinders used for canteen & laboratories purpose - 10 PC /year
 - d. Diesel used for green Generator- 60 liter/month
- ❖ Number of Green Generators - 01

- ❖ Cost of fuel for generator purpose – Rs. 5400/month
- ❖ Cost of Wooden Fuel for cooking- Rs. 49500/ Month

USING OF DIFFERENT VEHICLES/ WAYS	
Types of Vehicles	Number of Vehicles
Car	30
Cycle	660
Motorbike	70
Bus	280
others	75



USE OF ENERGY (Electricity) IN DIFFERENT PURPOSE		
Use of Purpose	Use Energy in Percentage (%)	Use Energy (Unit)
Light & Fan	59	25370
Computer	15	6450
Street Lihgt	12	5160
Pump	6	2580
Others	8	3440

Routine of Energy save Practices

- World Environment Day – June 5,
- Non AC Campus
- Ozone Day – September 16
- Awareness seminars are organized on various environmental problems.

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

Energy Audit

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

4.4 Energy Conservation Proposals :

Providing Energy Saver Circuit to the Wooden Fuel: The energy saver circuits for the cooking purpose of the hostels, replace and change the fuel items in the hostels is very essential part of the energy audit. . We have observed that the high emission point of CO₂ & CO and maximum source of GHGs have been centered at the cooking place in college premises. It is hot spot of Carbon foot print. Other hand, the cost of fuel for this type of energy is about Rs.49500 per month which annual cost of the fuel is about Rs. 495000. It is recommended that the source of energy is being changed with new energy efficient fuel system for cooking. Considering the average saving the cost:

Proposal for Wooden Fuel to save of energy cost:

Kg /month /required of wooden fuel for cooking purpose (11, 000kg x Rs. 4.5)=Rs.. 495000/ Month.

Consumed of yearly wooden fuel = 1100 Quintal /year for cooking purpose which cost is about Rs. 4,95,000/

- Considering the change of system and will be converted to LPG Gas, the save of cost for fuel energy which is about Rs. 145350/
- Yearly savings = Rs.145350/year from Fuel energy.

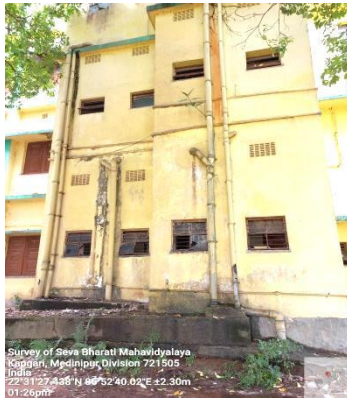
Conclusion and Recommendations

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.

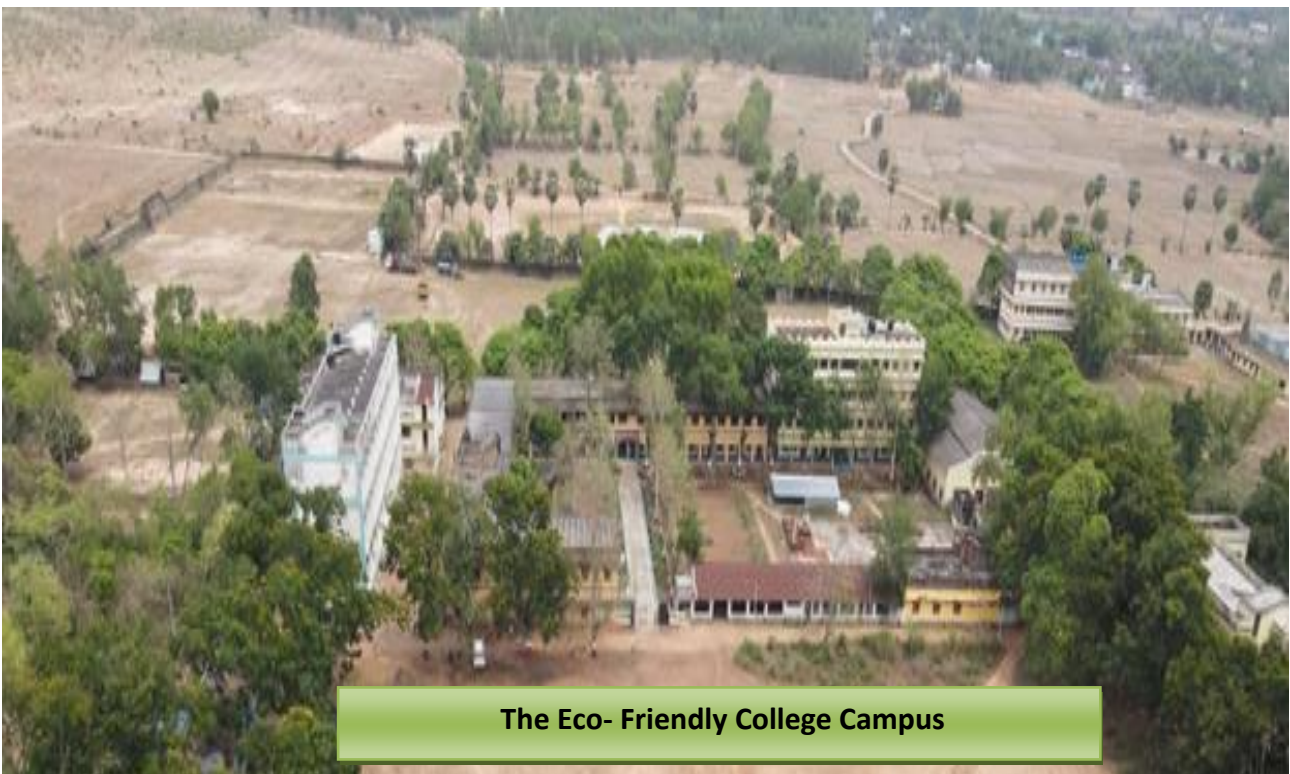
Recommendations for Energy Saving

- ✓ 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:-

TIEER and CMS are thankful to the Honorable Principal and IQAC of the Seva Bharati Mahavidyalaya at Jhargram 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.



The Eco- Friendly College Campus

