ENERGY AUDIT

(2022-2023)

GOVERNMENT GENERAL DEGREE COLLEGE, GOPIBALLAVPUR-II, BELIABERAH , WEST BENGAL

CONSULTRAIN MANAGEMENT SERVICES,
LAKE ROAD, KOLKATA

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

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

Academic Year: 2022-2023

This is to certify that Government General Degree College, Gopiballavpur –II, Beliaberah, 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

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 Tripathi**	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.	**Ms. Subhangi Duttagupta**	Assistant Researcher , M.Sc Molecular Biology and Human Genetics	Environmental Molecular Aspect
10.	**Sri Sarat Chatterjee**	Surveyor & Assistant Researcher	Water and Air Quality Measurement
11.	**Sri Sanjib Mahata**	Surveyor & Expert in RS &GIS	Map Designer

Front view of the College Campus

CONTENTS :

Chapter No.	Title	Page No.
1.0	INTRODUCTION	6-7
1.1	Objectives and views of Energy Auditing	
1.2	Advantage of Energy Audit	
2..0	Methodology and Survey Schedules	8-10
3.0	AUDIT STAGE	11-14
3.1	Campus Observation and Enquiry	
3.2	Grouping and Strategy	
3.3	Different sources of Energy Enquiry	
3.4	Cost of Energy	
4.0	POST AUDIT STAGE	15-17
4.1	Data analysis and Assessment	
4.2	Result and Findings	
4.3	Energy Cost	
4.4	Energy conservation proposal	
5.0	CONCLUSION & RECOMMENDATIONS	18
	ACKNOWLEDGEMENTS	19

CHAPTER-1

1.0 INTRODUCTION


Meeting with Hon'ble OIC

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 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 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	**23**
Playground and Fallow land	30
Vegetation Cover	47

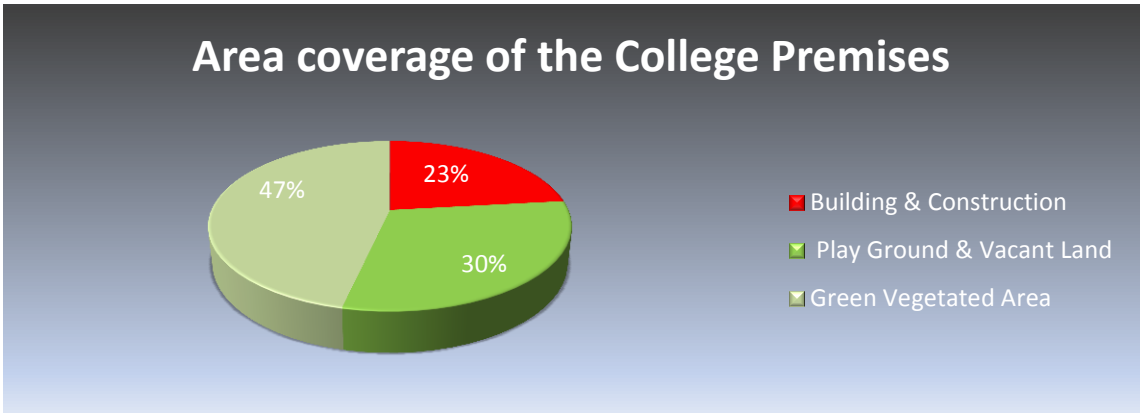
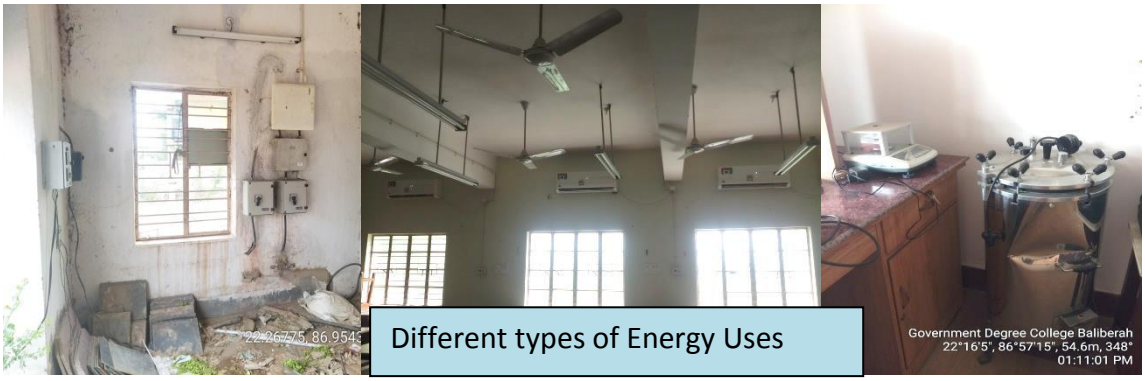


Fig. 1 Area Coverage of College Premises

Different Building and Sectors:

Building and Sectors	
Administrative Buildings	**Library**
	Gymnasium
	Seminar Hall, Digital class rooms/ smart classroom

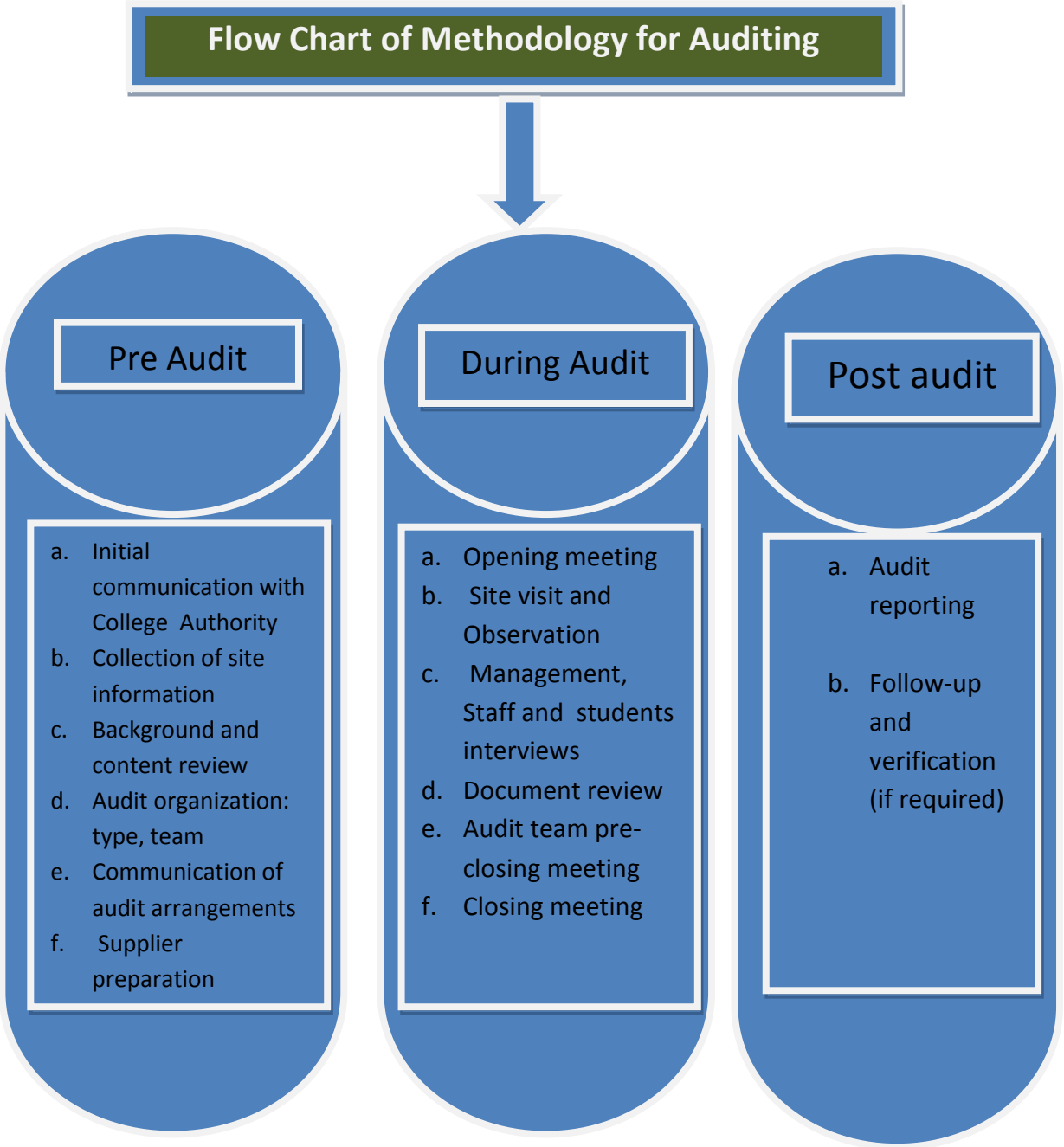


Different types of Energy Uses

CHAPTER – 2

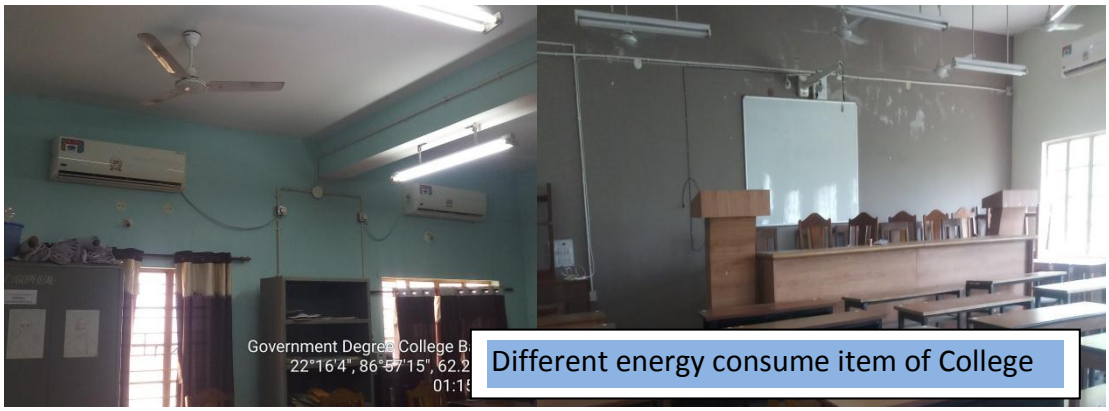
Methodology and Survey Schedules

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.



Different energy consume 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 GHGs
5. Energy Efficiency and Energy Management

3.2 Grouping and Strategy

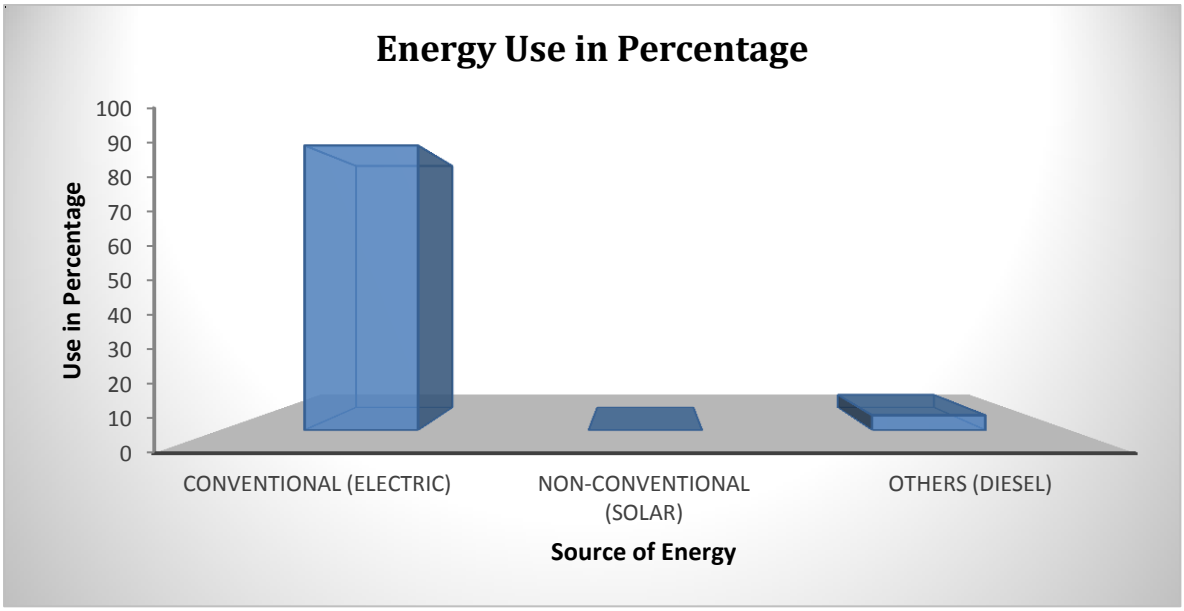
The following groups were formed with specific target areas and end users assigned.
Group 1: Lighting and fans in Main building and Library
Group 2: Lighting and fans in Departments (all departments, offices, class rooms and labs)
Group 3: Lighting common area – Covering Street lights, corridors, grounds
Group 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 - 22722 Unit, Rs.- 224904/- Per Year
- Fossil fuel consumption per Year:
  Diesel used for green Generator- 50 liter
- Number of Green Generators - 01
- Cost of fuel for generator – Rs. 4500 /month

Table2. Source of Energy in Percentage:

Source of energy	In Percentage
Conventional (Electric)	95
Non-conventional (Solar)	0
Others (Diesel)	5



Using the Conventional Energy

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 & Fan	**39**
Ac	14
Computer	23
Street Light	13
Pump	3
Others	8

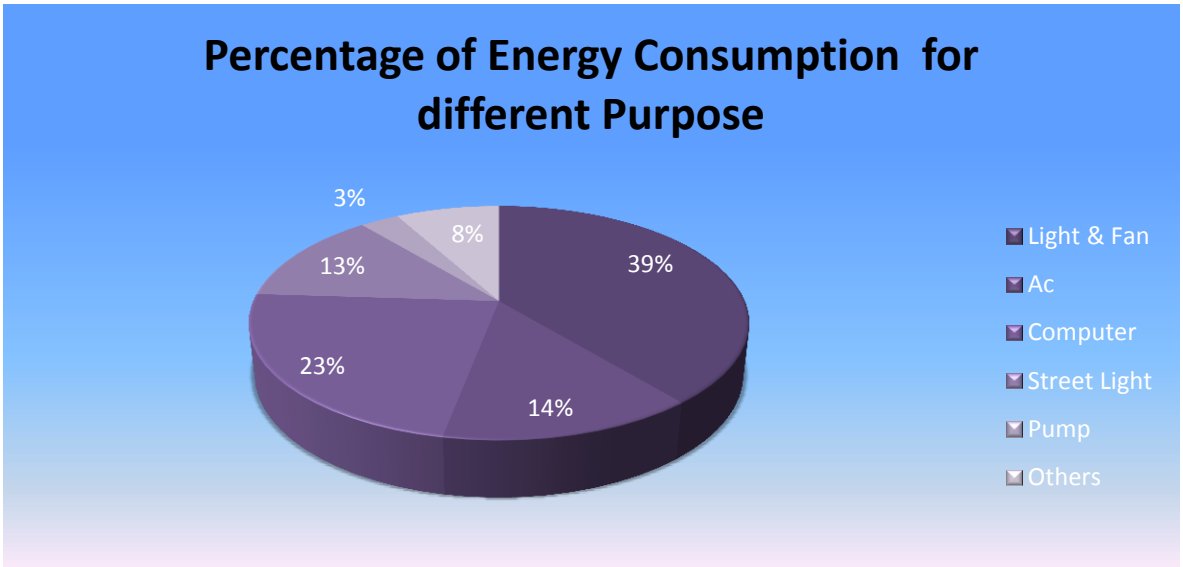


Fig. : Percentage of Energy Consumption in different Purpose

3.4 Cost of Energy :

❖ Electricity Consumption - 22722 Unit, Rs.- 224904/- Per Year

❖ Fossil fuel consumption per Year: Diesel used for green Generator- 50 liter

❖ Number of Green Generators - 01

❖ Cost of fuel for generator – Rs. 4500 /month

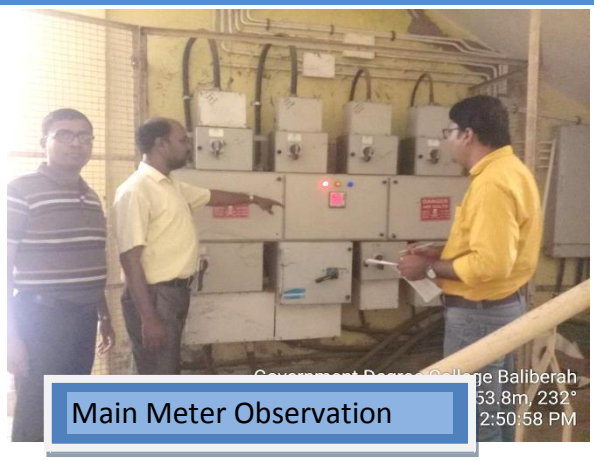


Table-4 Amount of CO_2 (ppm) in different location of the College Campus

Different location of the College Premises	Amount of CO2 (ppm)
Principal Chamber	463
Office	420
Physics Lab	430
Mathematics Lab	420
Anthropology lab	445
Geology Lab	407
Class room	400
Central Library	470
Conference Hall	430
Computer lab	520
Main gate	380

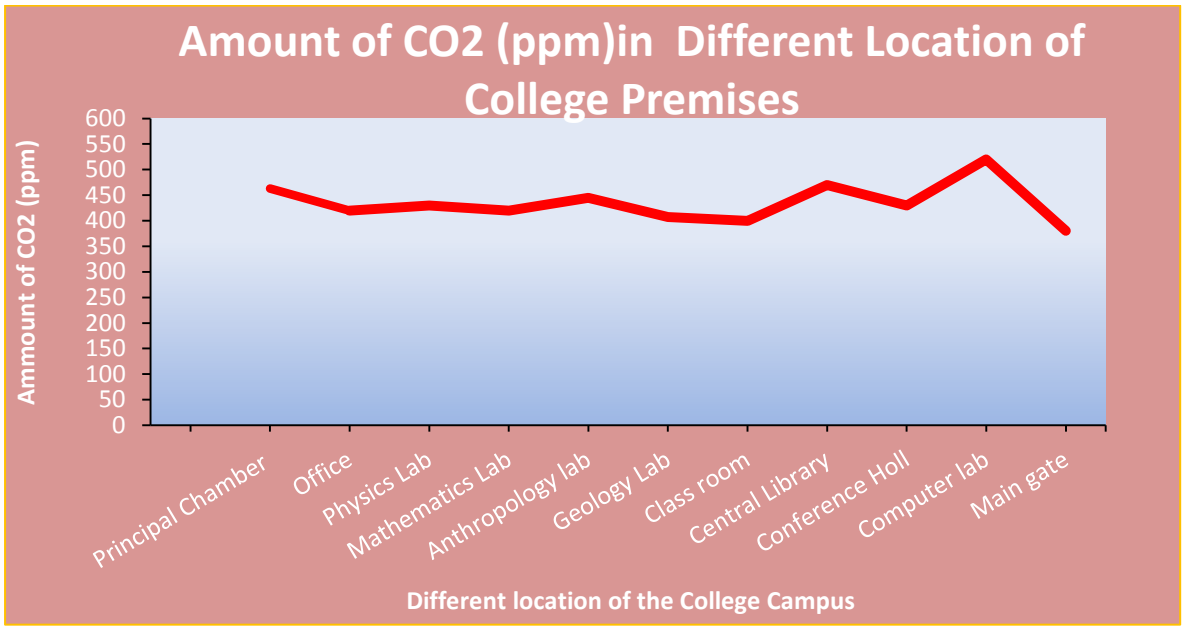


Fig. Amount of CO2 (ppm)in Different Location of the College Premises

Table-5 Amount of CO_2 (ppm) in the air in different location,(College Campus) session 2022-2023

Different Location of the College Campus	Amount ofCO_2 (ppm)
Outdoor	390
Indoor (Class room)	410
Indoor (Laboratories)	430

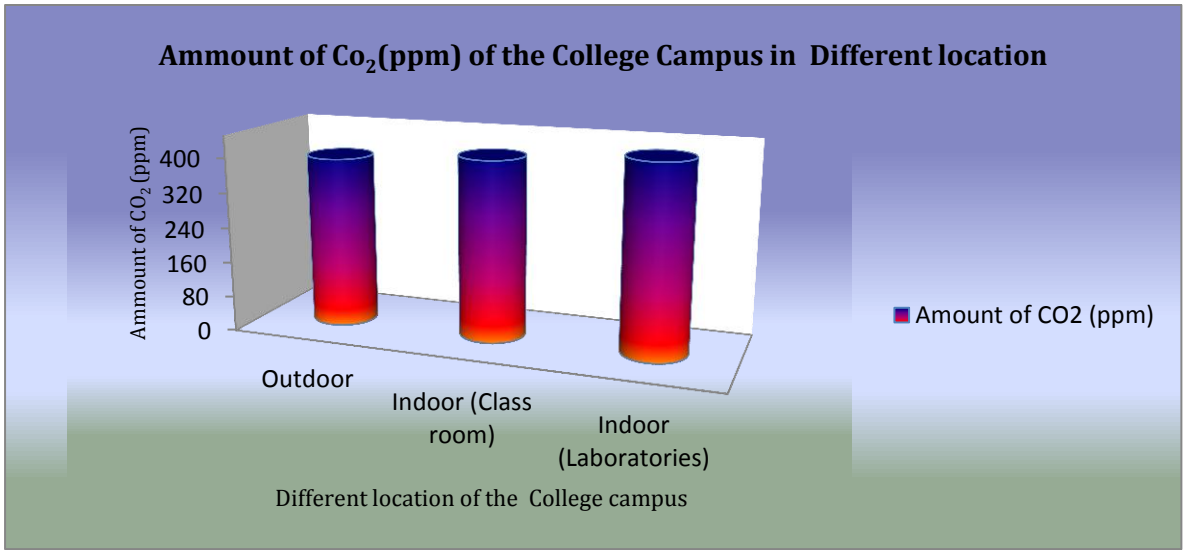


Fig. Amount of CO_2(ppm) of the Air in Different location of the College Premises

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	22722unit
3	The maximum use of conventional Electric Power	22722 unit
4	Maximum energy consumption in the purpose	Light and fans - 8861 Unit/year
5	Energy Consumption in Computer & Lab.	3181unit /year
6	Amount of diesel used for green generator	50 liter/Year
7	No. of AC use of energy	3181unit/year

4.2 Results and Findings

Power Consumption in different sectors:

Sl.no	Use of Sectors	Energy Consumption in Percentage (%)
1.	Administrative Office	16
2.	Computer Lab	17
3.	Central Library	7
4.	Laboratories	13
5.	Street light	17
6.	Class Room	21
7.	Pumps	2
8.	Others	7

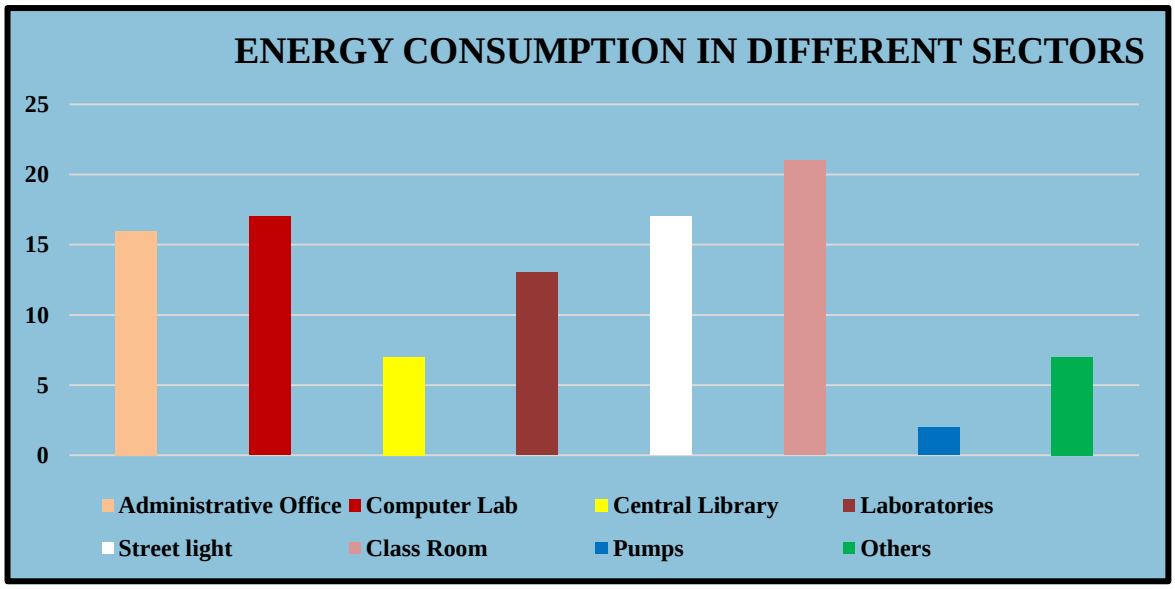


Fig. Power Consumption in different sectors of the College Premises

4.3. Energy Cost:

- Electricity Consumption - 22722 Unit, Rs.- 224904/- Per Year
- Fossil fuel consumption per Year:
  Diesel used for green Generator- 50 liter
- Number of Green Generators - 01
- Cost of fuel generator – Rs. 4500 /month

Table 6. Expenditure cost of uses energy

Source of Energy	Energy of Percentage (%)
Conventional (Electric)	95
Non-conventional (Solar)	0
Others (Diesel)	5

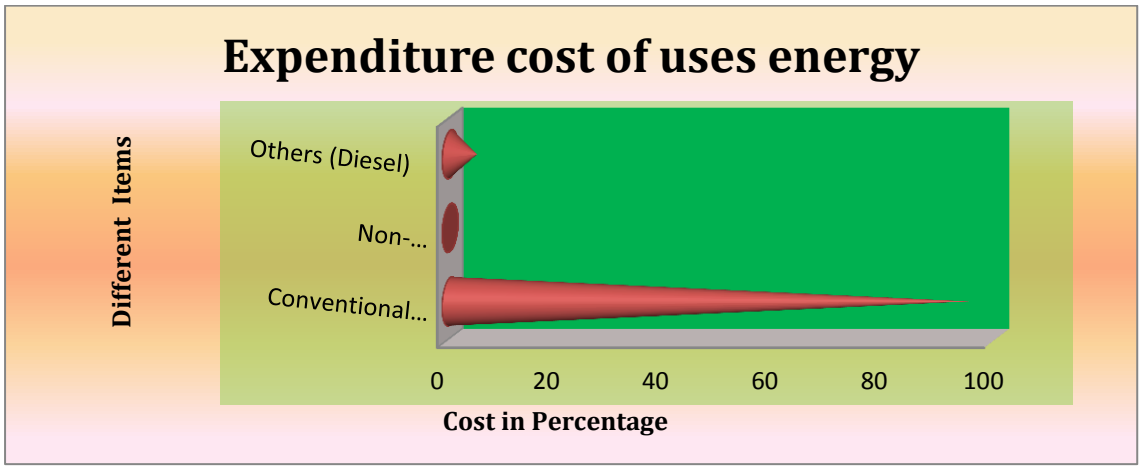


Fig. Expenditure cost of uses energy

Energy consumption in different purpose , 2022-23		
Sl. No.	**Use of Purpose**	**Use of Energy (Unit)**
1.	Light & Fan	8862
2.	Ac	3181
3.	Computer	5226
4.	Street Light	2954
5.	Pump	682
6.	Others	1818

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 = 3181unit/year for air conditioner
- Considering a saving of 15%,totel annual savings = 15% x 3181 unit
  477.15 unit/year for air conditioners, cost of electricity = Rs.4719.01/-
- Yearly savings = Rs.4719.01/year from air conditioners

Conclusion and Recommendations

General 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

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.

Audit Team with Staff

Acknowledgements:-

TIEER and CMS are thankful to the Honorable Principal and IQAC of the Government General Degree College , Gopiballavpur-II, Jhargram WB 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.

GREEN AND ENVIRONMENTAL AUDIT REPORT
(2022-2023)

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ACKNOWLEDGEMENT

We, The Environment Audit Team thank the management of Government General Degree College, Gopiballavpur-II for assigning us such an important work on Green & Environmental 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/ OIC of the College
- ❖ IQAC Members
- ❖ Teaching & supporting staff

AUDIT EXPERT MEMBERS

The Committee members are listed below:

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4.	**Dr. Pijush Kanti Tripathi**	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
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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.	**Ms. Subhangi Duttagupta**	Assistant Researcher , M.Sc Molecular Biology and Human Genetics	Environmental Molecular Aspect
10.	**Sri Sarat Chatterjee**	Surveyor & Assistant Researcher	Water and Air Quality Measurement
11.	**Sri Sanjib Mahata**	Surveyor & Expert in RS &GIS	Map Designer

CONTENTS

Chapter No.	Title	Page No.
1.0	INTRODUCTION	7-10
1.1	Goals & Objectives	
1.2	About the College	
1.3	Purpose of Green and Environmental Auditing	
2.0	PRE –AUDIT STAGE	11-12
2.1	Methodology and Survey Schedules	
2.2	Site Visit	
2.3	Survey & Data Collection	
3.0	AUDIT STAGE	13-33
3.1	Campus Survey and Enquiry	
3.2	Water Efficiency and Water Management	
3.3	Energy Efficiency and Energy Management	
3.4	Air Quality and Carbon Footprints	
3.5	Generation of Waste and Waste Management	
3.6	Auditing for Biodiversity & Green Campus Management	
3.7	Reviews of Documents and Records	
3.8	Review of Policies	
3.9	Interviews	
4.0	POST AUDIT STAGE	34-40
4.1	Data analysis and Assessment	
4.2	Result and Findings	
4.3	Summary	
4.4	Environmental Education	
4.5	Common Recommendations	
4.6	Criteria Wise Recommendations	
	EXECUTIVE SUMMARY	41-42

1.0 INTRODUCTION:

The term 'Green' stands for Resource balance, Quality environment, Recycled products and Ecofriendly environment. Green and environmental Audit is a process of systematic, documented, periodic and objective evaluation of components of environmental diversity with the aim of ensuring readiness in eco-friendly environment and conservation of natural resources in its operations. The process starts with systematic identification, quantification, recording, reporting and analysis of components of environmental diversity of the college. Green auditing is a means of assessing environmental performance. Green audit is a valuable means for a College to determine how and where they are using the most energy or water or other resources; the College can then consider how to implement changes and make savings. It can create healthy consciousness and promotes environmental awareness, values and ethics.

1.1 Goals & Objectives:

It aims to analysis environments within and outside of the concerned area, which will have an impact on the eco-friendly atmosphere. It provides staff and students better understanding of Resource management on their area of work.

The Main Objectives of Carrying out of Green and Environment Audit:

- To ensure the performance of the Institution with respect to environmental activities they are involved in, in compliance with existing laws and regulations
- To locate the Green area and the Geographical location of the College – aerial view
- To document the floral and faunal diversity of the College
- To develop and follow the waste management system
- To reduce the energy consumption of the Institution
- To report the expenditure on green initiatives, carbon foot print
- To record the air, water quality of the Institution
- To conserve the natural resources

Areas of Concern:

- WATER MANAGEMENT
- ENERGY MANAGEMENT
- AIR QUALITY AND CARBON FOOTPRINT
- WASTE MANAGEMENT
- E-WASTE MANAGEMENT
- BIODIVERSITY

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 and statutory requirements of Centre as well State. The basic data was gathered and compiled, which the committee analyzed. By and large, the audit reveals a healthy environment inside of the Government General Degree College at Gopiballavpur-II campus. The committee has suggested short term as well as long-term suggestions for improved environmental conditions to a higher level and authorities and all stakeholders of the College

Meeting with Hon'ble OIC & IQAC Team

conform that they will give due attention and utilize opportunities for identified improvements.

1.2 About the College :

Government General Degree College, Gopiballavpur-II. An appreciable approach of State Government is to decentralize higher education and enrich the thoughts & minds of the students of Junglemahal. This Govt. General Degree College has just started its journey in the year 2015 and is affiliated to Vidyasagar University, Midnapore . It started its academic function from the session 2015-16 with 5 Honours Departments Bengali, English, Sociology, Anthropology, Geology. This College is proud of having qualified, dedicated faculty members, Office staffs and the securities. All the staffs are always engaged themselves motivating & inspiring students to build up their capacity in various desirable sections. Healthy ambience of this College campus maintained by the stakeholders is our best policy to achieve excellence not only in Teaching - Learning but also in other co-curricular fields. We are determined to make this Institution a center of excellence. I am proud to be in - charge of this Institution and

getting support from parents and local peoples. This Institution is going to be the destination of many poor, young talented minds in near future, I believe.

I would like to thank Higher Education Departments, Govt. of West Bengal and our stakeholders for unwavering commitment and their impeccable support. This has been a precursor in allowing us to raise our ladder to the next level and as well enabled us to realize our new thrust. It is our collective pleasure to invite our partners in government, industry and the community to engage with us in realizing our vision of "Aim high, Shoot high!". When you shoot, always aim for the moon so that if you miss this big target, at least your bullet will settle for one of the many stars. Remember a journey of a thousand miles starts with a single step. Let us walk this journey side by side with each other until we help you realize your career aspirations.

Table 1 Area Coverage of the College Campus

Area Coverage of College Premises:	Area in Percentage
Building & Construction	23
Play Ground & Vacant Land	30
Green Vegetated Area	47

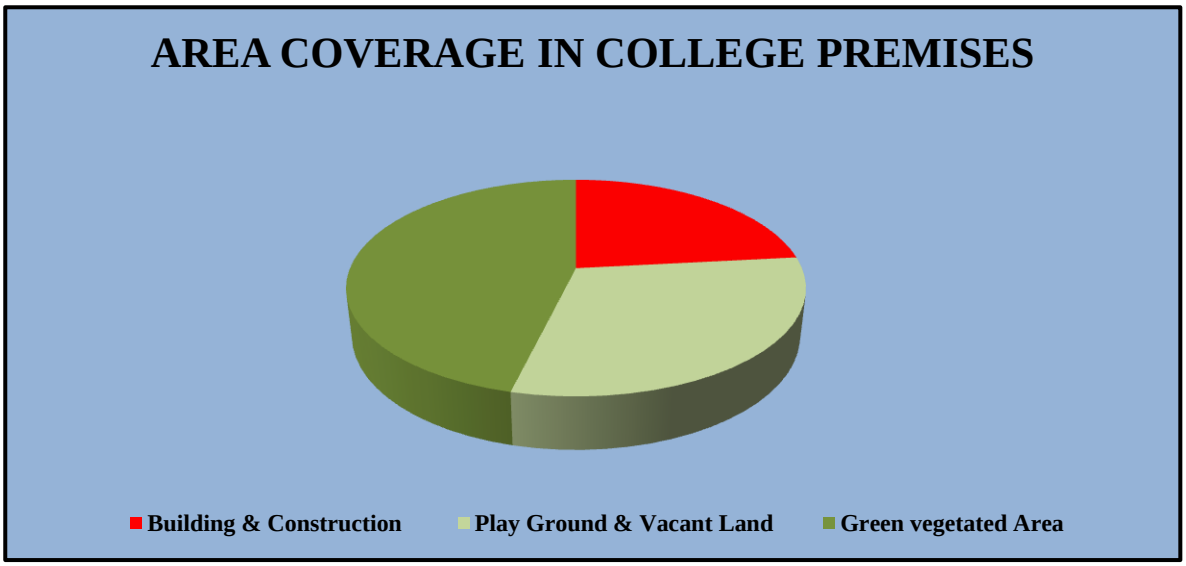


Fig. 1 Area Coverage of College Premises

General Information:

Total area of the college campus – 4.33 acre

Building area: 1.01 acres,

Green & Vegetated area: 2 acres.

Play Ground & Vacant land area: 1.32 acre

Departments: 9 (UG Departments)

Laboratories: 5

Students: 366 nos. approx.

Teaching & Non-teaching staff: 24 (Including Officer-in-Charge) + 07

Others stakeholder: 07 (Security Sweeper & Canteen staff)

Total Stake holders: 404

Auditorium /Seminar hall: 01

Digital class rooms/ smart classroom: 02

Gymnasium Hall: 01

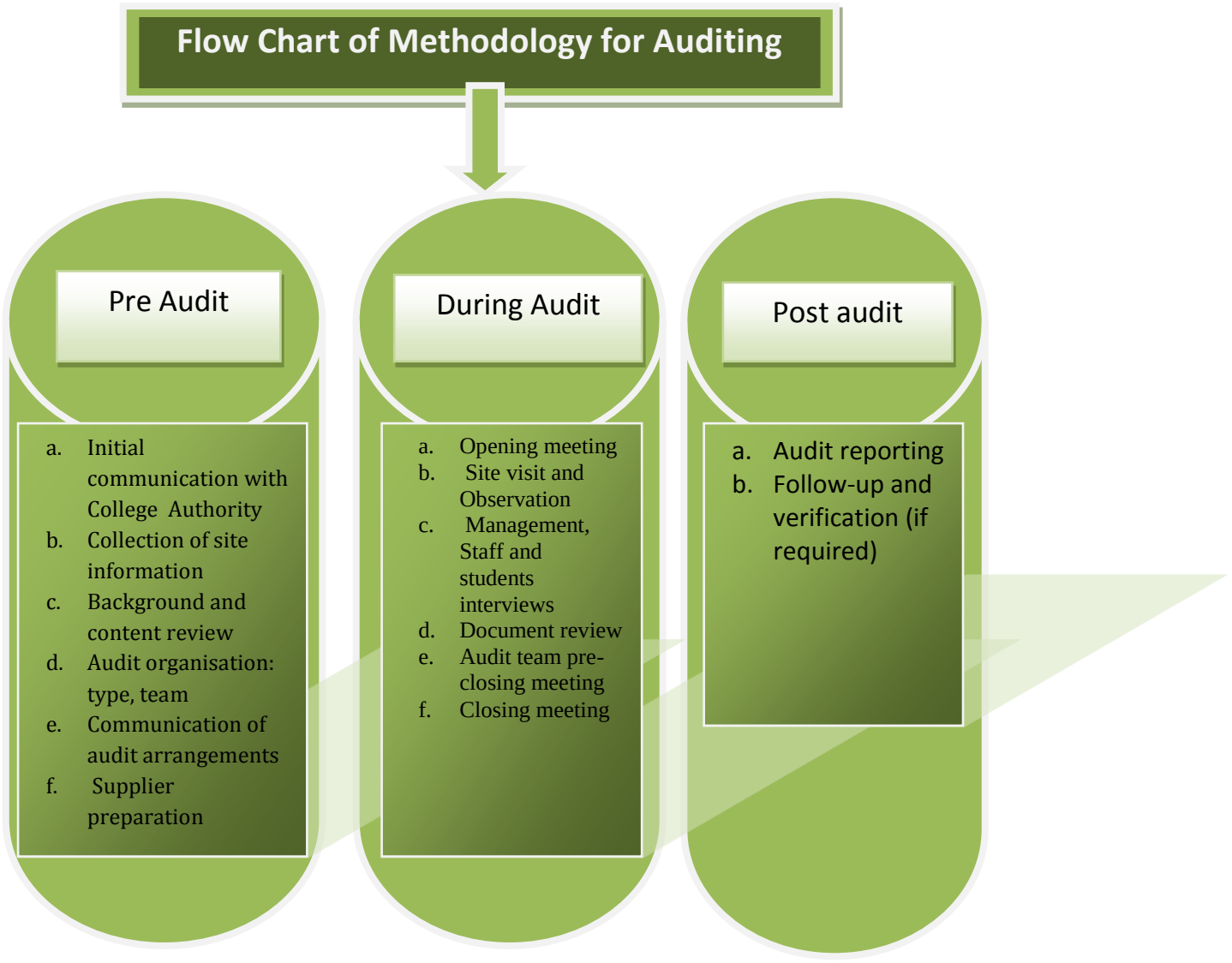
1.3 Purpose of Green and Environmental Auditing:

- To develop to more efficient resource management
- To provide basis for improved sustainability
- To create a green campus
- To enable waste management through reduction of waste generation, solid- waste and water recycling
- To promote plastic free campus and evolve health consciousness among the stakeholders
- To recognize the cost saving methods through waste minimizing and managing
- To empower the organizations to frame a better environmental performance
- To develop an environmental ethics and values systems in youngsters.
- To establish valuable tools and methods for managing and monitoring of environmental and sustainable development programs.

2.0 PRE-AUDIT STAGE:

2.1 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 survey are also included in the Auditing Report.



2.2 Site Visit:

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

Ecofriendly College premises

Following steps were taken for data collection:

- Survey to each department, Laboratories, Library, etc.
- Data collected by observation and interview.
- Assessment of the environmental condition through measurement

2.3 Survey & Data Collection:

- A Questionnaire was developed covering all aspects of Green and Environment aspects for collection of data.
- Arrangement of Drone survey was made available to cover every corner of the college and its neighborhood areas.
- Data Analysis - Calculation of energy consumption, analysis of water reused, waste generation & disposal arrangements.
- Recommendation — On the basis of results of data analysis and observations, some steps for reducing power consumption, water consumption, waste management etc. were recommended.

We have discussed and interacted with different groups like teachers, students and staff to identify the attitudes and awareness towards environmental issues at the institutional, district, national and global level. Data and information were also collected form utility bills, reuse of water, waste management, use of energy-saving devices and e-waste. This information was added to the carbon footprint data, generating a fairly clearer picture of the emissions and impact of the reduction measures undertaken.

Campus Survey

3.0 AUDIT STAGE :

3.1 Campus Survey and Enquiry:

Green and Environmental audit forms part of a resource management process. Total area including neighborhoods was surveyed using Drone and the data derived from this survey was detailed in our report.


College Office

Eco-campus concept mainly focuses on the reduction of contribution to emissions, on the efficient use of energy and water; Minimize waste generation or pollution and also economic efficiency. All these indicators are assessed in process of "Green Auditing of educational institute". Covered areas included in this green auditing are water, energy, air quality & carbon footprint, waste, biodiversity campus.

The Audit covered the following major areas:

1. Water Efficiency and Water Management
2. Energy Efficiency and Energy Management
3. Air Quality and Carbon foot print and Management
4. Waste Produce and Waste Management
5. Biodiversity and Green Zone management

Table-2 Total Stakeholders of the College

Students -	366 persons
Teaching, Non-teaching and Other Stakeholders	38 persons
Total	404 persons
Approximate no of visitor (per day)-	**11 persons**

3.2 Water Efficiency and Water Management :

The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water and also proper water management practices along with rooftop rain water harvesting system must be installed in whole campus for

recharging ground water and meeting part of the water requirements. It is therefore essential that any environmentally responsible institution examine its water use and Re-use practices.

a	Usage of water	That water is use for Drinking, Washing, Cleaning, Cooking, Bathing and gardening purpose. The maximum water is use for Bathing and washroom in the college. About 11000Litre water has been supplied for that sector.
b.	Consumption of water	About 17000 Litre water per day
c.	Water wastage	The leakage and misuse of water is about 220 Litre in whole campus. Small drip from a leaky tap, sewage water from pan in toilets and over flow can waste significant amount of water per day.
d.	Rain water harvesting unit	Total no. of harvesting unit are 02

Table-3 Use of water for Different Purpose of College Premises

Use of water for Different Purpose Per Day	Use in Percentage
Drinking Purpose	9
Washroom	44
Cleaning	13
Gardening	26
Others	6
Overflow & Leakage	2

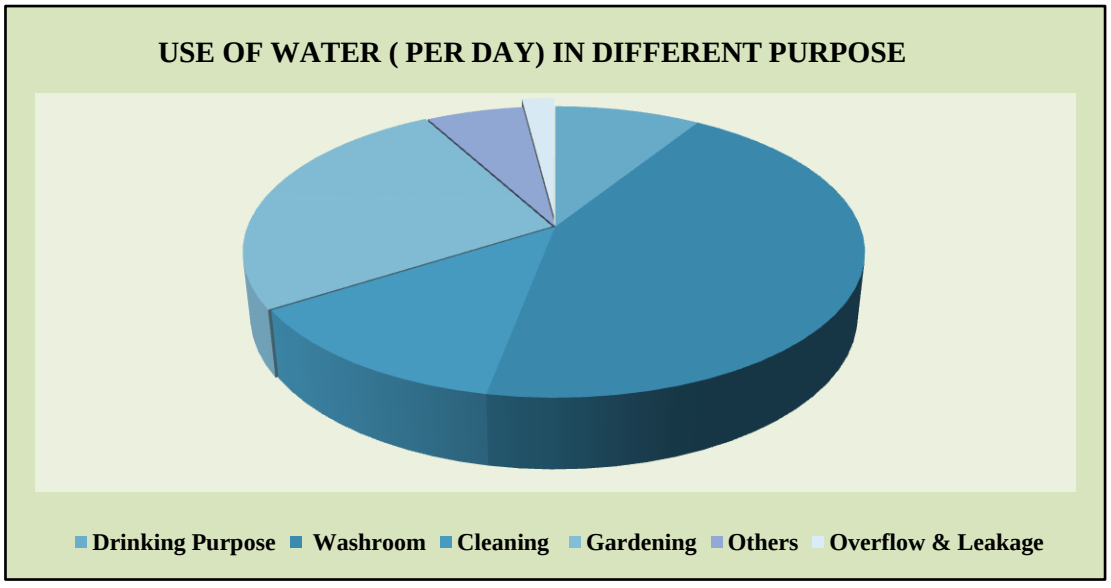


Fig.2 Use of water in Different Purpose Per Day

Taken Water management policy

Sl. No.	Factors	Weightage
1	Quality of Water	H
2	Re-use of water	L
3	Water Harvesting & Recharge	M
4	Use of Surface Water	L

*H Taken management policy level above 60%
** M denote- Taken management policy level 40%-60%
*** L denote-Taken management policy level below 40%

Observation and Recommendation
Water conservation faucets in washrooms were not seen. Installation of such faucets can save water and will help in minimising the water footprint of the institute. Sanitary wastewater generated from washrooms is connected to sewerage system.

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 usable energy is Conventional energy. The used Electricity energy is 22722 units which costing is Rs. 224904/- Per Year. The Maximum energy is consumed for Light & Fan, ACs and Computer Section amounting to 39% of total consumption.

Observing the Electric power unit and Green generator

Table-4 Source of Energy in Percentage

Source of Energy	In Percentage
Conventional (Electric)	95
Non-conventional (Solar)	0
Others (Diesel)	5

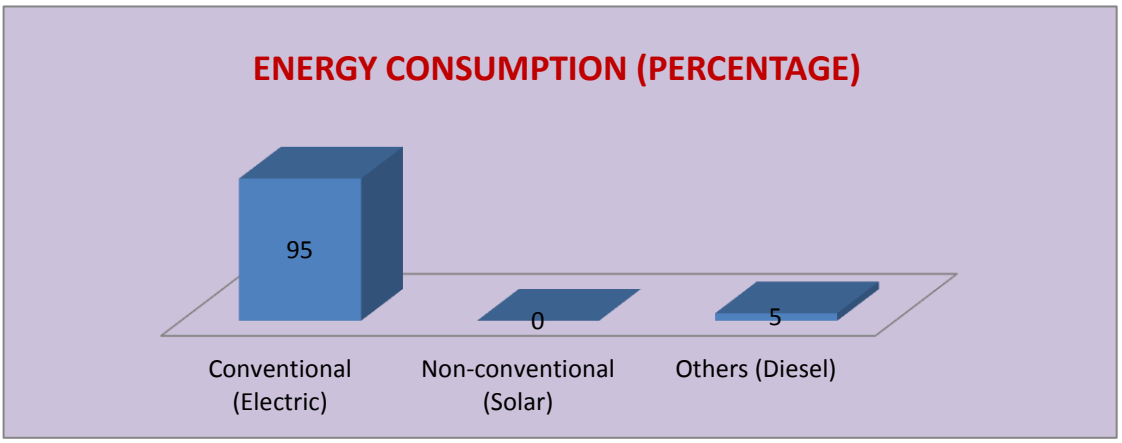


Fig. 3 Use of Energy

Table-5 Energy Consumption for different Purpose in Percentage

Energy Consumption for different Purpose	In Percentage
Light & Fan	39
Ac	14
Computer	23
Street Light	13
Pump	3
Others	8

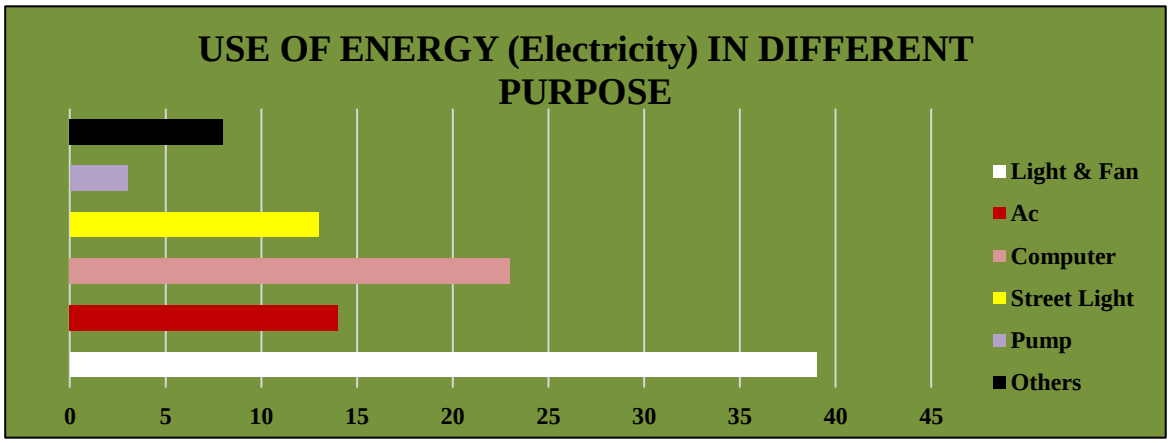


Fig. 4 Percentage of Energy Consumption in different Purpose

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.

3.4 Air Quality and Carbon Footprints :

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol, Diesel, LPG Gas). The most common greenhouse gases are carbon dioxide, CFC, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most

Measurement of Air Quality

leading greenhouse gas, comprising about 214ppm (2022) to the Earth's atmosphere. It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the organization

through which the carbon accounting is done. It is observed that the Outdoor air quality is Fresh and comfortable for breathing to human life.

Table-6 Amount of CO_2 (ppm) in different location of the College Campus

Different location of the College Premises	**Amount of CO_2 (ppm)**
Principal Chamber	463
Office	420
Physics Lab	430
Mathematics Lab	420
Anthropology lab	445
Geology Lab	407
Class room	400
Central Library	470
Conference Hall	430
Computer lab	520
Main gate	380

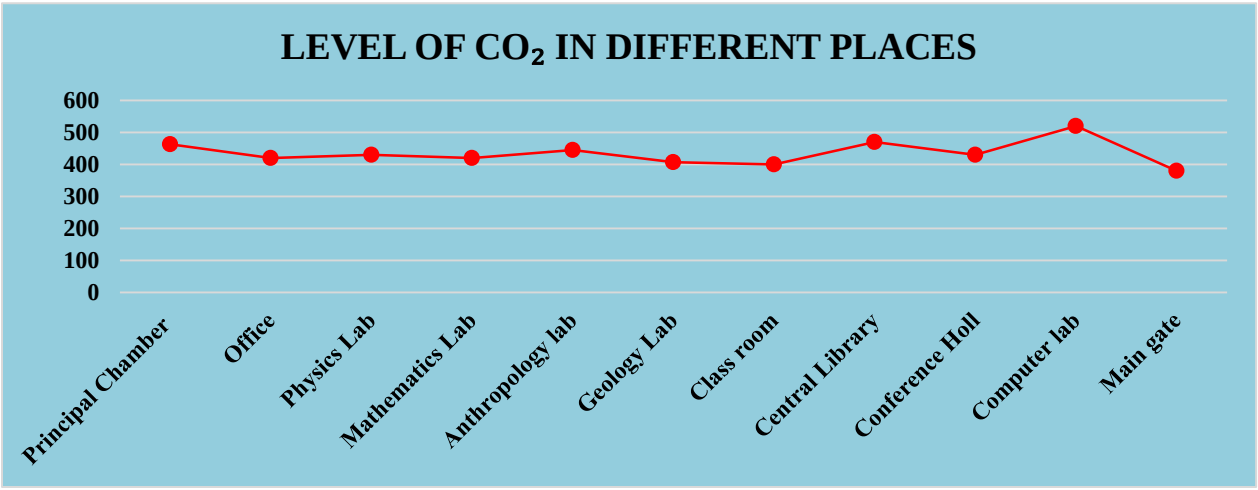


Fig. 5 Amount of CO_2 (ppm) in Different Location of the College Premises

Table-7 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 of CO_2 (ppm)**
Outdoor	390
Indoor (Class room)	410
Indoor (Laboratories)	430

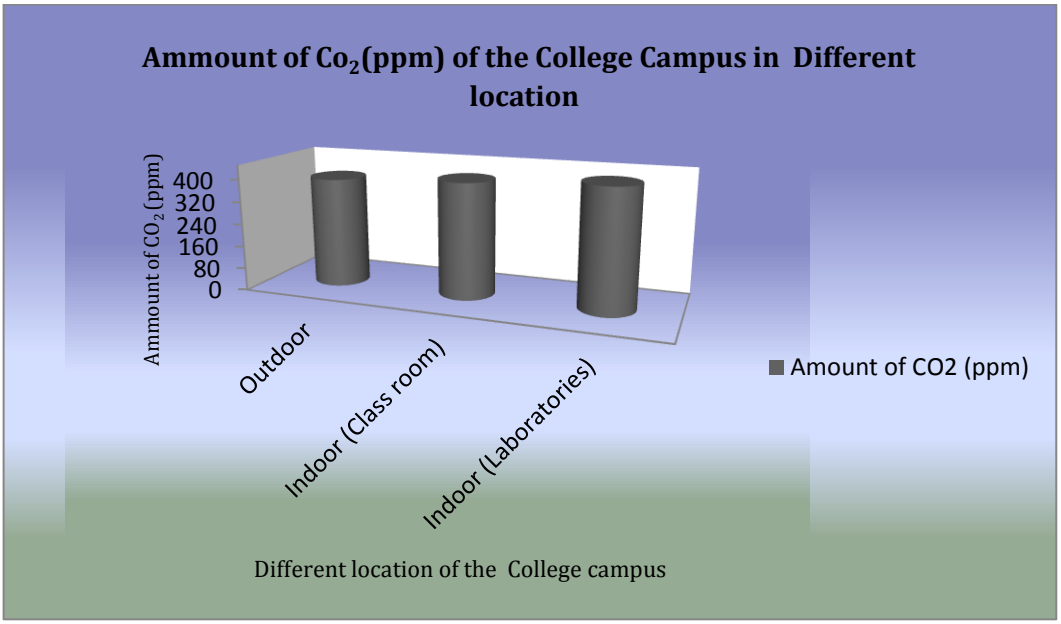


Fig. 6 Amount of CO_2(ppm) of the Air in Different location of the College Premises

Observation and Recommendation:

a) Ventilation is achieved by fans in the institute and air conditioners in Official and Lab. places.
b) Heating Ventilation and Air Conditioning (HVAC) system is not installed.
c) No Exhaust fans in washrooms and chemistry lab.

d) No indoor plants were observed in the entire institute. Indoor plants can be plotted not only for the aesthetic appearance but also for health benefits.

3.5 Generation of Waste and Waste Management:

In modern outlook waste may be a valuable substance subject to an appropriate operation or action on the waste. With the context of waste management RRR (Reduce, Reuse and Recycle) model may be followed in appropriate fashion.

The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible institution examine its waste processing practices. Keeping the objective of the audit the following study will be limited to the waste generated in an academic campus and surroundings.

Table-8 Types of wastes

Type of Wastage	Amount in Kg
Degradable	22
Non degradable	3

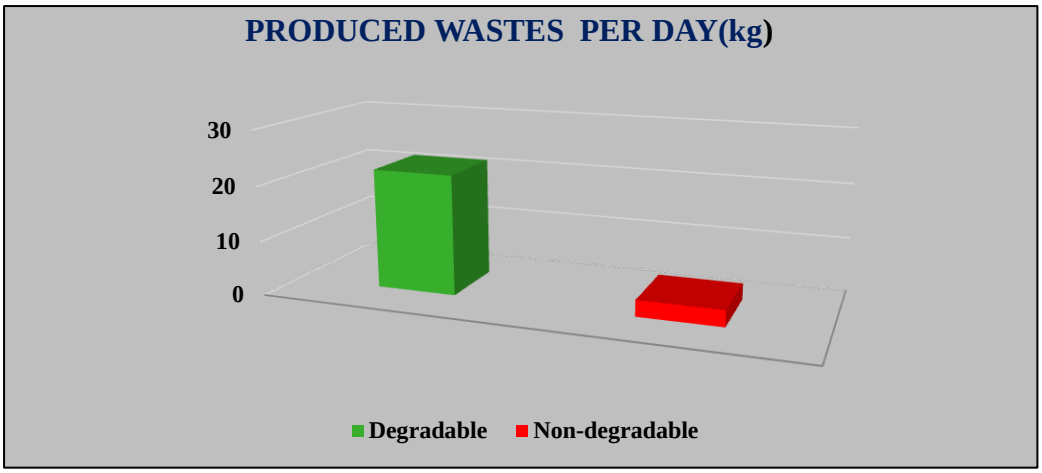


Fig. 7 Type and Amount of Waste

The following categories of wastes are generated in the College campus:

a) Solid waste - Waste generated through paper, plastic packaging causes nuisance. Some wastes are generated after various experiments, primarily, chemistry laboratory; broken test tube, glassware are the example.

Plastic wastes

b) Liquid waste - There are bio-chemical wastes generated through various chemical reactions and biological processes. Generally, these are being drained to nearby Surface water bodies contaminating water and soil. Appropriate means is suggested to adopt scientific liquid waste management practices. These are neutralization, bacterial control, and natural control through plantation.

Different types of Waste management Container

Table-9 Source of Wastage in Different Sector (per day in Kg)

Sectors	Degradable(23kg) in kg	Non-degradable (8kg) in kg
Office	3	2
Department & Class Room	1	0.5
Garden	18	0.5

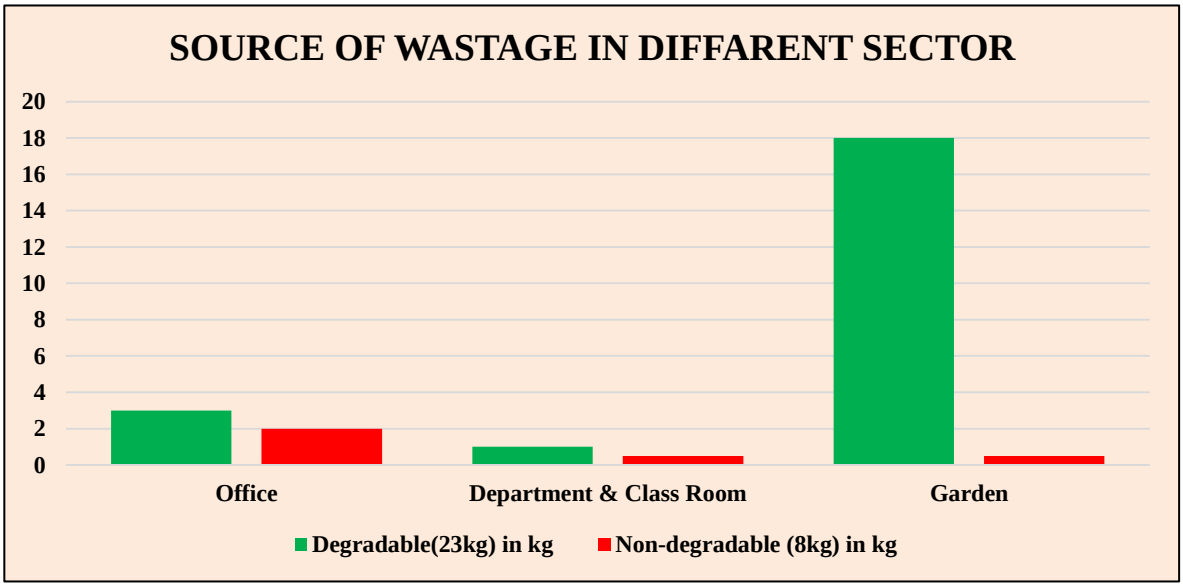


Fig. 8 Source and Amount of Wastage in Different Sector (per day in Kg)

The following are being emphasized during audit of waste management:

a) Name of the waste

b) Category of waste

c) Quantity of waste

d) Hazardous effect of the waste

e) Institutional action and mechanism for waste management

Source of organic waste

Compliance audit of waste issues:

At the present stage the institute is capable in managing their waste. They are complying with the essential requirements of waste management although suggestions are given for future improvements.

Performance Audit of Waste Issues:

Implemented wastes management		
Sl.no	Factors/Indicators	Weightage
1	Plastic and Polythene free	M
2	Re-use of papers	H
3	Hazardous effect waste management	M
4	Removal of E-Wastes	M
5	Organic & food waste	L
6	Others solid wastes	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%

No critical audit issue is there with respect to the waste management.

3.6 Auditing for Biodiversity & Green Campus Management:

Measurement of Trees

Unfortunately, biodiversity is facing serious threats from habitat loss, pollution, over consumption and invasive species. Species are disappearing at an alarming rate and each loss affects nature's delicate balance and our quality of life. In one year, a single mature tree will absorb up to 48 pounds of Carbon dioxide from the atmosphere, and release it as Oxygen. The amount of oxygen that a single tree produces is enough to provide one day's supply of oxygen for people. So while you are busy studying and working on earning those good grades, all the trees on campus are also working hard to make the air cleaner for us. Trees on our campus impact our mental health as well; studies have shown that trees greatly reduce stress, which a huge deal is considering many students are under some amount of stress.

About 65% area is under greenery and biodiversity zone Biodiversity includes the genetic variability and diversity of life forms such as plants, animals, microbes etc. living in a wide range of ecosystems. Flora and fauna of College campus premises is rich.

Biodiversity Study

Sl. No.	Botanical Name	Family	Common Name	Local Name	Remarks
1	*Abroma augustum* (L.) L.f.	Malvaceae	Devil's cotton	Olot kambal	
2	*Acacia auriculiformis* A.Cunn. ex Benth.	Fabaceae	Earleaf acacia	Akashmoni	Planted
3	*Acalypha wilkesiana* Müll.Arg.	Euphorbiaceae	Copperleaf 1. Green, crinkled 2. Red, crinkled 3. Green, flat		Planted, ornamental
4	*Achyranthes aspera* L.	Amaranthaceae	Prickly chaff flower	Apang	

5	*Adina cordifolia* (Roxb.) Brandis	Rubiaceae	Haldu	Karam	
6	*Albizia lebbeck* (L.) Benth.	Fabaceae	Siris tree	Shirish	Planted
7	*Allophylus serratus* (Roxb.) Kurz	Sapindaceae	Toothed-leaf allophylus		
8	*Aloe vera* (L.) Burm.f.	Asphodelaceae	Aloe vera	Gritakumari	Planted
9	*Alternanthera ficoidea* Griseb.	Amaranthaceae	Joseph's coat		
10	*Alternanthera philoxeroides* (Mart.) Griseb.	Amaranthaceae	Alligator weed	Mishti hingcha	
11	*Alternanthera sessilis* (L.) DC.	Amaranthaceae	Sessile joyweed	Sancha	
12	*Alysicarpus vaginalis* (L.) DC.	Fabaceae	Alyce clover		
13	*Amaranthus viridis* L.	Amaranthaceae	Green amaranth	Ban nate	
14	*Areca catechu* L.	Arecaceae	Betel palm	Supari	Planted
15	*Aristolochia indica* L.	Aristolochiaceae	Indian birthwort	Isher mul	
16	*Artocarpus heterophyllus* Lam.	Moraceae	Jack fruit	Kanthal	Planted
17	*Ayapana triplinervis* (Vahl) R.M.King & H.Rob.	Asteraceae	Water hemp	Ayapan	Planted
18	*Azadirachta indica* A.Juss.	Meliaceae	Neem	Nim	
19	*Bergera koenigii* L.	Rutaceae	Curry leaf	Kari-pata	Feral
20	*Boerhavia diffusa* L.	Nyctaginaceae	Red spiderling	Rakta punarnaba	
21	*Bombax ceiba* L.	Malvaceae	Red silk-cotton	Simul	
22	*Bougainvillea glabra* Choisy	Nyctaginaceae	Lesser bougainvillea	Kagaj phul	Planted
23	*Bridelia retusa* (L.) A.Juss.	Phyllanthaceae	Spinous kino tree	Koyesh	
24	*Bulbostylis barbata* (Rottb.) C.B.Clarke	Cyperaceae	Bearded watergrass		
25	*Cajanus scarabaeoides* (L.) Thouars	Fabaceae	Showy pigeonpea	Ban kulthi	
26	*Calotropis gigantea* (L.) Dryand.	Apocynaceae	Crown flower	Akanda	
27	*Carica papaya* L.	Caricaceae	Papaya	Penpe	Planted
28	*Caryota urens* L.	Arecaceae	Fishtail palm		Planted, ornamental
29	*Catharanthus roseus* (L.) G.Don	Apocynaceae	Periwinkle	Nayantara	Planted, ornamental
30	*Causonis trifolia* (L.) Mabb. & J.Wen	Vitaceae	Bush Grape	Amalkuchi	
31	*Cheilocostus speciosus* (J.Konig) C.Specht	Costaceae	Crepe-ginger	Keu	
32	*Chromolaena odorata* (L.) R.M.King & H.Rob.	Asteraceae	Christmas bush		
33	*Chrozophora rottleri* (Geiseler) Spreng.	Euphorbiaceae	Rottler's chrozophora	Ban okra	
34	*Chrysalidocarpus lutescens* H.Wendl.	Arecaceae	Areca palm		Planted, ornamental
35	*Cissus quadrangularis* L.	Vitaceae	Devil's backbone	Harhjorha	Planted
36	*Citrus maxima* (Burm.) Merr.	Rutaceae	Pomelo	Batabi lebu	Planted
37	*Citrus* × *aurantiifolia* (Christm.) Swingle	Rutaceae	Lime	Kagji lebu	Planted
38	*Citrus* × *limon* (L.) Osbeck	Rutaceae	Lemon	Gandharaj lebu	Planted
39	*Cleome viscosa* L.	Cleomaceae	Asian spiderflower	Halud hurhure	
40	*Clerodendrum infortunatum* L.	Lamiaceae	Hill glory bower	Ghentu	

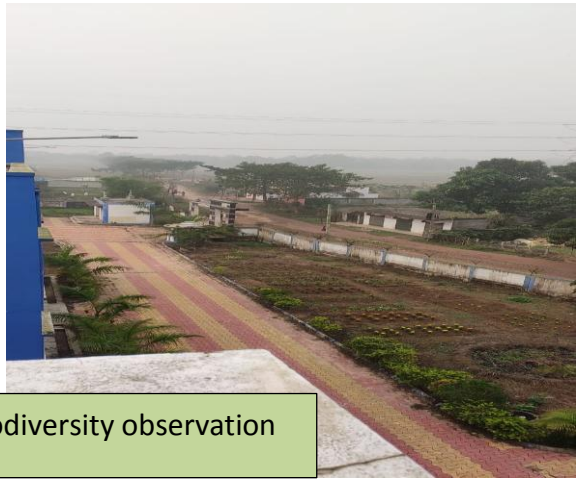
41	*Coccinia grandis* (L.) Voigt	Cucurbitaceae	Ivy gourd	Telakucha	
42	*Cocculus hirsutus* (L.) W.Theob.	Menispermaceae	Broom creeper	Doi-pata	
43	*Cocos nucifera* L.	Arecaceae	Coconut	Narikel	Planted
44	*Codiaeum variegatum* (L.) Rumph. ex A.Juss.	Euphorbiaceae	Garden croton	Patabahar	Planted, ornamental
45	*Coldenia procumbens* L.	Boraginaceae	Creeping coldenia		
46	*Commelina benghalensis* L.	Commelinaceae	Bengal dayflower	Kanshira	
47	*Commelina longifolia* Lam.	Commelinaceae	Long-leaf day flower	Ghora kanshira	
48	*Corchorus olitorius* L.	Malvaceae	Nalta jute	Jhot shak	Wild
49	*Crotalaria pallida* Aiton	Fabaceae	Smooth crotalaria	Ban atasi	
50	*Croton bonplandianus* Baill.	Euphorbiaceae		Man gach	
51	*Cucumis melo* L.	Cucurbitaceae	Wild malon	Ban phuti	
52	*Cyanthillium cinereum* (L.) H.Rob.	Asteraceae	Little ironweed	Kuksim	
53	*Cycas revoluta* Thunb.	Cycadaceae	Sago palm		Planted, ornamental
54	*Cymbopogon flexuosus* (Nees ex Steud.) Will.Watson	Poaceae	East-Indian lemon grass		Planted
55	*Cynodon dactylon* (L.) Pers.	Poaceae	Bermuda grass	Durba	
56	*Cyperus rotundus* L.	Cyperaceae	Nut grass	Muthaghas	
57	*Dalbergia sissoo* Roxb. ex DC.	Fabaceae	Indian rosewood	Shishu	Planted
58	*Delonix regia* (Boj. ex Hook.) Raf.	Fabaceae	Royal poinciana	Radhachura	Planted
59	*Digitaria ciliaris* (Retz.) Koeler	Poaceae	Wild crabgrass		
60	*Diplocyclos palmatus* (L.) C.Jeffrey	Cucurbitaceae	Lollipop climber	Mala	
61	*Echinochloa colonum* (L.) Link	Poaceae	Small barnyard grass	Shyama	
62	*Eragrostis tenella* (L.) P.Beauv. ex Roem. & Schult.	Poaceae	Feather love grass	Shada phulka	
63	*Euphorbia heterophylla* var. *heterophylla*	Euphorbiaceae	Wild poinsettia		
64	*Euphorbia hirta* L.	Euphorbiaceae	Asthma-plant	Barha-karni	
65	*Ficus benghalensis* L.	Moraceae	Banyan tree	Bat	
66	*Ficus hispida* L.f.	Moraceae	Opposite-leaf fig	Dumur	
67	*Ficus racemosa* L.	Moraceae	Cluster fig	Jagga-dumur	
68	*Ficus religiosa* L.	Moraceae	Sacred fig tree	Ashwattha	
69	*Ficus rumphii* Blume	Moraceae	Golden Rumph's fig	Gaya aswatha	
70	*Flacourtia indica* (Burm.f.) Merr.	Convolvulaceae	Governor's plum	Banichi	
71	*Grona triflora* (L.) H.Ohashi & K.Ohashi	Fabaceae	Three-flower beggarweed	Kodalia	
72	*Heliotropium indicum* L.	Boraginaceae	Indian heliotrope	Hatisurh	
73	*Ichnocarpus frutescens* (L.) W.T.Aiton	Apocynaceae	Black creeper	Shyamalata	
74	*Iris domestica* (L.) Goldblatt & Mabb.	Iridaceae	Leopard flower	Dash-bai chandi	Planted, ornamental
75	*Ixora coccinea* L.	Rubiaceae	Jungle flame	Rangan	Planted, ornamental
76	*Jatropha gossypiifolia* L.	Euphorbiaceae	Black physicnut	Lal-bherenda,	

				Lal-gabjarha	
77	*Lannea coromandelica* (Houtt.) Merr.	Anacardiaceae	Indian ash tree	Jiole	
78	*Lantana camara* subsp. *aculeata* (L.) R.W.Sanders	Verbenaceae	Lantana	Saibani	
79	*Leucaena leucocephala* (Lam.) de Wit	Fabaceae	Wildtamarind	Subabul	Planted, self-sown
80	*Leucas aspera* (Willd.) Link	Lamiaceae	Common leucas	Halkusa	
81	*Litsea glutinosa* (Lour.) C.B.Rob.	Lauraceae	Indian laurel	Piplas	
82	*Luffa aegyptiaca* Mill.	Cucurbitaceae	Sponge gourd	Dhundul, Pitapalli	
83	*Magnolia champaca* (L.) Baill. ex Pierre	Magnoliaceae		Champa	Planted, ornamental
84	*Mangifera indica* L.	Anacardiaceae	Mango	Am	Planted
85	*Mecardonia procumbens* (Mill.) Small	Plantaginaceae	Baby jump up		
86	*Melochia corchorifolia* L.	Malvaceae	Chocolate-weed	Ban okra	
87	*Merremia emarginata* (Burm.f.) Hallier f.	Convolvulaceae	Kidney-leaf morning glory	Mushakani	
88	*Mikania micrantha* Kunth	Asteraceae	Climbing hempweed	Raban lata	
89	*Mimosa pudica* L.	Fabaceae	Touch-me-not	Lajjaboti	
90	*Mimusops elengi* L.	Sapotaceae	Spanish cherry	Bakul	Planted, ornamental
91	*Monoon longifolium* (Sonn.) B.Xue & R.M.K.Saunders	Annonaceae	Mast tree	1. Debdaru 2. Rani debdaru	Planted, ornamental
92	*Morinda coreia* Buch.-Ham.	Rubiaceae	Indian mulberry	Aich	
93	*Moringa oleifera* Lam.	Moringaceae	Horse-radish tree	Sajne	Planted
94	*Mucuna pruriens* (L.) DC.	Fabaceae	Cowitch	Alkushi, Negus	
95	*Neolamarckia cadamba* (Roxb.) Bosser	Rubiaceae	Burflower-tree	Kadam	Planted
96	*Ocimum kilimandscharicum* Gürke	Lamiaceae	Camphor basil	Karpur tulsi	Planted
97	*Ocimum tenuiflorum* L.	Lamiaceae	Holy basil	Tulsi	Planted
98	*Oldenlandia corymbosa* L.	Rubiaceae	Diamond flower	Khet-papra	
99	*Oplismenus burmanni* (Retz.) P.Beauv.	Poaceae	Wavy-leaf basket grass	Banspati	
100	*Parthenium hysterophorus* L.	Asteraceae	Carrot grass	Parthenium	
101	*Paspalum scrobiculatum* L.	Poaceae	Creeping paspalum	Kodo	
102	*Passiflora foetida* L.	Passifloraceae	Stinking passionflower	Ban jhumko lata	
103	*Pergularia daemia* subsp. *daemia*	Apocynaceae	Pergularia	Dudhilata	
104	*Phoenix sylvestris* (L.) Roxb.	Arecaceae	Wild date palm	Khejur	
105	*Phyllanthus reticulatus* Poir.	Phyllanthaceae	Black-honey shrub	Jhinjha	
106	*Phyllanthus urinaria* L.	Phyllanthaceae	Common leaf-flower	Bhui-amla	
107	*Phyllanthus virgatus* G.Forst.	Phyllanthaceae	Seed under leaf	Bhui amla	
108	*Physalis angulata* L.	Solanaceae	Balloon cherry	Ban-tepari	
109	*Pigea enneasperma* (L.) P.I.Forst.	Violaceae	Pink ladies slipper	Brindabani durba	
110	*Pithecellobium dulce* (Roxb.)	Fabaceae	Manilla tamarind	Jhilapi gach	

	Benth.				
111	*Platycladus orientalis* (L.) Franco	Cupressaceae	Oriental thuja	Jhau	Planted, ornamental
112	*Psidium guajava* L.	Myrtaceae	Guava	Peyara	Planted
113	*Pteris vittata* L.	Pteridaceae	Ladder brake		
114	*Pterocarpus marsupium* Roxb.	Fabaceae	Indian kino tree	Rakta chandan	Planted
115	*Rauvolfia serpentina* (L.) Benth. ex Kurz	Apocynaceae	Indian snakeroot	Sarpagandha	Planted
116	*Rosa* spp.	Rosaceae	Rose	Golap	Planted
117	*Roystonea regia* (Kunth) O.F.Cook	Arecaceae	Royal palm	Botol palm	Planted
118	*Ruellia prostrata* Poir.	Acanthaceae	Bell weed	Phatka gach	
119	*Saccharum spontaneum* L.	Poaceae	Wild sugarcane	Kash, Chor-kharhka	
120	*Scoparia dulcis* L.	Plantaginaceae	Sweet broom weed	Ban dhane	
121	*Senna occidentalis* (L.) Link	Fabaceae	Coffee senna	Kalkasunde	
122	*Senna tora* (L.) Roxb.	Fabaceae	Foetid cassia	Chakunda	
123	*Sesbania javanica* Miq.	Fabaceae	Sesbania pea	Kundra	
124	*Setaria flavida* (Retz.) Veldkamp	Poaceae	Yellow water crown grass		
125	*Setaria viridis* (L.) P.Beauv.	Poaceae	Green bristle grass		
126	*Shorea robusta* C.F.Gaertn	Dipterocarpaceae	Sal	Shal	
127	*Sida cordata* (Burm.f.) Borss.Waalk.	Malvaceae	Flannel weed		
128	*Sida rhombifolia* L.	Malvaceae	Arrowleaf sida	Lal berhela	
129	*Solanum nigrum* L.	Solanaceae	Black nightshade	Kakmachi	
130	*Solanum sisymbriifolium* Lam.	Solanaceae	Sticky nightshade	Bhiji-begun	
131	*Spermacoce ocymoides* Burm.f.	Rubiaceae	Basil buttonweed		
132	*Stephania japonica* (Thunb.) Miers	Menispermaceae	Tape vine	Patha	
133	*Streblus asper* Lour.	Moraceae	Toothbrush tree	Shyaora	
134	*Strobilanthes hirta* (Vahl) Blume	Acanthaceae	Hairy coneflower	Mushakani	
135	*Syzygium cumini* (L.) Skeels	Myrtaceae	Black plum	Jam	
136	*Tabernaemontana divaricata* (L.) R.Br. ex Roem. & Schult.	Apocynaceae	Cape jasmine	Tagar	Planted, ornamental
137	*Terminalia arjuna* (Roxb. ex DC.) Wight & Arn.	Combretaceae	Arjun tree	Arjun	Planted
138	*Tinospora cordifolia* (Willd.) Hook.f. & Thomson	Menispermaceae	Heart-leaved moonseed	Gulancha, Agnikumari	
139	*Tinospora sinensis* (Lour.) Merr.	Menispermaceae	Malabar gulbel	Padma gulancha	
140	*Tragia involucrata* L.	Euphorbiaceae	Indian stinging nettle	Bichuti	
141	*Tridax procumbens* L.	Asteraceae	Tidax daisy	Murhki ganda	
142	*Triumfetta rhomboidea* Jacq.	Malvaceae	Chinese bur	Ban-okra	
143	*Urochloa distachyos* (L.) T.Q.Nguyen	Poaceae	Signal grass		
144	*Urochloa reptans* (L.) Stapf	Poaceae	Creeping signal grass		
145	*Zamia furfuracea* L.f. ex Aiton	Zamiaceae	Cardboard palm		Planted, ornamental
146	*Ziziphus jujuba* Mill.	Rhamnaceae	Jujube	Narkela kul	

147	*Ziziphus mauritiana* Lam.	Rhamnaceae	Indian jujube	Kul	
148	*Ziziphus nummularia* (Burm.f.) Wight & Arn.	Rhamnaceae	Wild jujube	Buda kul	

Faunal Diversity- The College has trees, waste land, low land, banana garden which are habitat of faunal components. So, wide varieties of fauna are supporting its biodiversity. The college campus is the feeding and breeding ground of the many animals. Different types of earth worm, insects (moths, butterfly, wasp, and bees), amphibian, reptilian, birds and mammals. From conversation with faculty members, different stakeholders of the college, following information are collected.



Seasonal flower garden and biodiversity observation

Local	Name	Scientific Name
1	Kecho	*Pheretima posthuma*
2	Joke	*Hirudinaria* sp.
Phylum: Arthropoda		
1	Prajapati	*Papilio* sp.
2	Moth	*Galleria* sp.
3	Moumachi	*Apis* sp.
4	Jonaki	*Lampyris noctiluca*
5	Arsola	*Periplaneta americana*
6	Vimrul	*Vespa orientalis*
7	Lalpipra	*Oecophyllas maragdina*
8	Kakrabicha	*Buthus* sp.

9	Tetulbicha	*Scolopendra* sp.
10	Kenno	*Julus* sp.
11	Pangapal	*Schistocera gregaria*
12	Anopilis masa	*Anopheles* sp.
13	Culex masa	*Culex* sp.
14	Ades masa	*Aedes* sp.
15	Gubrepoka	*Copris lunaris*
16	Pharing	*Orthetrum* sp.
17	Wepoka	*Odontotermes* sp.
18	Machi	*Muska domestica*
19	Makarsa	*Nephila* sp.
Phylum: Mollusca		
20	Sthalsamuk	*Achatina fulica*
21	Jalsamuk	*Pila globosa*
22	Gugli	*Bellamya bengalensis*
23	Jhinuk	*Lamellidens marginalis*
24	Kath joke	*Limax* sp.
Fresh water fishes		
1	Ruimach	*Labeo rohita*
2	Katlamach	*Catla catla*
3	Mrigelmach	*Cirrhinus mrigala*
4	Bata mach	*Labeo bata*
5	Kalbose	*Labeo calbasu*
6	Batkurmach	*Glossogobius giuris*
7	Magurmach	*Clarias batrachus*
8	Singimach	*Heteropneustes fossilis*
9	Latamach	*Channa punctatus*
10	Chang mach	*Channa gachua*
11	Sholmach	*Channa striata*
12	Koi mach	*Anabasa testudineus*
13	Phaloimach	*Notopterus notopterus*
14	Phutimach	*Puntius ticto*
15	Mourlamach	*Amblypharyngodon mola*
16	Techoka or Bostam pona	*Aplocheilus panchax*
17	Kholsamach	*Colisa* sp.
18	Pankalmach	*Mastacembelus sp.*
19	Dhariamach	*Esomus danricus*
20	Chandamach	*Chanda* sp.
21	Tangra	*Mystus* sp.
Class : Amphibia		
1	Kuno bang	*Duttaphrynus melanostictus*
2	Sona bang	*Rana tigrina*
Class: Reptilia		

1	Loudaga	*Ahaetulla nasutas*
2	Jaldhora	*Xenochrophis piscator*
3	Matiali sap	*Elachistodon westermanni*
4	Jamna sap	*Ptyas mucosus*
5	Godi sap	*Varanus* sp.
6	Keute	*Naja*sp
7	Tiktiki	*Hemidactylus flaviviridis*
8	Girgiti	*Calottes versicolor*
9	Kachhap	*Tryonix* sp.
Class : Aves		
1	Charaipakhi	*Passer domesticus*
2	Tuntuni	*Orthotomus* sp.
3	Satbhaya	*Turdoidese audatus*
4	Doyel	*Copsychuss aularis*
5	Bulbul	*Pycnonotus* sp.
6	Kak	*Corvus splendens*
7	Shalik	*Acridotheres tristis*
8	Phinge	*Dicrurus adsimilis*
9	Kajalpakhi	*Lanius cristatus*
10	Kat thokra	*Dinopium benghalense*
11	Baspati	*Merops orientalis*
12	Chotomachranga	*Alcedo atthis*
13	Sadabookmachranga	*Halcyon* sp.
14	Tia	*Pisttacula* sp.
15	Gughu	*Streptopelia chinensis*
16	Paira	*Columba livia*
17	Dahuk	*Amaurornis phoenicurus*
18	Bak	*Ardeola grayii*
Class : Mammalia		
1	Katbirali	*Funambulus pennantii*
2	Neul	*Herpestes edwardsii*
3	Mechobiral	*Prionailurus viverrinus*
4	Katas	*Felis chaus*
5	Chucha	*Suncus murinus*
6	Indur	*Bandicota bengalensis*

Table-10 Green Coverage of the College Premises

Use of Area	Area in Percentage(%)
Natural & Native Plants	38
Plantation Trees	29
Agro Forest	28
Herbal Plants	5

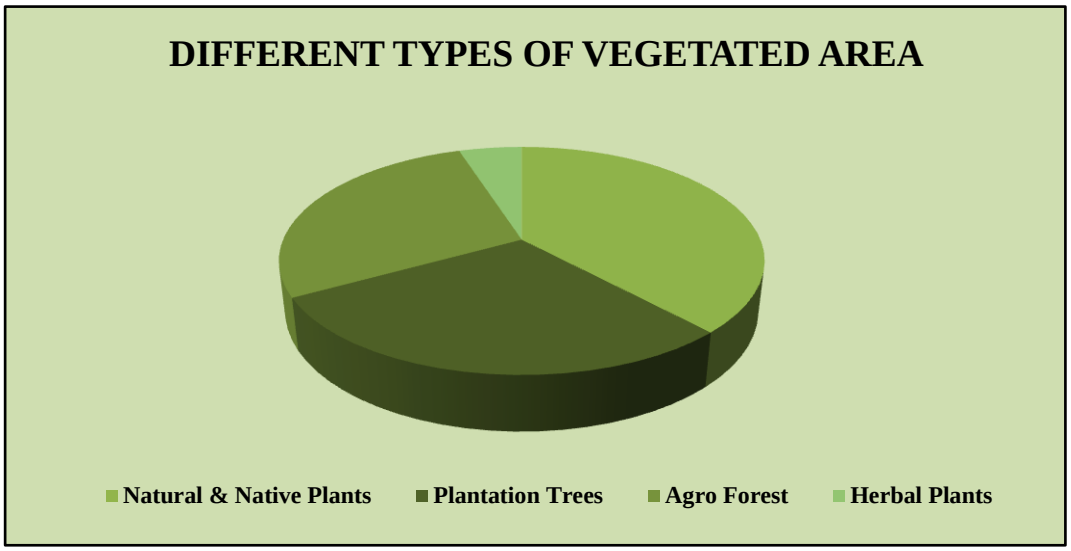


Fig. 9 Green Coverage of the College Premises

Table-11 The Avian fauna observed in the campus is enlisted below-

SL. NO.	COMMON NAME	BENGALI NAME	SCIENTIFIC NAME	IUCN STATUS
1	Red Whiskered Bulbul	Sipahi Bulbul	*Pycnonotus jocosus*	LC
2	Red Vented Bulbul	Bulbul	*Pycnonotus cafer*	LC
3	House Sparrow	ChotiCharai	*Passer domesticus*	LC
4	Eurasian Collared Dove	Par ghughu	*Streptopelia decaocto*	LC
5	Oriental Turtle Dove		*Streptopalia orientalis*	
	Spotted Dove	Chhiteghughu	*Streptopelia chinensis*	DD
6	Rock Dove	Rock Pigeon	*Columba livia*	LC
	Black Drongo	Finga	*Dicrurus macrocercus*	LC

7	Asian Pied Starling	GuyeSalik	*Sturnus contra*	LC
8	White-breasted Kingfisher	Sandabuk Machhranga	*Halcyon smyrnensis*	VU
9	Common Kingfisher	Chotto Machhranga	*Alcedo atthis*	LC
10	House Crow	Kak	*Corvus splendens*	LC
11	Jungle Babbler	Chhatare/Satbhai	*Argyas triatus*	LC
12	Black-headed Oriole	Bene Bau	*Oriolus xanthornus*	LC
13	Eurasian Golden Oriole	SonaBau	*Oriolus oriolus*	LC
14	Common Myna	Salik	Acridotheres tristis	LC
15	Blue Rock Pigeon	Gola Payra	*Columba livia domestica*	
16	Common Hoopoe	Mohonchura	*Upupa epops*	LC
17	Asian Koel	Kokil	*Eudynamys scolopacea*	LC
18	Rose-ringed Parakeet	Tia	*Psittacula krameri*	LC
19	Brown Shrike	Karkata	*Lanius cristatus*	LC
20	Indian Treepie	Handi Chacha	*Dendrocitta vagabunda*	LC

Table-12 The Mammalian checklist is as follows-

SL. NO	COMMONNAME	BENGALINAME	SCIENTIFICNAME	IUCN RED LIST
1	Five striped Palm Squirrel	Kath Berali	*Funambulus pennantii*	Least Concern (LC)
2	Free-ranging Cat	Biral	*Felis domesticus*	DD
3	Free-ranging Dog	Kukur	*Canis familiaris*	DD
4	Asian Palm Civet	Bham	*Paradoxurus hermaphroditus*	LC
5	Field Rat	Metho Indur	*Bandicota bengalensis*	LC
6	Grey Mongoose	Beji	*Herpestes edwardsii*	LC
7	House Mouse	Nengti Indur	*Mus musculus*	LC
9	Bengal Fox	Fox	*Vulpes bengalensis*	LC
10	Indian gray mongoose	Neul	*Herpestes edwardsii*	LC

*NE: Not evaluated; LC: Least concerned; NA: Not accessed

Implemented Biodiversity & Green Management		
Sl. No	Factors/ Indicators	Weightage
1	Plants Diversity	M
2	Birds and Insects	M
3	Mammals	L
4	Fishes and Amphibian	L
5	Fungus & Organisms	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%

3.7 Reviews of Documents and Records:

Documents such as admission registers, registers of Engineering and water charge remittance, furniture register, laboratory equipment registers, purchase register, audited statements, and office registers were examined and data were collected. College calendars, college magazines, annual report of the college and NAAC self-assessment reports, UGC report etc. were also verified as part of data collection.

3.8 Review of Policies:

Discussions were made with the College management regarding their policies on environmental management. Future plans of the College were also discussed. The management would formulate a revised environment /green policy for the college in the light of green auditing. The purpose of the green audit was to ensure that the practices followed in the campus are to be in accordance with the Green Policy adopted by the institution.

3.9 Interviews:

In order to college information for green auditing different audit groups which are IQAC Cell, Dept. HOD, Teaching and non-teaching staff, students, parents and other stakeholders of the College. Discussions were also made with the office bearers to clarify doubts regarding certain points.

Observation in the Laboratories

Plant Diversity Counting and Species Observation

4.0 POST AUDIT STAGE :

4.1. Data Analysis and Assessment :

The base of any Green audit and Environmental audit is that its findings are supported by documents and verifiable information. The audit process seeks, on a sampled basis, to track past actions, activities, events, and procedures to ensure that they are carried out according to systems requirements and in the correct manner. Although Green & Environmental audits are carried out using policies, procedures, documented systems and objectives as a test, there is always an element of subjectivity in an audit. Each of the three components is crucial in ensuring that the organization's environmental performance meets the goals set in its green policy. The individual functioning and the success of integration will all play a role in the degree of success or failure of the organization's environmental performance.

4.2 Results and Findings:

a) Water -

Water Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1.	Source of water	➢ Underground(12000 liter)
2.	Capacity of water storage (Daily)	➢ Reservoir and Overhead tanks- 17000 liter ➢ Total amount of used & misused water- 11220ltr ➢ Total misuse of water-220 ltr
3.	Amount of used water per day	11000liter
4.	Misuse of water in daily	Leakage, overflow and Misuse-220 liter
5.	Maximum used of water per day - for washroom purpose	44% (4840 liter)
6.	Amount of water for used per day- Drinking Purpose	9 % (990liter)
7.	Rain water Harvesting	The two(2) rain water Harvesting unit are available in college campus..
8.	pH level of drinking water	7.1
9.	TDS level of drinking water	120ppm -140ppm

Source of water & Water Quality measurement

b. Energy

- Electricity Consumption - 22722 Unit, Rs.- 224904/- Per Year
  - Fossil fuel consumption per Year:
    Diesel used for green Generator- 50 liter
  - Number of Green Generators - 01
  - Cost of generator fuel – Rs. 4500 /month

Energy Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Source of energy (conventional)	100 %
3	Total consumption of Electric Power	22722unit
4	The maximum use of conventional Electric Power	22722 unit
5	Maximum energy consumption in the purpose	Light and fans - 8861 Unit/year
6	Energy Consumption in Computer & Lab.	3181unit /year
9	Amount of diesel used for green generator	50 liter/Year
10	No. of AC use of energy	3181unit/year

c. Wastes-

- Total Students - 366 persons
- Other Stakeholders – 38 persons
- Total Stakeholders - 404 persons
- Departments – 9

D. Wastes Management Policy:

- Biological Wastes treatment by Vermi-compost system .
- E-wastes- computers, electrical and electronic parts – Disposal by selling
- Plastic waste- disposal by selling
- Solid wastes – Damaged furniture, Iron & Metal scraps- Disposal by Selling
- Food wastes – Waste food , Vegetable, Paper plates- Disposal in Earthen pit and Compost pit.
- Chemical wastes – Laboratory waste – Not proper treatment
- Waste water – washing, urinals, and bathrooms in soak pits.
- Glass waste – Broken glass wares from the labs by selling.
- Napkin & Clothes incinerators- Disposal in earthen pit

Waste Audit and Assessment

Sl. No.	Object and Parameter	Observation and Finding
1	Degradable waste	22 (Kg/Day)
2	Non degradable	3 (Kg/Day)
3	Main Source of waste (Organic)	Classroom and Garden
5	Plastic waste management	Use of separate dustbin and fixing of different waste unit

d) Green Campus-

Green cover of the campus- 2acre area

Free space including Playground- 1.32 acre area

Crops cultivated in the campus: Banana, Tapioca, Chilly, Cabbage, Tomato, Spinach, Brinjal, Cauliflower, Ladies finger, Pea and different seasons flowers are produced during different seasons in College premises area.

Table 13 Biodiversity and Green Coverage

Sl. No.	Object and Parameter	Observation and Finding
1	Vegetation coverage area	46 % (2 Acre)
2	Types of green coverage	➢ Native and Natural Vegetation- 38% ➢ Medicinal plants- 5% ➢ Agro-plants- 28 %
3	Different types of Animal	➢ Mammals -Squirrel, Rat, Free ranging Cat, Free ranging Dog, Field Rat, Bengal Fox etc. ➢ Amphibian-Snake, Frogs ➢ Birds- Crow, Common Moyna, Pigeon, etc. ➢ Insects- Ants, Butterfly, Spider etc.
4	Biodiversity and Green Management Programme	➢ Awareness program arrange by- college among the students and Stuff through the year ➢ Observation and celebration of environmental days ➢ Installation of different trees and plants naming plate

Campus farming

Organic vegetable cultivation as interim crop is another plan to be materialized soon. The department of Zoology has been consistently undertaking Fishes cultivation and Botany department has been planting of flowers and ornaments trees in winter.

e) Carbon Footprint-

- Number of Students & Staff using cycles – 150
- Number of persons using cars – 10
- Number of persons uses two wheelers – 20
- Number of students uses Buses - 100
- Number of persons using other transportations – 20
- Number of visitors per day – 10
- Average distance travelled by stake holders – 10 kms /day
- Expenditure for transportation per person per day – Rs.20/-

4.3 SUMMARY:

I. The environmental awareness initiatives are adequate.
II. The College campus is plastic free and maintained the outdoor air quality.
III. The installation of solar panels, organic vegetable cultivation, Vermi composting practices are inadequate.
IV. There is NSS team of the College towards its environmental performance for Community development.
V. Indoor air quality of the laboratories is very uncomfortable and inhospitable.
VI. Use of notice boards and signs are inadequate to reduce over exploitation of natural resources.
VII. Programs on green initiatives have to be increased. Campus is declared "Clean Campus"
VIII. Fully carbon foot prints and wastes free zone actions should be taken to maintain this.
IX. Rain water harvesting systems, solar power generation, Bio Gas, Re-use of water environmental education programs have to be fully explored.

Implemented Air Quality management		
Sl No	**Indicator**	**Weightage**
1	Carbon & Smoke free	H
2	Exhaust fans &Ventilation	M
3	Emission of GHGs	M
4	Indoor Plants	L

* H denote- Taken management policy level above 60%
** M denote- Taken management policy level 40%-60%
*** L denote-Taken management policy level below 40%

Major Audit Observations		
Sl. No	**Sectors/Indicators**	weightage
1	Water efficiency Audit	M
2	Energy efficiency Audit	M
3	Air Quality & Carbon foot print Audit	M

4	Wastes Audit	M
5	Green & Biodiversity Audit	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 Environmental Education:

The following environmental education program may be implemented in the College before the next green and environmental auditing:-

- ❖ Increase the number of display boards on environmental awareness such as – save water, save electricity, no wastage of food/water, no smoking, switch off light and fan after use, plastic free campus etc.
- ❖ Activate the nature or green clubs
- ❖ Set up Organic vegetable garden, Honey farm, Mushrooms, Indigenous fish farm etc. for providing proper training to the students.
- ❖ Setting up Water recycle and Reuse project for Gardening purpose.
- ❖ Setting up of medicinal plant nursery, water management, vegetable cultivation, tree planting, energy management, landscape management programme, and rain water harvesting and water re-use methods.
- ❖ Conduct exhibition and poster competition on Green and Clean campus for sustainable and healthy academic environment.

4.5 Common Recommendations

- ✓ Introduce UGC Environmental Science course to all students
- ✓ Conduct more seminars and group discussions on environmental education
- ✓ Students and staff can be permitted to solve local environmental problems
- ✓ Renovation of cooking system in the canteen to save gas and wooden fuel
- ✓ Installation of modern e-waste management unit
- ✓ Maintain of Indoor air quality
- ✓ Establish a solar pump house or solar submersible pump
- ✓ Adopt an environmental policy for the college
- ✓ Establish a purchase policy for environmental friendly materials
- ✓ Establish the crasser machine for plastic waste treatment
- ✓ Establish a biodiversity park
- ✓ Establish a scientific treatment unit for chemical waste management.

Campus cleaning by the Students

4.6 Criteria Wise Recommendations

Water Audit

- .
- Drip irrigation for gardens and micro irrigation technology can be initiated.
- Establish the re-use water management methods.
- Establish rain water harvesting systems for each building and each campus.
- Remove damaged taps and install sensitive taps is possible
- Establish water treatment systems.
- Awareness programs on water conservation to be conducted.

Energy Audit

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

Waste Audit

- ❖ Establish a Regular functional bio gas plant.
- ❖ A model solid waste treatment system to be established.
- ❖ Practice of waste segregation to be initiated.
- ❖ Establish of a unit for chemical liquid wastes and Hazardous waste management
- ❖ A model Vermi composting plant to be set up in the Hostels, canteen and Quarters of college campus.
- ❖ Establish an e-waste management unit
- ❖ Establish the crasser machine for plastic waste treatment

Green Campus Audit

- ✓ All trees in the campus should be named scientifically.
- ✓ Establish a biodiversity park
- ✓ Create more space for planting in vacant land.
- ✓ Develop the Herbal and medicinal plants garden for large area
- ✓ Establish a butterfly park.
- ✓ Establish an Orchid ex-situ zone.
- ✓ Develop the Fruits trees area for Birds conservation
- ✓ Grow potted indoor plants at verandah, class rooms and Laboratories.
- ✓ Create automatic drip irrigation system during summer holidays.
- ✓ Not just celebrating environment day but making it a daily habit.
- ✓ Providing funds to nature club for making campus more green
- ✓ Encouraging students not just through words, but through action for making the campus green

- ✓ Conducting competitions among departments for making students more interested in making the campus green.

Carbon footprint Audit

- ❖ Establish a system of carpooling among the staff and visitors to reduce the number of four wheelers coming to the college.
- ❖ Establish the indoor plants in OIC Chamber, office rooms ,computer lab and other laboratories to CO_2 management
- ❖ Providing more college bus services to the students and staff.
- ❖ Encourage students and staff to use cycles.
- ❖ Establish a more efficient cooking system to save gas.

Audit Team with staff

Executive Summary: 2022-23

Environmental Audit is a process of systematic, documented, periodic and objective evaluation of components of environmental diversity with the aim of safeguarding the environment and natural resources. The process starts with the systematic identification, quantification, recording, reporting and analysis of components of environmental diversity and is a means of assessing environmental performance (Welford, 2002). It aims to analyze environments within and outside of the concerned area, which will have an impact on the eco-friendly atmosphere. Green and Environmental audit is a valuable means for an institution to determine how and where they are using the most resources; the institution can then consider how to implement changes and take necessary management measures. It can create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of green impact on their area of work. Environmental auditing and the implementation of mitigation measures is a win-win situation for the institution, the learners and the planet. It can also create health consciousness and promote to holistic approaches to environmental management, awareness, values and ethics. Green and Environmental auditing promote financial savings through efficiency of resource usage. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self-enquiry is a natural and necessary outgrowth of a quality educational institution. Thus it is imperative that the institute evaluate its own contributions toward a sustainable future. As

environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.

In Government General Degree College,Gopiballavpur-II,W.B the audit process involved initial interviews with the teachers and staffs to clarify policies, activities, records and the cooperation in the implementation of mitigation measures. This was followed by collection of data through the questionnaires, review of records, observation and enquiry of practices and observable outcomes. In addition, the approach ensured that the management and staff are active participants in the Green and Environmental auditing process. The baseline data prepared for the Government General Degree College,Gopiballavpur-II,W.B will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development. Existing data will allow the College to compare its programmers and operations with those of peer institutions, identify areas in the need of improvement, and prioritize the implementation of future projects.

The area of the College premises is 4.33acres out of which about 2acre areas is covered by trees, plants etc. . In the present audit report most of the aspects are covered such as tree plantation, awareness about environment programmers, rain water harvesting and plastic free premises. The College has already taken some steps to protect the environment with help of teachers, staff and students under the guidance of Dr. Sujit Kisku, OIC, Government General Degree College, Gopiballavpur-II,W.B. We expect that the management will be committed to implement the green and environmental audit recommendations. We are happy to submit this green and environmental audit report to the Government General Degree College,Gopiballavpur-II, W.B.