



অভয়াপুৰী মহাবিদ্যালয় অভয়াপুৰী



GREEN AUDIT REPORT

2020-21

PREPARED BY

GREEN AUDIT COMMITTEE, ABHAYAPURI COLLEGE

Preface

An eco-friendly campus is a concept used in educational institutions around the world to help them become more sustainable as a result of their high resource consumption and waste discharge into the environment. Waste minimization measures for educational institutes are increasingly required in order to keep the campus clean. The conduct of Green Auditing of Institutions is vital for determining the environmental performance of educational institutions and analysing feasible options for turning the educational campus into an eco-campus. The green auditing of Abhayapuri College, Abhayapuri, allows for an assessment of campus life, activities, and environmental impact.

This is the second time a green audit of this college campus has been done in this manner. This audit primarily focused on greening indicators such as drinking water quality, plant and animal vegetation, and campus waste management procedures, among others. Initially, a questionnaire survey was undertaken to learn about the campus's available resources and the students' and staffs' resource use patterns. Water samples were taken from several sites on the college campus and examined for factors in order to assess the quality of the water. The information gathered was organised, tallied, and analysed. Eventually, a report on the environmental management plan is documented, along with recommendations for the campus's environmental issues.

1st October, 2021

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GREEN AUDIT, ABHAYAPURI COLLEGE, 21-22

Acknowledgement

I, on behalf of the Green Audit team, convey our gratitude and gratefulness to Dr. Sadananda Nath, Principal, Abhayapuri College, Abhayapuri for conferring this noble task of green auditing of the college Campus and allow us to prepare the Green Audit Report, 2020-21. We extend our thankfulness to Dr. R. Tiwari, ex-Coordinator, IQAC and Dr. G. C Das, present Coordinator, IQAC, Abhayapuri College, Abhayapuri for their cooperation during the preparation of the Green Audit Report.

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3. Prof. Trishna Roy Prodhani, Dr. Ashoke Kumar Das and Prof. Dimpee Choudhury, all Asstt. Professor, Botany for preparing the Report on Green Coverage and Plant Audit.
4. Dr. Pori Devi, Asstt. Professor, Zoology for contribution in Faunal audit.
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Thanking all.

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Executive Summary

Several environmental and ecological crises have resulted from fast urbanisation and economic development on a local, regional, and global scale. In light of this, adopting the Green Campus concept for the institute that will lead to sustainable development becomes critical. Abhayapuri College, Abhayapuri, is genuinely concerned and unwaveringly thinks that these fundamental problems and tendencies must be addressed properly. The goal of the analysis was to make sure that the practises on campus were in line with the institution's Green Policy. Preparation and completion of a questionnaire, physical examination of the campus, observation and evaluation of documentation, key person interviews, data analysis, measurements, and recommendations were all part of the process. Water conservation, tree planting, waste management, paperless work, alternative energy, and biodiversity mapping are some of the aspects of 'Green Campus' that it works on. With this in mind, the study's particular goals were to assess the appropriateness of the environmental sustainability management control structure, as well as the degree to which the Departments complied with applicable rules, policies, and standards. It has the potential to have a significant influence on student health, learning, college prices, and the environment. The analysis' criteria, methodologies, and recommendations were all based on the identified hazards.

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1. INTRODUCTION

The green audit aims to analyse environmental practices within and outside the college campuses, which will have an impact on the eco-friendly atmosphere. Green audit can be defined as systematic identification, quantification, recording, reporting and analysis of components of university environment. It was initiated with the motive of inspecting the effort within the institutions whose exercises can cause threat to the health of inhabitants and the environment. Through the green audit, a direction as how to improve the structure of environment and there are include several factors that have determined the growth of carried out the green audit.

NEED OF GREEN AUDIT

Green auditing is the process of identifying and determining whether institutions practices are eco-friendly and sustainable. Traditionally, we are good and efficient users of natural resources. But over the period of time excess use of resources like energy, water, are become habitual for everyone especially, in common areas. Now, it is necessary to check whether our processes are consuming more than required resources? Whether we are handling resources carefully? Green audit regulates all such practices and gives an efficient way of natural resource utilization. In the era of climate change and resource depletion it is necessary to verify the processes and convert it in to green and clean one. Green audit provides an approach for it. It also increases overall consciousness among the people working in institution towards an environment.

GOALS OF GREEN AUDIT

The green audit with specific goals as:

1. Identification and documentation of green practices.
2. Identify strength and weakness in green practices.
3. Analyze and suggest solution for problems identified.
4. Assess facility of different types of waste management.
5. Increase environmental awareness throughout campus.
6. Identify and assess environmental risk.
7. Motivates staff for optimized sustainable use of available resources.
8. The long-term goal of the environmental audit program is to collect baseline data of environmental parameters and resolve environmental issue before they become problem.

OBJECTIVES AND SCOPES OF GREEN AUDIT

The main aim objective of this green audit is to assess the environmental quality and the management strategies being implemented in Abhayapuri College, Abhayapuri. The specific objectives are:

1. To assess the quality of the water in the college campus
2. To quantify the waste generation and management in the campus.
3. To quantify the floral and faunal diversity in the college campus.
4. To identify the gap areas and to suggest recommendations to improve the Green Campus status of the College.

The broad aims/benefits of the eco-auditing system would be

1. Environmental education through systematic environmental management approach
2. Improving environmental standards
3. Benchmarking for environmental protection initiatives
4. Sustainable use of natural resource in the campus.
5. Financial savings through a reduction in resource use.
6. Development of ownership, personal and social responsibility for the College campus and its environment.
7. Enhancement of College profile
8. Developing an environmental ethic and value systems in young people

BENEFITS OF GREEN AUDIT TO EDUCATIONAL INSTITUTES

There are many advantages of green audit to an Educational Institute:

1. It would help to protect the environment in and around the campus.
2. Recognize the cost saving methods through waste minimization and energy conservation.
3. Empower the organization to frame a better environmental performance.
4. It portrays good image of institution through its clean and green campus.

Finally, it will help to build positive impression for through green initiatives the upcoming NAAC visit.

2. EXECUTIVE SUMMARY

An environmental audit is a snapshot in time, in which one assesses campus performance in complying with applicable environmental laws and regulations. Though a helpful benchmark, the audit almost immediately becomes outdated unless there is some mechanism in place to continue the effort of monitoring environmental compliance.

This audit report contains observations and recommendations for improvement of environmental consciousness.

3. BASIC DETAIL OF THE COLLEGE

About the college

Abhayapuri College was founded on August 13, 1955, as a consequence of the dedication and relentless efforts of some of the area's brightest minds, led by late Govinda Chandra Dev Sarma, and with the enthusiastic support of the local community. Residents of Abhayapuri, the headquarters of the erstwhile Bijni Raj Estate, and the people of the surrounding territories were united in their desire to see a centre of higher education established in this backward region. Since then, Abhayapuri College has been developing young minds and paving their road to the future in the region.

Abhayapuri College is located in the heart of Abhayapuri town, which is the administrative centre of the North Salmara Sub-Division of the Bongaigaon district in Assam. Abhayapuri is a little town set among isolated hillocks, rich in scenic beauty and surrounded by a tranquil and clean

atmosphere. Many historical monuments dot the town and surrounding area, serving as reminders of a bygone period. RaneeAbhayeswari, the queen of the erstwhile Bijni Raj Estate, is the inspiration for Abhayapuri.

Abhayapuri College began its journey with simply the Arts stream and was incorporated under the shortfall Grants-in-Aid scheme by the Assam government in 1962. University Grants Commission later recognised the college under 2(f) and 12(b) recognitions (UGC). The Science stream, which began in 1979, was brought under the deficit Grants-in-Aid system in 1986, and the College made a significant step toward its goal of providing higher education in the region.

Abhayapuri College has had a long and prosperous journey over the previous seven decades. Abhayapuri College has been able to attain its current prominent position as a result of the selfless and ardent efforts of the College administration, as well as the cooperation of accomplished and committed instructors and office staff, students, and the local community. The College was inspected and recognised by the National Assessment and Accreditation Council (NAAC) with a 'B' Grade during the first cycle of its inspection in the Golden Jubilee year of 2004. The college received a 'B' grade (CGPA 2.50) from the National Accreditation and Assessment Council (NAAC) during its 2nd Cycle of inspection in 2016. Abhayapuri evolved over time.

Vision

To impart holistic and progressive education with a view to moulding students into competent, confident and responsible citizens ingrained with high moral and cultural values.

Mission

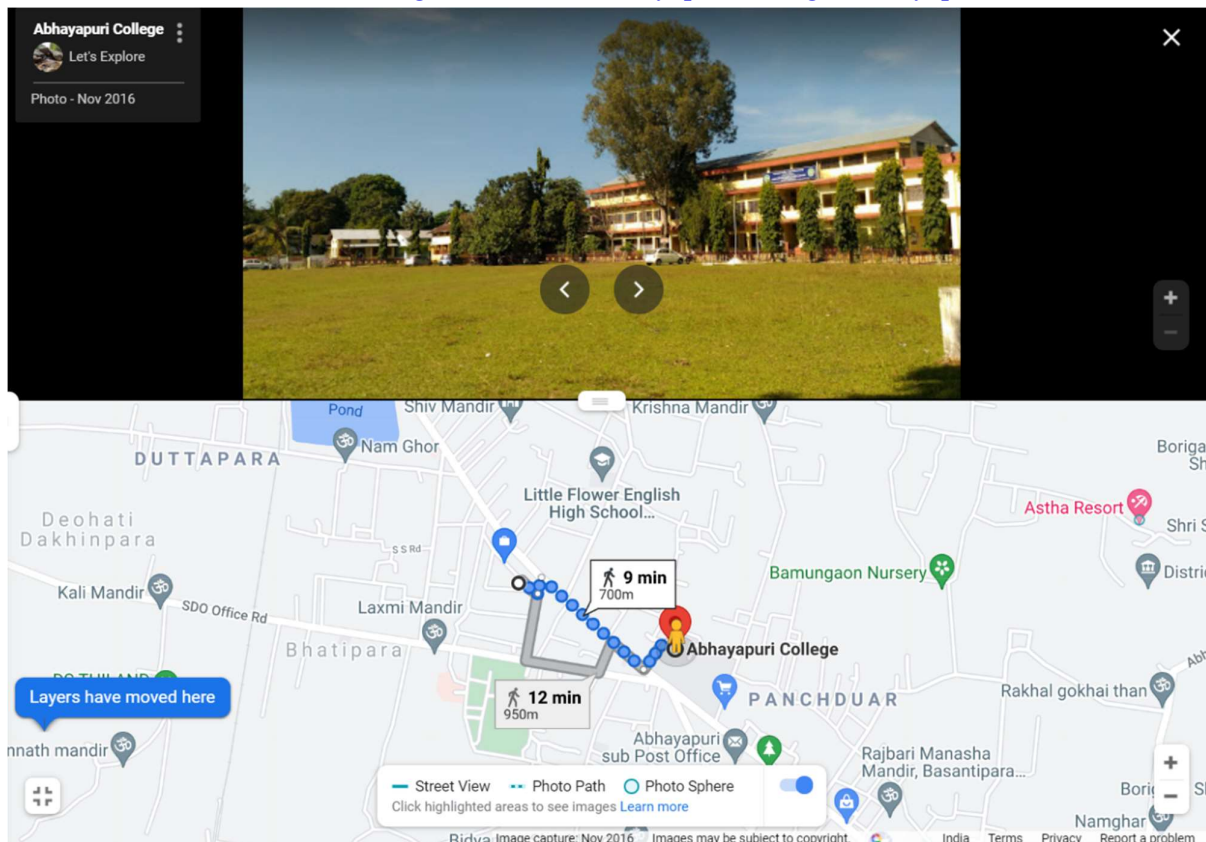
* To impart higher education up to postgraduate level by using contemporary teaching-learning methods in both formal and distance learning modes.

* To offer a host of career oriented and vocational courses including computer courses so as to equip students to confidently face competition and the growing demands of the fast-changing job market.

* To develop a scientific temperament and instil humanitarian values in young minds.

* To raise awareness and empathy among students towards the problems of their society through the Extension Education Programmes of the College. To work towards all-round development of the students through regular personality development programmes, soft skill trainings, seminars and co-curricular activities aimed at bringing out their best and to give them an edge over others.

Fig: Location of Abhayapuri College, Abhayapuri



Abhayapuri college is situated in a total area of **24** acres of land divided in three campuses. The total built-up area of the college is **1.88** acres.

The student and faculty strength of the college

Number of Students	2073
Number of teaching staffs (inclusive of Contract Teachers)	79
Number of non-teaching staffs	43
Total	2195

Physical Structure

Academic Departments	20
Extra Curriculum Department	03
Laboratories	12
Conference Hall	01
Library	01 Central Library + Departmental Libraries of each department
Hostels	03 (02 girls' + 01 boys')
Play Grounds	02
Canteen	01
Campus	03

1. WATER AUDIT

QUALITATIVE ANALYSIS OF DRINKING WATER

Introduction

A water audit is a systematic and full analysis of water process by utility. It includes quantitative and qualitative analysis of water in a system. The process begins with an extensive approach to generate the water balance using available data and estimates which helps in identifying specific areas to concentrate in further stages.

Water audit is an effective management tool for minimizing losses, optimizing various uses and thus enabling considerable conservation of water. Therefore, institutional audit of water is very essential practice as it develops awareness about the quality and utilization quantity of water among the peoples associated with such institute

Objectives

Analysis of water quality is very essential in a college as it is always used for drinking and other purposes like laboratory cleaning, reagent preparation for practical, household practices in hostels etc. Moreover, this kind of audit is necessary as permissible range of water quality parameters enhance the quality of public health of peoples engaged in a particular institute or organization.

Benefits of Water Audit

There are lots of benefits of water audit in a system, which are as follows:

1. Water audit improves the knowledge and documentation of the distribution system,
2. Identifies the problem and risk areas and a better understanding of what is happening to the water after it leaves the source point.
3. Leads to reduced water losses,
4. Improved financial performance,
5. Improved reliability of supply system
6. Efficient use of existing supplies
7. Better safeguard to public health and property and reduced legal liability,
8. Reduced disruption, thereby improving level of service to customers.
9. Large potential cost savings that can be achieved by water harvesting, through the recycling of water and the use of rain water.

SOURCES OF WATER

Quantitative analysis of water of campus and both the hostels of Abhayapuri College were made. An account on storage of water and amount of utilization calculated in the table below..

Type of Water Storage	Location	Water Storage	Number of	Utilization of water

		capacity (litre)	Water loadings on daily basis	(litre)
Tank	Principal Office	1000	2	2000
	Dept of English	1000	2	2000
	Dept of Chemistry	1000	2	2000
	Dept of Geography	1000	1	1000
	Dept of Botany (2 numbers)	1000	1	1000
	Dept of Economics	500	1	1000
	Boy's Hostel	1000	1	1000
	Girl's Hostel	1000	2	2000
Large Aqua guard for drinking water	In front of Dept of Economics	200	2	400
	In front of Dept of Political Science (4 numbers)	200 x 4	1	800
	In front of Room-20	200	1	200
Small Aqua guard	In Office	10	1	10
Total Utilization of Water =				13410

From the above-mentioned quantitative analysis of the different water storages it is estimated that the daily average water use during working days in the Abhayapuri College campus along with both the hostels were 13410 litres per day.

Methodology

All the parameters of water are estimated after the methods of APHA (2000). Among these parameters Biological Oxygen Demand (BOD) and Dissolved Oxygen (DO) were estimated in college laboratory and remaining parameters were estimated in the laboratory under District Water Analysis Laboratory, Bongaigoan. All the results of this analysis summarized in table-2.

Parameters Tested	Pin Point Location					
	Boring near office	Boring near Botany Dept	Boring near Geography Dept	Boring near Economics Dept	Boring of Boy's Hostel	Boring of Girl's Hostel
BOD (mg/l)	02	02	02.2	02.1	02	02
DO (mg/l)	08	8.1	8.2	08	08.3	08
pH Value	6.89	6.90	6.87	6.79	6.80	6.85
Turbidity (NTU)	02	2	4	3	2	3
Iron(mg/l)	0.18	0.14	0.43	0.16	0.11	0.16
Nitrate(mg/l)	NIL	NIL	5	3	NIL	2
Chloride(mg/l)	44	48	60	46	40	40
Hardness(mg/l)	82	94	90	86	76	78

Fluoride(mg/l)	0.17	0.15	0.24	0.22	0.18	0.20
Arsenic(mg/l)	NIL	NIL	0.001	NIL	NIL	NIL
Manganese(mg/l)	0.14	0.16	0.23	0.18	0.10	0.09
Residual Chloride(mg/l)	NIL	NIL	NIL	NIL	NIL	NIL
Bacteriological (Coli form)	Absent	Absent	Absent	Absent	Absent	Absent

Normal Ranges of Parameters of Water

Parameters Tested	Accepted Limit	Permissible Limit
BOD (mg/l)		
DO (mg/l)		
pH Value	6.5 to 8.5	No Relaxation
Turbidity (NTU)	1 NTU	5 NTU
Iron(mg/l)	0.3 mg/l	No Relaxation
Nitrate(mg/l)	45 mg/l	No Relaxation
Chloride(mg/l)	250 mg/l	1000 mg/l
Hardness(mg/l)	200 mg/l	600 mg/l
Fluoride(mg/l)	1 mg/l	1.5 mg/l
Arsenic(mg/l)	0.01 mg/l	No Relaxation
Manganese(mg/l)	0.1 mg/l	0.3 mg/l
Residual Chloride(mg/l)	0.2 mg/l	1 mg/l
Bacteriological (Coli form)	Absent in any 100 ml Sample	

All the parameters of water are found to be under permissible limit after drinking water quality parameters prescribe by WHO.

2. WASTE MANAGEMENT AUDIT

Introduction

Waste is any substance which is no longer useful after primary use or which have no use. There are different types of waste. But mainly in college campus solid waste, liquid waste and hazardous waste are generated. Waste management includes the activities and actions required to manage from its inception to its final disposal. Improper management of waste causes hazards to the environment and also the people who are residing in that particular area. Proper waste management keep the environment clean and makes health standards better. The objectives of waste management audit is to evaluate the current status, identify and overcome the problems. In addition to waste generation from different sources institutions are also generating waste in large quantities. Waste management directly implicates that waste generation could be reduced, recycled and reused which further reduces the pressure of solid wastes at disposal sites.

In order to reduce waste on Abhayapuri College all students, faculty and staff must be properly educated on proper waste management practices. The waste management audit of Abhayapuri College mainly focuses on types of wastes generated in the College campus and its hostel campus and how it

can be disposed, reuse or recycled by applying a proper methodology. By observing the college and hostels campus mainly two types of waste products have been found. The waste management audit has found the fallen dry leaves of plants, wasted papers, carry bags, plastic bottles, bulbs, wooden materials, thermocol, cardboard, glass etc. Among these some are biodegradable and some are non- biodegradable. The waste generated at Abhayapuri College was not properly disposed, only dumped un-hygienically. There is no proper methodology in AbhayapuriCollege to measure the waste materials. So here it's not possible to say the exact amount of different types of solid waste materials.

Solid waste management

The term “solid waste management” refers to the process of collecting, treating and recycling the solid wastes. By waste management we can change the solid waste to a valuable resource. The primary goal of solid waste management is reducing and eliminating adverse impacts of waste materials on human health and the environment. Solid waste includes of all wastages arising from human and animal activities that are normally solids and discarded as useless or unwanted. To maintain the solid waste management College Authority already installed green, yellow and blue dustbins in the college and hostel campus. Out of these most of the dustbins are green dustbins, a few are yellow and very few are blue dustbins. There is no black coloured dustbin in the college and hostel campus. Usually, the green-coloured dustbins are for wet and biodegradable waste. Yellow dustbins are for papers and glass bottles. Blue dustbins are for papers and glass bottles. Black dustbins for hazardous chemicals. Investigation reveals that there are a total 28 dustbins installed in the college campus and 4 dustbins in the women hostel and one small dustbin in the boy's hostel. Besides these dustbins every department have personal dustbins depending on their needs for solid waste disposal.

Table 1: Different colour of dustbins installed in college and hostel campus with location

Sl. No	Location of dustbins	No. of dustbins	Colour of dustbins
1	Geography department	1	Green
2	Zoology laboratory	2	Green
3	Hall North	2	Green
4	Hall South	1	Yellow
5	English	2	Green
6	Philosophy & Mathematics department	1	Green
7	Assamese department	1	Green
8	Room No. 21	1	Green
9	Room No. 20	1	Green
10	Back side of office room	1	Green
11	NSS and Political Science department	1	Green
12	Physics department	1	Green
13	Principal chamber and office room	1	Blue
14	In front of Office room	1	Green
15	Education department	1	Green
16	Library	1	Green
17	Room RCC-1	1	Green
18	Room RCC-2	1	Green
19	Room RCC-4	1	Green
20	Room RCC-5	1	Green
21	Seminar Hall	1	Green
22	Boy's common room	1	Green
23	Basketball court	2	Green

24	Women's Hostel	5	Green, blue, brown
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a) Green dustbin in front of Hall North



b) Yellow dustbin in front of Hall south



b) Blue dustbin in front of office room



d) Green dustbin in front of English department

Fig1: Different types of dustbins installed in the college campus

There are no separate dustbins for segregation of different types of waste materials. The dustbins are not properly used. Wastes are disposed of randomly all over the campus and there is open dumping of waste. The green colour dustbins are used for biodegradable wastes such as leaves, fruits, vegetables etc. and yellow colour dustbins for paper and glass bottles. But by observation it is found that yellow colour dustbins also filled with biodegradable waste and there is mixing of biodegradable and non-biodegradable waste products. There are also concrete waste materials in the campus which are generated due to the works related to the infrastructure.



e) Burning of waste



f) Non segregation of waste



g) Open dumping of waste



h) Disposal of concrete waste



g) Disposal of Concrete waste



i) Disposal of wooden waste

Fig 2: Views of open dumping of waste and non-segregation of different waste materials and disposal of different types of waste products

Hazardous waste management

Hazardous waste is the waste that has potential to threats the public health or the environment. In case of hazardous waste products there are not too much hazardous materials are produced in the college campus. Because there are not that much sources to generate it. There are two chemical laboratories in the Chemistry department from where some hazardous products are produced. If these materials are not properly disposed then it may create substantial hazards to students, faculty, and the other staff of the college or to the entire environment of the college campus. The chemical wastes include chromium, sulfide and some toxic solvents. Besides these, solid wastes like glass, broken reagent bottles and unused bottles are found where once concentrated acids had kept. The liquid waste generated in chemistry laboratory are managed to some extent by percolation method. The waste chemicals mixed with water from laboratory passes through concealed pipe line into the soil which are ultimately reaches to the ground water. In physics department waste materials like damaged battery, damaged voltmeter and other electronic gadgets.



g) Disposal of unused reagent bottles used in chemistry laboratory



k) Disposal of water pipe and some wires used for different activities in college

Fig 3: Views of laboratory waste in college campus

In Women hostel 5 dustbins are installed for disposal of waste products. Out of these two dustbins for dry wastes and three dustbins for wet wastes. There is only one small dustbin in Boy's hostel. In hostels wastes are managed by using dustbins, by burning, by dumping beside the hostels or by throw away method. Different types of household waste commonly found in the student's residence. The household waste commonly found is vegetable waste, fruit waste, paper, tissue, plastic wrappers etc. Students should practice waste segregation and then placed the waste materials in specific dustbins. But the students placed waste in dustbins regardless of the type. There are no separate dustbins for biodegradable and non-biodegradable waste. But Green Audit Committee observed there are separate dustbins for dry and waste. In boy's hostel waste are disposed in a well. Waste water coming from kitchen and bathroom are not properly managed as it is treated by digging the ground wherein the water gets accumulated in the same place. Such measures lead to water logging and stagnation which enhances the liability of mosquito borne diseases like dengue and malaria. In girl's hostel sanitary napkins are disposed in the ground by digging the soil near the surrounding areas. This improper disposal of waste leads to soil contamination wherein it pollutes the natural environment.



l) Disposal of wet waste in hostel campus



m) Disposal of wet waste in women's hostel campus



n) Disposal of dry waste in women's hostel campus



o) Digging of waste water outside the women's hostel



p) Improper use of drainage system in women's hostel



q) Disposal of solid waste boy's hostel

Fig 4: Management of different types of waste in both Women's and Boy's hostel

Suggestions and recommendations

1. In both college and hostel campus, we can keep a set colour coded dustbins such as green, blue, yellow and black colour for different waste materials whereas and these bins shall be properly labelled.
2. In hostel campus also install two bins, one for kitchen's dry waste and one for wet waste.
3. Trained the students, teaching and non-teaching staff, housekeeping staffs in segregation.
4. The large amount of leaves can be composted using the method of mesh composting by setting up the composting unit and also trained people to run the composting units.
5. The Authority can opt to compost the wet waste inside the hostel campus by the method of tank composting. The compost might be used in the garden.
6. Tie up with Community bin of Abhayapuri Municipality for recycling and disposal of solid waste generated in the college campus which can be reused.
7. Organic manure can be produced from biological waste generated in the college campus and further this can be used for the plants in the college campus.
8. Use micro methodology in laboratory so that chemical waste is reduced and minimum amount of wastes are produced.
9. Organic waste generated in the campus can be used in vermicomposting which is initiated by Botany department.
10. To reduce waste at college, Authority can practice waste management education through lectures, advertisement on notice or boards displaying slogans on boards in the campus.

3. ENERGY AUDIT

SUMMARY OF THE ENERGY AUDIT:

Details of the energy audit conducted in the campus of Abhayapuri College are furnished in this report under different sections. The report is based on detailed study including analysis of available data as well as findings based on inspections. The entire exercise is aimed to detect wastage of energy in onehand and to identify energy saving potential on the other.

Key findings –

- The campus consumes 32300 units of electrical energy from APDCL per year which is based on consumption data for 2019-20.
- Energy Performance Index for the same year is 6.71, which may be considered to be fairly good. (details in para- 6.6)
- Annual cost of electricity (for 2019-20) is Rs 2,92,074.00 This amount is without the surcharge on arrear paid during the year.
- In the whole year of 2018-19 and even from around half year before, the electricity bills were served on assessment basis, on the basis of an assessed consumption of 99.86 Kwh per day. Average per day actual billed unit in the following year - 2019-20 which was based on actual meter readings, was 89.18 Kwh. From the above data, it is seen that the daily consumption considered in 2018-19 for assessed bills was higher than the actual average daily consumption found from meter readings in 2019-20. Even ignoring the fact that normally there is an increasing trend in power consumption, there was over billing to the extent of 11.97% in 2018-19 compared to 2019-20. Thus, in the year 2018-19, overbilling was done to the extent of around 4216 Kwh (billed unit of 18-19, 36512 – billed unit of 19-20, 32296 Kwh). In terms of money, extra billed amount was Rs 28,668.80. Thus the college had to make an additional payment of around Rs 28,669.00 in the year 2018-19 as a result of non-installation of meter by APDCL. (details in para- 6.4.1)
- Electricity bills were served at highly irregular intervals for most of the years- 2018-19 and 2019-20. It may be seen in the report that bills were served for periods ranging from 6- 10 months. This caused serious problem for the college authorities to clear the payment on time. As a result, the college had to pay huge amounts as surcharge in 2018-19 and 2019-20. This has been elaborately discussed in para- 6.4.2
- There is scope for saving in power consumption in the lighting system by replacement of existing lights by energy efficient lights. (Details in para- 6.1)
- The room air-conditioners installed in the buildings are with conventional compressors. Though inverter-based room air conditioners are judicious options for energy efficient performance, the replacement of the existing room air-conditioners by inverter air-conditioners has not been recommended due to high-cost implications and long payback period. Instead, measures for running and maintaining the existing air conditioners for optimum energy efficient performance have been suggested. (Details in para- 6.2)
- Attention is needed in the reactive power management of the campus. The college was deprived from the benefit of power factor rebate in 2018-19, as no power factor record was shown in the bills as the meter was stopped/ damaged. In parts of 2019-20 also, power factor record was not shown resulting in deprivation of the college from the benefit. Power factor has been found to be properly recorded only in the bills of 2020-21. Since maximum rebate is available at power factor above 0.97, it should be targeted to maintain power factor at around 0.99 consistently throughout the year by installation of APFC panels. In the year 2020-21 (up to Feb'21) the college was deprived from rebate to the tune of Rs 771.00 for not maintaining the power factor above 0.97 in couple of months. This has been elaborately discussed in para- 6.3

- Installation of roof top solar panels has been suggested for utilization of greenenergy and also to relieve the college from the burden of high electricity bills
- It is also suggested to involve students in energy conservation through launching of enrolment of GREEN VOLUNTEERS from students

SUMMARY OF RECOMMENDATIONS/ SUGGESTIONS

Items	Recommendations/ Suggestions
Lighting system (Details in para-6.1)	<ul style="list-style-type: none"> i) It is suggested to replace the fluorescent tubes by LED tubes, which will yield an annual saving of Rs 18,751.00 to the college ii) Similarly, it is also suggested to replace the CFL lamps by LED lamps which is likely to save Rs 2614.00 annually. iii) Only few number of incandescent bulbs installed in the college buildings (only 8) should also be changed by LED lamps. This would yield an annual saving of Rs 3376.00
Air conditioners (Details in para-6.2)	Though inverter based room air conditioners are judicious options for energy efficient performance, Though inverter based room air conditioners are judicious options for energy efficient performance, the replacement of the existing room air-conditioners by inverter air-conditioners has not been recommended due to high cost implications and long payback period. Instead, measures for running and maintaining the existing air conditioners for optimum energy efficient performance have been suggested. However whenever new ACs are procured either for new installation or for replacement of existing ones, it is suggested that inverter based ACs with BEE star rating (if available) should be procured.
Reactive Power Management (Details in para-6.3)	It is recommended to maintain power factor at around 0.99 consistently throughout the year by installation of APFC panels. On the basis of annual consumptions of 2019-20, there is a potential to save Rs 6395.00 per year through rebates on power factor with maintenance of power factor above 0.97.
Students' involvement in energy conservation (Details in para-7)	<ul style="list-style-type: none"> i) Awareness should be created among the students to inculcate the habit of switching off the fans, lights and air-conditioners whenever no student is present in the class room, laboratory etc. This may reduce the power consumption to a great extent and will avoid wastage of power. Such habits will also help the students in saving power at theirhomes. ii) It is suggested to form a society of GREEN

	VOLUNTEERS from students to take up energy conservation and environmental activities in the place of study, home and society including creating awareness among the students and society.
Installation of roof topsolar plant (Details in para-8)	It is suggested to explore the feasibility of installing roof top solar plant in the college building. Initially it is suggested that a roof top plant of 10/15 KWp be installed. There are two business models for installation of solar PV plant- CAPEX & RESCO which are explained in the relevant para. It is shown that if a solar plant of 10 KWp is installed in RESCO model, annual saving to the college should be around Rs 43,099.00.

SCOPE OF WORK:

The scope of this energy audit includes-

- Collection of all relevant data, documents, electricity bills, log books relating to electricity use operation etc.
- Inspection of the buildings and installations.
- Interview, interactions with management, operation and maintenance personnel.
- Analyze the data to evaluate assess energy use and to suggest measures to save energy use and improve performance.
- Scope includes all sectors like HVAC, lighting and other power loads including electrical distribution system.

BASIC DATA OF THE CAMPUS:

The campus houses a combination of multi-storeyed as well as Assam type buildings are accommodating administrative offices, class-rooms, laboratories, conference rooms etc. Power supply is taken in the campus at single point from APDCL in 11KV through a 63KVA, 11/0.433KV transformer.

Table-1: Main buildings

Sl.No	Buildings	Floor area (Sqm)		Purpose of use
		Excludin gcorridor	Including corridor	
1	Front RCC Building			
	Gr. floor	589.18	786.81	Principal, Vice Principal's rooms, administration/ staff office, GB room, TCR, smart classroom etc.
	1 st floor	619.96	759.58	Education department, classrooms, seminar hall,

				library, reading room etc.
	2 nd floor	577.86	776.12	Class rooms, IT lab, datacentre, tech meeting rooms etc.
2	New RCC Building			
	Gr. floor	125.42	194.54	Class room
	1 st floor	125.42	194.54	Class room
3	Physics, Chemistry Block- AT	608.57	653.58	Class rooms, laboratories, Teachers' common room etc of Physics & Chemistry departments
4	Back Block- AT	401.92	508.83	Geo TCR, labs, classrooms etc.
5	Hall North Zoo-Botany Block- AT	802.19	1017.44	Labs, classrooms, TCR, halls, etc of Bot & Zoo department
6	KKHSOU-Canteen-Nano Lab Block- AT	282.05	344.39	Nano lab, class room, IQAC room, KKH, Canteen etc.
7	Room 3 & 4 Block(Middle Block)- AT	430.02	637.06	TCRs of Philosophy, Assamese, History, Arabic and classrooms.
8	Room-20 & 21- AT	218.23	344.34	Class rooms
9	Union Body Room- AT	26.57	26.57	Union body office
	Total	4807.39	6243.80	

Observations on the available documents/ data relating to electricity use:

The analysis made in this report is mainly based on the electricity bills available on records and produced before the auditor. However, few bills could be found from records. The consumptions and amount of these bills are assessed from the meter readings from the immediate previous and next bills and prevailing tariff respectively. In specific, following observations are made in respect to the electricity bills from APDCL on the basis of which analysis are made-

For the entire year 2018-19, electricity bills were served on the basis of assessed consumptions as the meter was reportedly stopped/ damaged. In fact, most of the bills in the preceding year also were served on assessment basis only.

- Bills were served rather irregularly and even one bill was served for a period of about six months (184 days, from 3-10-18 to 05-04-19). As a result, it became difficult for the college to clear the huge amount of accumulated bill. Due to this, the college had to pay huge amount in terms of surcharge on arrears.
- Bills were served considering a consumption of around 99.86 units per day, which was almost 11.97% higher than the average billed units of 89.18 per day for the year 2019-20 which was based on actual meter reading.
- As the bills were not based on meter readings, no data in respect to the power factor were available in the bills. From the data recorded in the bills of subsequent years (2020-21 where proper records of power factor were available in the bills) after installation of the new meter, it is seen that the actual power factor of the college ranges

from 0.95 to 0.99. Thus, the college was deprived from the rebate on power factor due for power factor of 0.95 and above. It is to be noted that as per the APDCL tariff, rebate on power factor is admissible in percentage of monthly consumptions as follows- from 0.85 to 0.95: 1 %, from 0.95 to 0.97: 2% and from 0.97 to 1.0: 3%.

Bills were served on the basis of meter readings from 2019-20 onwards effective from 05-04-2019. However, in this year also, there were issues relating to submission of bills and data recorded on the bills:

- First bill of 2019-20 was served for a period of almost 10 months (302 days, from 05-04-19 to 01-02-20). This also caused a huge burden for payment as the bill amount was very high. Consequently, the college had to pay extra amount by way of surcharge on arrears.
- Though the bill (05-04-19 to 01-02-20) was served on the basis of meter readings, the relevant data like maximum recorded demand, power factor etc, were missing. Also, the bill was not prepared as per applicable tariff as the LTMU, power factor rebates were not shown.

In the year 2020-21, bills were served almost regularly, except for the first two bills which had some anomalies-

- The first bill was served for a period of 61 days (from 01-04-20 to 01-06-20).
- The bill had shown a power factor of 0.85 which seemed to be unrealistic when compared with the power factors recorded in other bills which ranged from 0.95 to 0.99. The maximum recorded demand was not shown in the bill.
- The second bill was served for a period of 60 days- from 02-08-20 to 31-07-20. Apart from the period, which was for two months, this bill had properly shown all the relevant data like maximum demand, power factor etc.
- All the subsequent bills for the year were however found to be normal with proper records of all relevant data.

Basic electricity data of the campus:

The electricity data made available to the auditor along with data collected/ acquired from site visit, interactions with the faculty and staff, have been analyzed with the objective of assessing the energy saving potentials, which are elaborately stated in the following sections of the report. The key electricity data of the campus are shown in Table-2.

Table-2 : Basic data of electricity in the campus

Sl No	Details	Data		
1	Sanctioned load KW (KVA)	39 KW (46 KVA)		
2	Supply Voltage from utility	11 KV		
3	Installed transformer capacity	1 X 63 KVA		
4	Installed capacity of DG set	1 X 62.5 KVA (3 Phase)		
		1 X 15 KVA (1-Phase)		
		Total- 77.5 KVA		
5	Annual Electricity Consumption Data	2018-19	2019-20	2020-21 (up to Feb'21)

5.1	Annual electricity consumption from utility (as per bills from utility)	36512 Kwh (Assessed bill, not based on meter)	32300 Kwh	25210.41 Kwh
5.2	Annual electricity consumption from DG set	Data not available	Data not available	Data not available
5.3	Total annual electricity consumption (5.1 + 5.2)	36512 Kwh	32300 Kwh	25210.41 Kwh
6	Annual Cost of electricity	2018-19	2019-20	2020-21(up to Feb'21)
6.1	Purchased from utility(including elect charge, fixed charge & elect duty etc after considering all admissible rebates including surcharge on arrear)	Rs 3,57,379.00 (Assessed bill, not based on meter)	Rs 3,66,263.00	Rs 2,62,095.00
6.2	Cost of HSD consumed by DG sets	NA	NA	NA
6.3	Total electricity cost	Rs 3,57,37900	Rs 3,66,263.00	Rs 2,62,095.00
7.0	Major loads apart from light, fan, and small equipment, appliances etc-			
7.1	Unitary air- conditioners	15 X 1TR 5 X 1.5 TR 2 X 2 TR		
7.2	Water pump	5 X 0.5 HP		

ELECTRICITY CONNECTION & POWER CONSUMPTION DETAILS-

Power connection in the campus is provided in 11 KV. The substation consists of 1 X 63 KVA, 11 0.433KV transformer. From The contract demand for the campus is 39KW (46KVA).The college campus has 2 (two) DG sets- 1X 62.5 KVA (3-phase) and 1X 15KVA (1- phase) to cater for the standby power needs.

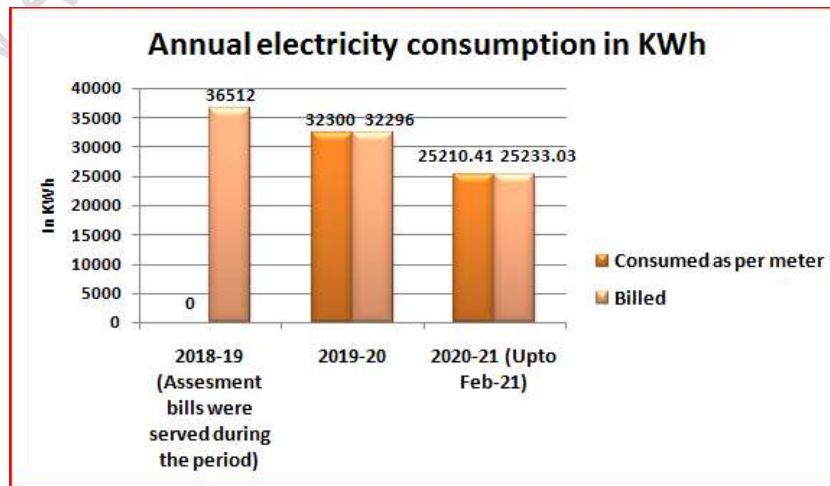
Electrical energy consumptions from APDCL source:

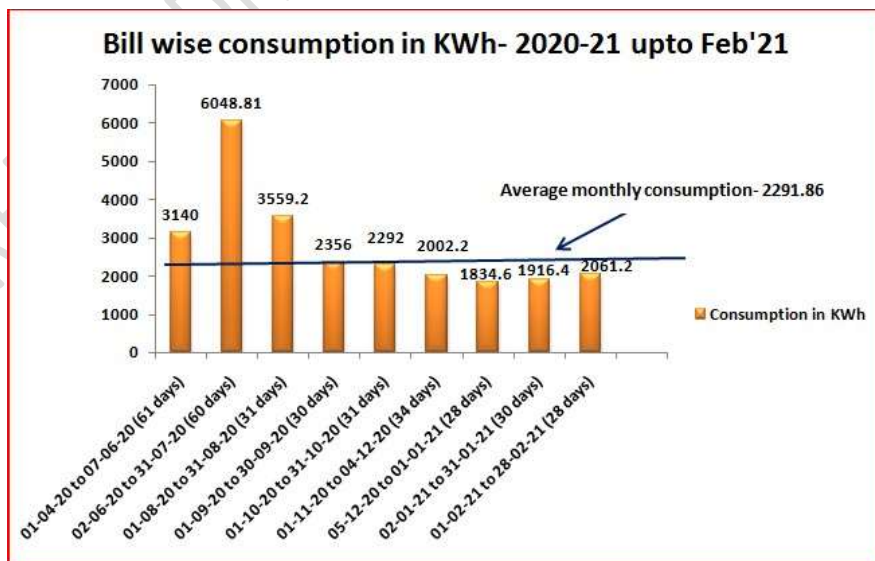
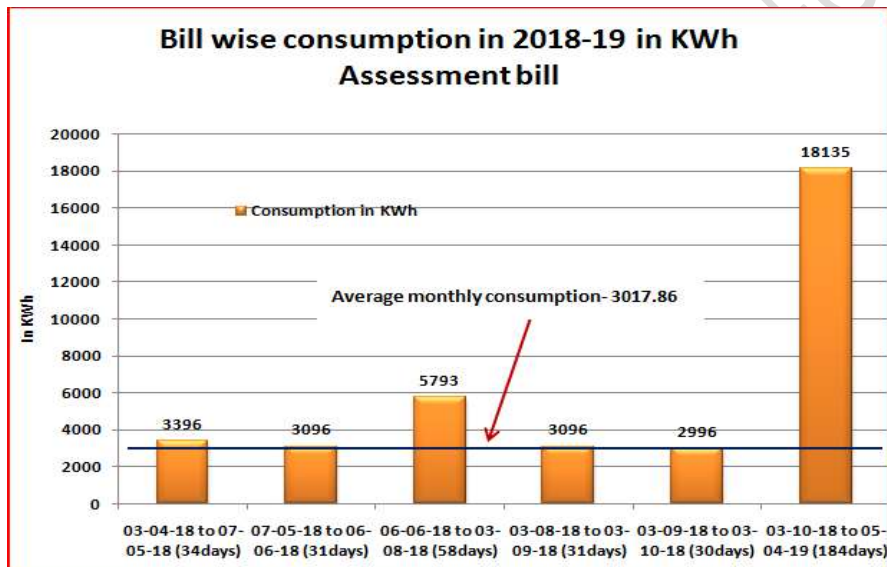
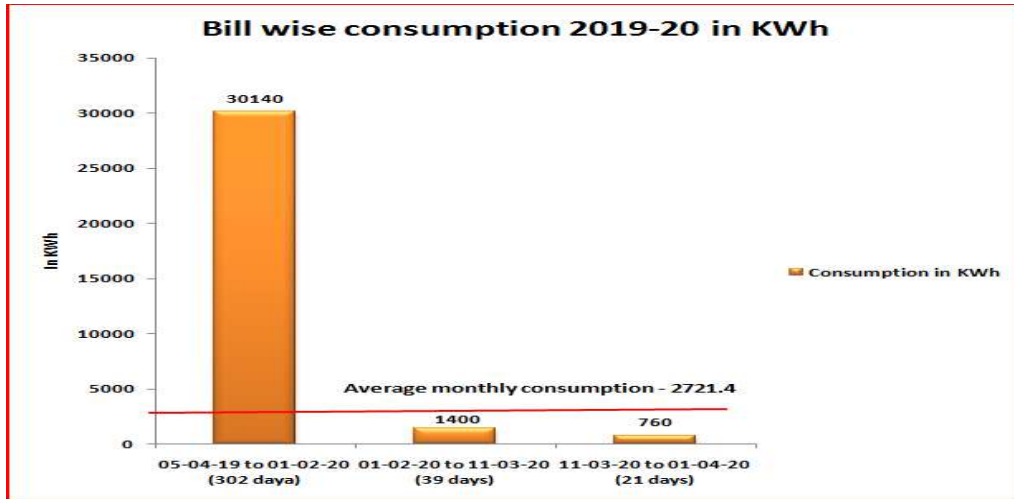
Electricity consumption details of the college campus for the years 2018-19, 2019- 20 & 2020-21 (upto Feb'21) are furnished in Annexure-1. The summary electricity consumption data from APDCL are shown Table-3 below-

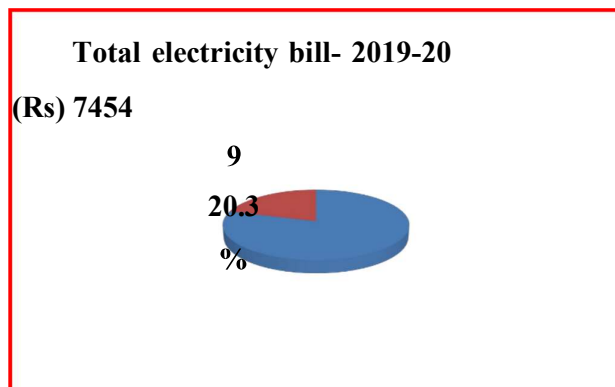
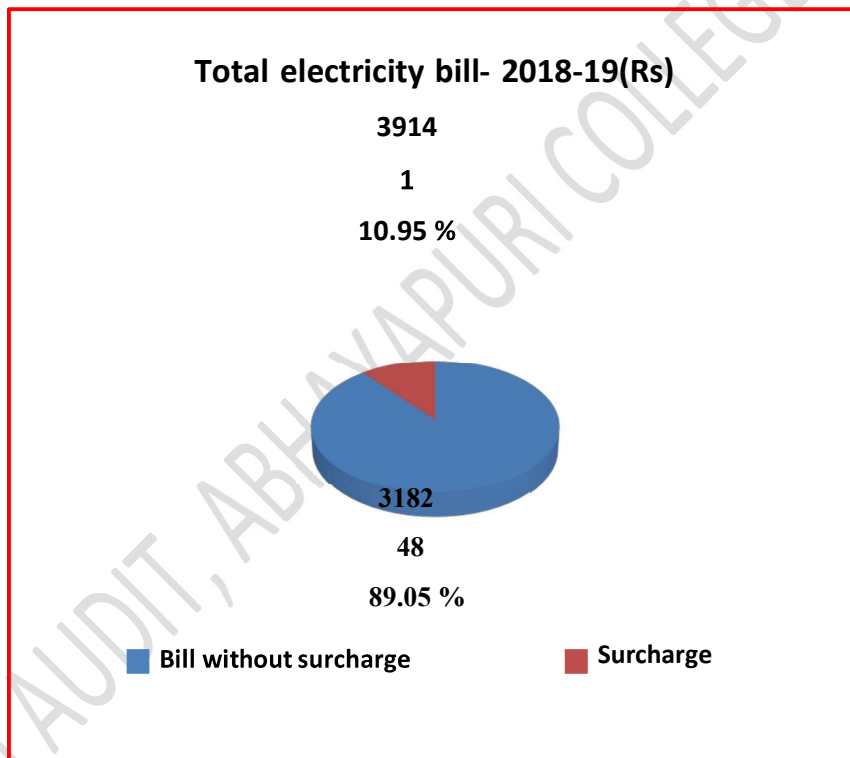
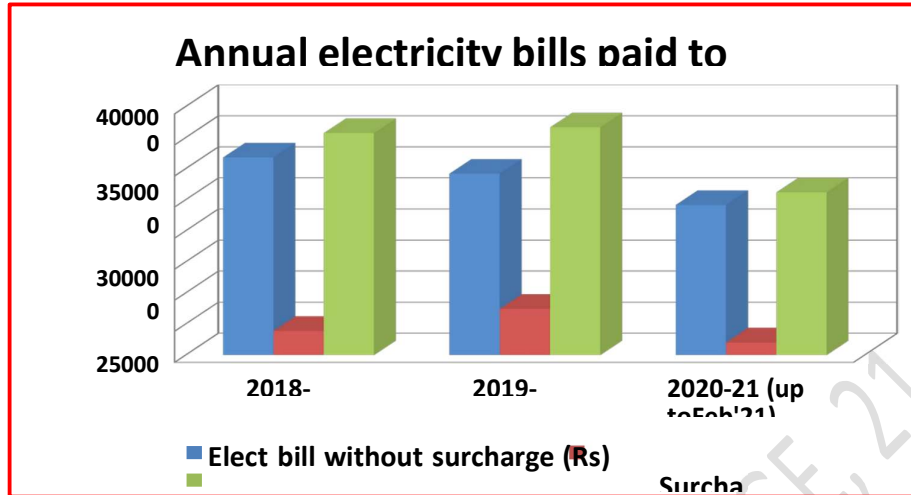
Table-3
Summary of electricity consumption & other important data from APDCL bills

Sl.No	Description	Data		
		2018-19	2019-20	2020-21 (up to Feb'21)
1	Total Electricity consumption (KWh)	37011 (assessed bill)	32300	25210.41
2	Total units billed	36512	32866	25233.03
3	Monthly average electricity consumption (KWh)	3017.96	2721.4	2291.85
4	Total annual electricity cost without surcharge on arrear (Rs)	3,18,238.00	2,92,074.00	2,41,682.00
5	Total annual surcharge paid on arrear (Rs)	39,141.00	74,549.00	20413.00
6	Total annual electricity cost including surcharge on arrear	3,57,379.00	3,66,623.00	2,62,095.00
7	Monthly average electricity cost, on data at sl-4 (Rs)	26,519.83	24339.50	21971.10
8	Maximum recorded monthly power factor	NA	0.95 (In the bill: 01-02-20 to 11-03-20))	0.99 (June-Aug'20)
9	Minimum recorded monthly power factor	NA	N/A	0.85 (In the bill: 01-04-20 to 01-06-20))
10	Maximum recorded demand (KVA)	NA	N/A	23.52 (Oct.20)
11	Minimum recorded demand (KVA)	NA	N/A	9.28 (Dec'20 & Jan'21)

It may be noted that as per tariff, the unit billed (sl-2 of the table) is calculated after adding 3% towards metering done on the LT side (LTMU charge) of the Transformer and adding or deducting penalty or rebate on power factor, as applicable, on consumed units. However, in the assessment bills served in 2018-19 and also in the first bill of 2019-20, these details were not shown.







Standby DG Set:

The college has 2 (two) DG sets- 62.5KVA and 15KVA. However details of operating data and log book were not available. The college authorities are requested to maintain the record of date wise operation data with on- off timings, HSD stock and procurement details for post audit review.

ELECTRICAL LOADS:

Main electrical load in the college consists of lights, fans, split type air-conditioners and laboratory instruments and appliances and few low capacities water pumps and water coolers. Details of lights, fans and air- conditioners are shown in Table-4, below-

Table-4
Details of lights, fans & air-conditioners

Building	Floor area (Sqm) Excl corridor (Incl corridor)	Fan	Lights					UPS	AC
			LED bulb	CFL bulb	Inc bulb	LED tube	Fl. tube		
RCC Gr Floor(Front block)	433.57 (585.58)	36	1	31	0	12	5	1X3KVA	2X1TR 1X1.5TR
RCC 1st Floor (Oldpart)	289.32 (368.98)	19	0	10	0	7	18		4X1TR 1X1.5TR
RCC 1st Floor (Oldpart, Central Library)	330.64 (390.60)	26	13	8	0	6	1		3X1.5TR
RCC 2nd Floor (Oldpart)	238.94 (287.63)	27	0	0	0	11	4		6X1TR
RCC 2nd Floor (Oldpart- RCC1, RCC2 Block)	338.92 (488.49)	21	0	12	0	10	0	1X30KV A	1X1TR 2X2TR
RCC Building (NewPart, GF)	155.61 (201.23)	14	0	5	0	2	14		
New RCC Building(Room RCC-6&7)	250.84 (389.07)	16	0	0	0	12	0		
Physics, ChemistryBlock- AT	608.57 (653.58)	29	3	10	4	6	14	1X3KVA	
Back Block- AT	401.92 (508.83)	23	9	2	2	0	1		
Hall North Zoo- Botany	802.19 (1017.44)	44	0	14	0	6	11		

Block- AT									
KKHSOU- Canteen- Nano LabBlock- AT	282.05 (344.39)	16	1	7	2	0	11		2X1TR
Room 3 & 4 Block(Middle Block)- AT	430.02 (637.06)	46	4	1	0	19	14		
Room-20 & 21- AT	218.23 (344.34)	17	0	0	0	9	0		
Union Body Room-AT	26.57 (26.57)	1	0	0	0	0	1		
Total	4807.39 (6243.79)	335	31	100	8	100	94	2X3KVA 1X30KV A	15X1TR 5X1.5TR 2X2TR

It may be seen from the above table that while LED lights (lamps and tubes) are being installed in the college, still there are substantial numbers of CFL lamps and fluorescent tube lights. Also, there are handful numbers of incandescent lamps in the college building. Split air conditioners installed are with conventional compressors, not the latest energy efficient versions like inverter types.

REVIEW & ANALYSIS OF THE DATA & THE SUGGESTIONS / RECOMMENDATIONS:

Lighting system:

Replacement of fluorescent tube by LED tube: There seems to be energy saving potential by replacement of fluorescent tubes by LED tubes. The 36 W fluorescent tubes may be replaced by 18 W LED tubes which has better light output than the fluorescents. The power input comparison of the two types are shown in Table-6 below-

Table-6
Input power comparison of fluorescent tube with LED tube

Type of light	Lamp watt	Ballast factor	Input power drawn (watt)
Fl. tube	36	0.88	40.9
LED tube	18	1	18
Difference			22.9

The difference in input power drawn by one LED (18 W) tube against one fluorescent tube (36 W) is shown in the above table. Saving in power consumption and corresponding amount in Rs per year by replacement of 94 fluorescent tubes are shown in Table-7. The assessment is based on consideration of average burning hours per day as 6 hours and yearly college opening days as 220 days.

Table-7
Saving by replacement of fluorescent tubes by LED tubes

No of lights	Difference in input power per light	Hours of operation per day	No of opening days per year	Saving in power consumption per year per light (2X3X4)	Saving in power consumption per year by replacement of all fl. tubes (1X5)	Yearly saving in Rs at supply tariff of Rs 6.60 per Kwh
1	2	3	4	5	6	7
94	22.9 W	6 hrs	220 days	30228 Wh 30.228 Kwh	2841432 Wh 2841.4 Kwh	18,751.00

Replacement of Compact Fluorescent lamps (CFL) by LED lamps: There are altogether 100 CFL lamps of different wattage in the college buildings. CFLs are considered to have lower efficiency in terms of light output per watt (light efficacy) compared to LED lamps. LEDs have also better advantage in terms of life (total burning hours). Moreover, CFLs (also, all fluorescent lamps) are considered to be environmentally harmful for disposal as they contain some amount of mercury. Considering the above advantages, the CFL lamps may be changed by LED lamps. It may be mentioned that cost of LED lamps and CFL lamps are almost similar. It is therefore suggested that all CFL lamps may be changed by 12W LED lamps. Consequent saving in power consumption and corresponding amount in Rs per year due to replacement of 100 CFL lamps by LED lamps are shown in Table-8. The assessment is based on consideration of average burning hours per day as 6 hours and yearly college opening days as 220 days. While actually, wattage of CFL lamps installed are different, in the assessment, CFL lamps are considered as 15W on uniform basis.

Table-8
Saving by replacement of CFL lamps by LED lamps
(Replacement of 15 W CFL lamps by 12 W LED lamps)

No of lamps	Difference in input power per lamp	Hours of operation per day	No of opening days per year	Saving in power consumption per year per lamp (2X3X4)	Saving in power consumption per year by replacement of all CFL lamps (1X5)	Yearly saving in Rs at supply tariff of Rs 6.60 per Kwh
1	2	3	4	5	6	7
100	3 W (15-12) W	6 hrs	220 days	3960 Wh 3.96 Kwh	396000 Wh 396.00 Kwh	2,614.00

Replacement of incandescent lamps by LED lamps:

The population of incandescent lamps in the college building is very nominal, only 8. Considering the fact that LED lamps consume almost 75 to 80% less energy than incandescent lamps, use of incandescent lamps should be avoided. As such, the incandescent lamps, though nominal, should

be replaced by LED lamps. All incandescent lamps may be replaced by 12 W LED lamps. Assessment of saving, considering the incandescent bulbs as 60 W, is shown in Table-9 below-

Table-9
Saving by replacement of incandescent lamps by LED lamps
(Replacement of 60 W Incandescent lamp by 12 W LED lamp)

No of lamps	Difference in input power per lamp	Hours of operation per day	No of opening days per year	Saving in power consumption per year per lamp (2X3X4)	Saving in power consumption per year by replacement of all CFL lamps(1X5)	Yearly saving in Rs at supply tariff of Rs 6.60 per Kwh
1	2	3	4	5	6	7
8	48 W (60-12) W	6 hrs	220 days	63360 Wh 63.36 Kwh	506880 Wh 506.880 Kwh	3376.00

Air-conditioners:

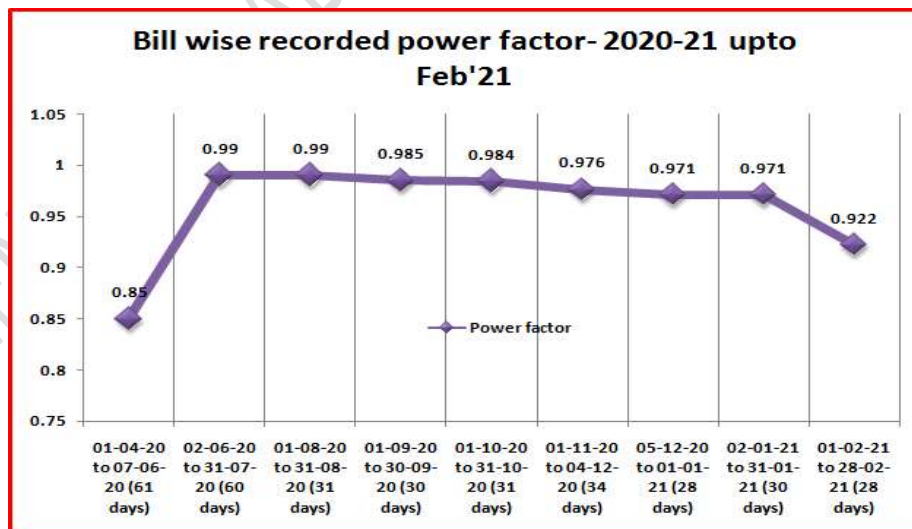
There are altogether 22 split air- conditioners (15 X 1TR + 5 X 1.5TR + 2 X 2TR) in the college buildings which constitute the major share of power consumption during the summer. Air conditioners are with conventional compressors and not with energy efficient inverter compressors. While the air conditioners based on inverter technology are considered to be much more energy efficient compared to the conventional air conditioners, considering the cost implications and long payback period as the use of ACs is limited to only few months of a year, replacement of the existing ACs has not been suggested. However, it is recommended that whenever new air-conditioners are purchased for new installation or replacement of any of the existing ones, inverter air-conditioners with energy efficient star labeling by BEE (Bureau of Energy Efficiency), if available, should be purchased. It is to be mentioned that the energy efficiency data provided by the manufacturer for a particular model are achieved under the designed weather conditions and most importantly, if the air-conditioners are properly maintained. Few tips for use of the air-conditioners are suggested below to achieve optimum energy efficiency-

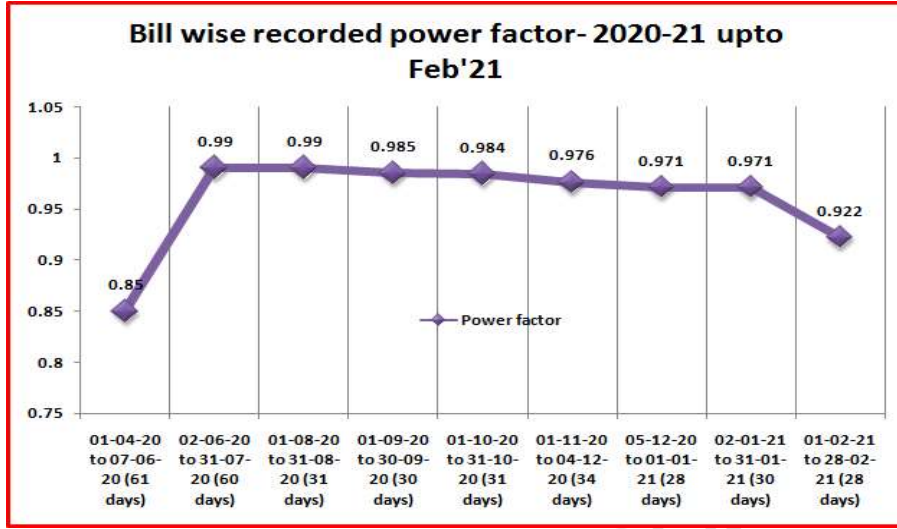
- a) Govt of India has now made the default temperature setting of 24°C mandatory for all room air-conditioners. This means that all new room air-conditioners henceforth will come with default temperature setting of 24°C. It is to be noted that approximately 5-6% power consumption can be reduced by raising one degree centigrade temperature setting of the air conditioners. For example, if temperature setting is increased from 20°C to 24°C, power consumption will be reduced by 20%, considering 5% reduction per °C. **Therefore, it is recommended that temperature setting of all room air- conditioners (unless for specific application), should be maintained at 24°C.**
- b) All air conditioned spaces should be properly sealed to avoid entry of ambient air, and windows should be curtained to avoid outside heat gain.

- c) Air conditioners should be properly maintained. Particular attention should be given to clean the air filters of the indoor units regularly and also the condenser coils of the outdoor units. Dirt and dust deposits result in clogging of the air filters which causes increase in power consumption besides reducing the cooling effect. Dirty and clogged airfilters cause as high as 10-12% more power consumption.

Reactive power management :

- a) As mentioned in para 3.2.1(c), APDCL tariff has provision for rebate on power factor in percentage of monthly consumptions as follows- from 0.85to 0.95 - 1 %, from 0.95 to 0.97 – 2% and from 0.97 to 1.0 – 3%
- b) In whole of 2018-19 and part of 2019-20, the college has been deprived of the benefit of this rebate on power factor for absence of records of power factor in the bills. Actual data of power factors are only available in the bills of 2020-21. After carefully examining the data for 2020-21 also, the power factor (0.85) shown in the bill for the period 01-04-20 to 01-06- 20, seems to be unrealistic and suspected to be erroneous as the same isinconsistent with the recorded power factors in all the subsequent months.
- c) As maximum rebate of 3% is available on power factor from 0.97 to 1.0, itshould be targeted to maintain the power factor consistently in every month above 0.99 to derive the maximum benefit. For maintaining the power factor at such level consistently, APFC (Automatic Power Factor Correction) panels need to be installed. To decide the capacity and specification of the APFC panel, actual data of maximum demand and power factor for the whole year is necessary. The relevant data available for the college is for the year 2020-21, which cannot be considered to be actual and realistic as most of the periods were under lockdown due to pandemic. Nevertheless, the data are shown in the charts below-





The rebates on power factor received against receivable (if power factor was maintained at 0.99 in every month) in 2020-21, up to Feb'21 are shown in the table below-

Table-10
Rebates on power factor Achievable against actual

Description	2020-21 (up to Feb'21)	
	In Kwh	In Rs (@6.60kwh)
Annual consumption	25210.41	-----
Rebate achievable (3%)	756.31	4,991.65
Actual rebate obtained	639.52	4,220.83
Difference	116.79	(Loss) 770.82

It may be noted that above data are for 2020-21 which may be below the normal consumption as most of the periods in the year were under lockdown. Moreover, the data are for 11 months only (up to Feb'21). Considering the basis for yearly consumption of 2019-20, during which the college was normally functioning except for the last week, annual consumption may be taken as 32300 Kwh. On that basis, yearly achievable rebate on power factor is 969.00 Kwh (3% of 32300) and yearly achievable rebate in terms of money would be Rs 6395.00 (at energy charge of Rs 6.60).

Review of yearly consumption and bill amounts:

It may be seen that the whole year of 2018-19 and even from around half year before, the bills were served on assessment basis, considering an assessed consumption of 99.86 Kwh per day. Average per day actual billed unit in the following year - 2019-20 which was based on meter reading, was 89.18 Kwh. It may be seen from above that average daily consumption considered by APDCL for serving assessed bills in 2018-19 was higher than the average daily consumption found from actual meter readings in 2019-20. Even if we ignore the fact that normally there is an increasing trend in power consumption, there was over billing to the extent of 11.97% in 2018-19 compared to 2019-20. Thus, in the year 2018-19, overbilling was done to the extent of around 4216 Kwh (billed unit of 18-19, 36512 – billed unit of 19-20, 32296 Kwh). In terms of money,

extra billed amount was Rs 28,668.80. Thus, the college had to make an additional payment to the tune of Rs 28,669.00 in the year 2018-19 as a result of non-installation of meter by APDCL. From the data shown in table-3 and also in the charts, the college had to pay Rs 39,141.00, Rs 74,549.00 and Rs 20,413.00 as surchargeon arrears in the years 2018-19, 2019-20 and 2020-21 respectively, These constituted 10.95%, 20.3% and 7.8% of the total billed amounts of the respective years.

Ceiling fans:

There are 335 ceiling fans in the college buildings, most of which are old fans. Presently, star labeled ceiling fans are available under BEE star labeling scheme. It is suggested that whenever, new fans are procured; only 5 star rated ceiling fans are selected.

Building Energy Performance Index:

The Energy Performance Index of the buildings in the campus, which is denoted by electricity consumption in Kwh per year per sqm of built up area for the years 2018-19 & 2019-20 are as follows-

2018-19: 7.6 Kwh/ Sqm

2019-20: 6.71 Kwh/ Sqm

As consumption data for full 2020-21 is not available, the EPI for 2020-21 has not been calculated. Moreover, as a long period in the year was under lockdown, the calculated index would not be realistic. From the index calculated for the two years as shown above, EPI for 2018-19 cannot be considered as actual since consumptions for the year was not based on actual meter reading. **Therefore, EPI of 6.71 (for the year 2019-20) may be considered as realistic figure for the analyzed period.**

STUDENTS' INVOLVEMENT IN ENERGY CONSERVATION:

It is highly essential and also will prove to be beneficial for the college, to create awareness among the students to inculcate the habit of switching off the fans, lights and air-conditioners whenever no student is present in the class room, laboratory etc. This may reduce the power consumption to a great extent and will avoid wastage of power. Such habits will also help the students in saving power at their homes.

FORMATION OF GREEN VOLUNTEERS:

It is suggested to form a society of GREEN VOLUNTEERS from students to take up energy conservation and environmental activities in the place of study, home and society including creating awareness among the students and society. They may also take up the responsibility of easy measures like switching off the fans, lights and air-conditioners whenever no student is present in the class room, laboratory etc. as suggested at 6.7.1 above. They may also be encouraged to organize awareness programmes on energy conservation and environment.

INSTALLATION OF SOLAR ROOF TOP PLANT:

There is scope for installation of roof top solar plant in the college building. Considering

the roof top spaces, it is feasible to install solar plants of around 100 KWp capacity on the roof tops of the buildings. However, a feasibility study shall have to be conducted to actually assess the capacity. As per the recent energy audit conducted by this energy auditor in Guwahati, roof solar plants have been found to generate 3.28 Kwh per KWp per day on the basis of yearly average in Guwahati weather, which should be similar to Abhayapuri.

There are two options available for executing the project- CAPEX or RESCO. In CAPEX mode entire capital expenditure is borne by the owner and the plants remain as the property of the owner. In RESCO mode, the agency bears the investment and also maintains the system. The owner shall have to buy the units generated from the plant as per purchase agreement with the RESCO agency as per agreed tariff. Present solartariff is around Rs 3.00 per Kwh. The capital cost on the other hand is around Rs 40,000.00 per KWp for grid interactive solar plants.

It is suggested that initially a plant of 10/15 KWp capacity may be installed. Considering execution in RESCO mode, calculation for a 10 KWp plant is shown below-

Table-11
Saving from installation of a 10 KWp roof top solar plant

Capacity (KWp)	Yearly generation from solar @ 3.28 Kwh/ day/ KWp(Kwh)	Purchase cost for solar @ Rs 3.00 per Kwh (Rs)	Cost, if purchased from APDCL @ Rs 6.60 per Kwh (Rs)	Yearly saving (Rs)
10	11972 Kwh	35,916.00	79,015.00	43,099.00

4. GREEN AREA AND FLORAL AUDIT

1. Introduction

All plant and animal species are linked together in a complex web of life; we depend upon biodiversity for our survival. Biodiversity is the key to healthy ecosystems and ultimately a healthy planet. It keeps the air and water clean, regulates our climate and provides us food, shelter, clothing, medicine and other useful products. Each part within this complex web diminishes a little when one part weakens or disappears. The modernization and industrialization are the two important outputs of twentieth century which have made human life more luxurious and comfortable. Today, people are getting more familiar to the global issues like global warming, greenhouse effect, ozone depletion and climate change etc. Simultaneously, human activities are the main cause of biodiversity loss. Habitat fragmentation, caused by urbanization and agriculture, overexploitation of resources, lead to depletion of species. Today, people are getting more familiar to the global issues like global warming, greenhouse effect, ozone

depletion and climate change etc. The time has come to wake up, unite and combat together for sustainable environment. University Grants Commission has mentioned „Green Campus, Clean Campus“ mission mandatory for all higher educational institutes.

Green Audit- a tool for Environmental Protection and Conservation. It is the most efficient ecological tool to solve such environmental problems. It is a process of regular identification, quantification, documenting, reporting and monitoring of environmentally important components in a specified area. Among various target areas of green auditing, green campus audit or floral audit is another most important one to control biodiversity exploitation.

2. Objectives:

- i. To study green cover of Abhayapuri College campus.
- ii. To study species diversity of woody and herbaceous vegetation in the College campus.
- iii. To explore potential of woody vegetation of the college campus as an oxygen source.

3. Benefits of the Green Campus/ Floral Audit

- i. To create a green campus.
- ii. To provide a basis for improved sustainability
- iii. Impart environmental education through systematic environmental management approach and improving environmental standards
- iv. Benchmarking for environmental protection initiatives
- v. Development of ownership, personal and social responsibility for the College
- vi. and its environment
- vii. Enhancement of college profile
- viii. Developing an environmental ethic and value systems in young people.

4. Methodology

A flora is work devoted to the plants of a particular region and restricted to the major segments of plant kingdom. The aim and methods of study flora and vegetation are different. Generally, a flora deals only with native plants of the given area and provides scope for further study with interdisciplinary significance. Studies on the flora of Assam started with the observation and writings of Buch Hamilton in 1820.

To study flora of Abhayapuri College, at first, all the secondary data required for the study was collected from various sources, like concerned departments of the college, students, teachers & all other staffs. The methodology of present study is basically based on onsite visits and personal observations. Depending upon the observations and data collected, interpretations were made. College records and documents were verified several times to clarify the data received through survey and discussions.



Fig 1: Data collection by green campus audit team along with students of Botany



Fig-2: Onsite Visit by Audit team in the college crop field, Bamungaon

The college and its premises were visited and analysed by the floral audit-team several times to gather information. Students of department of botany along with floral audit team took part in the data

collection of green auditing. The plant species of college campus including all three (College building, hostel and Bamungaon) were identified, trees were counted and data was tabulated. The audit team worked together, under the leadership of the lead auditor, to ensure completion with the brief and scope of the audit.

4. FINDINGS AND OBSERVATIONS:

After successful completion of site visiting, the audit team has identified important plant species from all three campus and plants were documented below.

Table-1: LIST OF PLANT SPECIES (MOSTLY HERB) IDENTIFIED DURING GREEN CAMPUS AUDITING

Sl. No.	Name of Plant Species	Family Name	No. of each species
Angiosperms			
1	<i>Acmella paniculata</i> Wall. ex DC.	Asteraceae	Numerous
2	<i>Ageratum houstonianum</i> Mill	Asteraceae	Numerous
3	<i>A. conyzoides</i> L.	Amaranthaceae	Numerous
4	<i>Actinidia deliciosa</i> A. Chev.	Actinidiaceae	One
5	<i>Alternanthera philoxeroides</i> (Mart.)	Asteraceae	Numerous
6	<i>A. sessilis</i> (L.) R. Br. Ex DC	Asteraceae	Numerous
7	<i>Axonopus compressus</i> L.	Poaceae	Numerous
8	<i>Aerua sanguinolenta</i> (L.) Blume	Amaranthaceae	Numerous
9	<i>Amaranthus viridis</i>	Amaranthaceae	Numerous
10	<i>A. tricolor</i>	Amaranthaceae	Numerous
11	<i>A. spinosus</i>	Amaranthaceae	Numerous
12	<i>Caladium bicolor</i> (Aiton) Vent.	Araceae	Numerous
13	<i>Cestrum nocturnum</i> L.	Solanaceae	Numerous
14	<i>citrus maxima</i> Merr.	Rutaceae	Numerous
15	<i>Cleome gynandra</i>	Cleomaceae	Numerous
16	<i>Cleome rutidosperma</i> DC.	Cleomaceae	Numerous
17	<i>Commelina communis</i> L.	Commelinaceae	Numerous
18	<i>crotalaria juncea</i> L.,	Leguminaceae	Numerous
19	<i>Desmodium triflorum</i> (L.) DC.	Papilionaceae	Numerous
20	<i>Dentelle repens</i> (L.) J.R. Forst.	Rubiaceae	Numerous
21	<i>Drymaria cordata</i> (L.) Willd. ex Schult	Caryophyllaceae	Numerous
22	<i>dypsis lutescens</i> H. Wendl.	Arecaceae	Numerous
23	<i>Eclipta prostrata</i> L.	Asteraceae	Numerous
24	<i>Euphorbia hirta</i> L.	Euphorbiaceae	Numerous
25	<i>Evolvulus nummularius</i> (L.) L.	Convolvulaceae	Numerous
26	<i>Heliotropium indicum</i> L.	Boraginaceae	Numerous
27	<i>Ixora chinensis</i> Lam.	Rubiaceae	Numerous
28	<i>Ixora finlaysoniana</i> Wall. ex G. Don.	Rubiaceae	Numerous
29	<i>justicia gendarussa</i> Burm. f.	Acanthaceae	Numerous
30	<i>kalanchoe pinnata</i> (Lam.) pers.	Crassulaceae	Numerous

31	<i>Leucus aspera</i> (willd.) Link	Lamiaceae	Numerous
32	<i>Leonurus sibiricus</i> L.	Lamiaceae	Numerous
33	<i>Lippia alba</i> L.	Asteraceae	Numerous
34	<i>Melastomamalabathricum</i> L.	Melastomataceae	Numerous
35	<i>Mimosa pudica</i> L.	Fabaceae	Numerous
36	<i>Ocimumgratissimum</i> L.	Lamiaceae	Numerous
37	<i>Ocimum sanctum</i> L.	Lamiaceae	Numerous
38	<i>Oxalis corniculate</i> L.	Oxalidaceae	Numerous
39	<i>Oxalis debilis</i>	Oxalidaceae	Numerous
40	<i>Paspalum conjugatum</i> Berg.	Poaceae	Numerous
41	<i>P scorbiculatum</i> L.	Poaceae	Numerous
42	<i>Persicaria chinensis</i>	Polygonaceae	Numerous
43	<i>Persicaria hydropiper</i>	Polygonaceae	Numerous
44	<i>Phyla nodiflora</i> (L.) Greene	Verbinaceae	Numerous
45	<i>Plectranthusscutellarioides</i>	Lamiaceae	Numerous
46	<i>Polygonum orientalis</i>	Polygonaceae	Numerous
47	<i>Pulmonaria obscura</i> Dumort.	Boraginaceae	Numerous
48	<i>Ravenia spectabilis</i> Engl.	Rutaceae	Numerous
49	<i>Rungia parviflora</i>	Acanthaceae	Numerous
50	<i>RungiaPectinata</i> (L.) Ness	Acanthaceae	Numerous
51	<i>Senna alata</i>	Caesalpinaceae	Numerous
52	<i>Senna occidentalis</i> (L.) Link	Caesalpinaceae	Numerous
53	<i>Sida cordifolia</i>	Malvaceae	Numerous
54	<i>Sidarhombifolia</i> L.,	Malvaceae	Numerous
55	<i>Solanum nigrum</i>	Solanaceae	Numerous
56	<i>Stellaria media</i> (L.) Villars	Caryophyllaceae	Numerous
57	<i>syzygiumcumuni</i> L.	Myrtaceae	Numerous
58	<i>syzygiumjambos</i> L. (Alston)	Myrtaceae	Numerous
59	<i>Teucrium scorodonia</i> L.	Lamiaceae	Numerous
60	<i>Tradescantia pallida</i> (Rose) D.R. Hunt	Commelinaceae	Numerous
61	<i>Verninia cinerea</i> (L.)	Asteraceae	Numerous
62	<i>Veronica serpyllifolia</i> L.	Plantaginacea	Numerous
63	<i>Zea mays</i>	Poaceae	Numerous
Gymnosperms			
64	<i>Araucaria Araucana</i>	Araucariaceae	2
65	<i>Cycas sp.</i>	Cycadaceae	6
66	<i>Pinus kesiya</i> Royleex Gordon	Pinaceae	2
67	<i>Thuja orientalis</i>	Cupressaceae	2
Pteridophytes			
68	<i>Pteris vittata</i>	Pteridaceae	Numerous
69	<i>Pteris multifida</i>	Pteridaceae	Numerous
70	<i>Diplazium esculentum</i>	Athyriaceae	Numerous

Table-2:List of Trees in the Abhayapuri College Campus (Including College building, Hostel & Auditorium)

Local Name	English Name	Scientific Name	Family	No. of species
1. Devdaru	Indian Mast Tree	<i>Polyalthia longifolia</i> (Sonn.) Thw.	Annonaceae	49
2. Devdaru (Pendula)	Indian Mast Tree	<i>Polyalthia longifolia</i> var. <i>pendula</i> (Sonn.) Thw.	Annonaceae	4
3. Australian Acacia	Ear Leaf Acacia	<i>Acacia auriculiformis</i> Benth.	Mimosaceae	2
4. Radhasura	Peacock Flower	<i>Caesalpinia pulcherrima</i> (L.) Sw.	Caesalpiniaceae	5
5. Arjun	Arjun	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	Combretaceae	2
6. Chaitan	Indian Devil Tree	<i>Alstonia scholaris</i> (L.) R. Br.	Apocynaceae	3
7. Bottlebrush	Crimson Bottlebrush	<i>Callistemon citrinus</i> (Curtis) Skeels	Myrtaceae	4
8. Rupahi	Silver Oak	<i>Grevillea robusta</i> A.Cunn. ex R.Br.	Proteaceae	1
9. Araucaria	Star Pine	<i>Araucaria heterophylla</i> (Salisb.) Franco	Araucariaceae (Gymnosperm)	2
10. Kadam	Kadam	<i>Anthocephalus cadamba</i> (Roxb.) Miq.	Rubiaceae	4
11. Sirish	Rain Tree	<i>Samanea saman</i> (Jacq.) Merr.	Mimosaceae	4
12. Aam	Mango	<i>Mangifera indica</i> L.	Anacardiaceae	3
13. Bogori	Indian plum	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	4
14. Sojina	Horseradish tree	<i>Moringa oleifera</i> Lam.	Moringaceae	2
15. BogiKoroi	White Sirish	<i>Albizia procera</i> (Roxb.) Benth	Mimosaceae	3
16. Gamari	Beechwood	<i>Gmelina arborea</i> Roxb.	Verbenaceae	4
17. Eucalyptus	Eucalyptus	<i>Eucalyptus maculata</i> Hook.	Myrtaceae	1
18. Krishnasura	Royal Poinciana	<i>Delonix regia</i> (Hook.) Raf.	Caesalpiniaceae	4
19. Ghora Neem	Indian Lilac	<i>Melia azedarach</i> L.	Meliaceae	5
20. Mahogany	West Indies Mahogany	<i>Swietenia mahagoni</i> (L.) Jacq.	Meliaceae	1
21. Nageswar/ Nahor	Indian rose chestnut	<i>Mesua ferrea</i> L.	Clusiaceae	2
22. Titasap	Champak	<i>Michelia champaca</i> L.	Magnoliaceae	1
23. Aamlokhi	Indian gooseberry	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	4
24. Narasingha	Curry Tree	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	2
25. Dalim	Pomegranate	<i>Punica granatum</i> L.	Punicaceae	1
26. Ponial	Indian plum	<i>Flacourtia cataphracta</i> Roxb. ex Willd.	Flacourtiaceae	1
27. Paharia Odal	Buddha Coconut	<i>Pterygotaalata</i> (Roxb.) R. Br.	Sterculiaceae	1
28. Khokon	-	<i>Duabanga grandiflora</i> (DC.) Walp.	Lythraceae	1
29. Khoksa	Fig Tree	<i>Ficus hispida</i> Vahl.	Moraceae	2
30. Ritha	Indiansoapberry	<i>Sapindusmukorossii</i> Gaertn	Sapindaceae	1
31. Goborhuta (Babla)	Glue berry/ Indian cherry	<i>Cordia dichotoma</i> G. Forster	Boraginaceae	1
32. Burikhojo	Koda tree	<i>Ehretia acuminata</i> (DC.)R.Br.	Boraginaceae	2
33. Koroch	Indian beech	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	3

34. Sama	Ironwood	<i>Senna siamea</i> (Lam.) H.S Irwin Barneby	Fabaceae	2
35. Teteli	Tamarind	<i>Tamarindus india</i> L.	Caesalpiniaceae	2
36. Polash	Flame-of-the-forest	<i>Butea monosperma</i> (Lamk.) Taub	Papilionaceae	1
37. Paharia odal	Buddha's Coconut tree	<i>Pterygotaalata</i> (Roxb.)R. Br.	Malvaceae	1
38. DuleeChampa	Evergreen magnolia	<i>Magnolia grandiflora</i> L.	Magnoliaceae	1
39. Sajina	Moringa	<i>Moringa oleifera</i> Lam.	Moringaceae	5
40. Bokul	Bullet wood	<i>Mimusopaelengi</i> L.	Sapotaceae	1
41. OuTenga	Elephant apple	<i>Dillenia indica</i> L.	Dilleniaceae	1
42. Senduri gos	Annato	<i>Bixa orella</i> L.	Bixaceae	1
43. Bogipoma	White Cedar	<i>Chukrasiatabularis</i> A. Juss	Meliaceae	1
44. Golabjamun	Rose Apple	<i>Syzygiumjambos</i> (L.) Alston	Myrtaceae	2
45. Kodom	Burflower tree	<i>Neolamarckiacadamba</i> (Roxb.)Bossier	Rubiaceae	2
46. Bogori	Indian Palm	<i>Ziziphus jujuba</i> Mill.	Rhamnaceae	3
47. RobabTenga	Pomelo	<i>Citrus grandis</i> (L.) Osbeck	Rutaceae	5
48. Leteku	Burmese grape	<i>Baccaurearamiflora</i> Lour	Phyllanthaceae	1
49. Kolajam	Black Palm	<i>Syzygiumcumini</i> (L.) Skeels.	Myrtaceae	2
50. Segun	Teak	<i>Tectona grandis</i> L.f.	Lamiaceae	103
51. Sama	Kassod tree	<i>Senna siamea</i> (Lam.) H.S IrwinBarneby	Fabaceae	3
52. Koros	Pongameoil tree	<i>Pongamia pinnata</i> (L.) Pierre	Fabaceae	2
53. Jolpai	Olive	<i>Elaeocarpus floribundus</i> Blume	Oleaceae	1
54. Silikha	Tropical almond	<i>Terminalia chebula</i> Retz.	Combretaceae	1
55. Madhuriam	Guava	<i>Psidium guajava</i> L.	Myrtaceae	4
56. Poma	Mountain.Cedar	<i>Toona ciliate</i> M.Roem.	Meliaceae	1
57. Bohera	Bahera	<i>Terminalia belirica</i> (Gaertn.)Roxb.	Combretaceae	1
58. Kordoi	Star fruit	<i>Averrhoa carambola</i> L.	Oxalidaceae	1
59. Agar	Agarwood	<i>Aquilaria malaccensis</i> Benth.	Thymelaeaceae	2
60. Sal	Sal tree	<i>Shorearobusta</i> Gaertn.	Dipterocarpaceae	1
61. Palash	Bastard teak	<i>Butea monosperma</i> L.	Fabaceae	1
62. Sotian	Blackboard tree	<i>Alstoniascholaris</i> L.	Apocynaceae	2
63. Neem	Neem	<i>Azadirachta indica</i> A.Juss.	Meliaceae	5
64. Leechu	Litchi	<i>Litchi chinensis</i> Sonn.	Sceaeapinda	1
65. Narikol	Coconut	<i>Cocos nucifera</i> L.	Arecaceae	2
66. Tipugos	Tipu tree	<i>Tipuanatipu</i> (Benth.) Kuntze	fabaceae	1
Total				292

PHOTO PLATE- 1



Pongamia pinnata (L). Pierre



Sidarhombifolia L.



Acmellapaniculata Wall. Ex DC.



Plumonaria obscura Dumort.



Oxalis corniculata L.



Ageratum houstonianum Mill.



Commelina communis L.



Phyllanodiflora (L.) Greene



Cestrum nocturnum L.

PHOTO PLATE-2



Alternanthera sessilis L.



Cleome rutidosperma DC.



Leucas aspera (Wild.) Link



Melastomamalabathricum L.



Heliotropium indicum L.



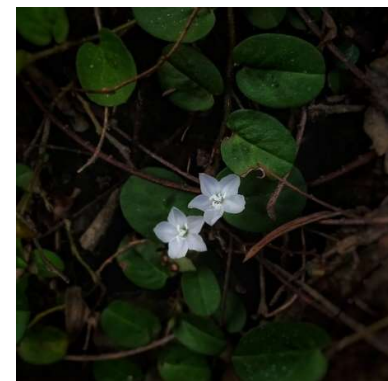
Desmodium triflorum (L.) DC.



Euphorbia hirta L.



Tradescantia pallida (Rose) Hunt



Evolvulus nummularius (L.) L.

Photo Courtesy: Trishna R. Prodhani

A number of green initiatives are taken by Abhayapuri college. Plantation activity is conducted every year on 5th June i.e. World Environment Day. Students of various departments like botany, NCC and NSS students make the plantation and nurturing programmes successful. The Botany Department has a small garden containing many ornamental and medicinal plants.

5. FAUNAL (ANIMAL) AUDIT

Introduction

“Biodiversity” refers to the variety of living organisms found on earth. According to Wilcox's "Biological diversity is the variety of life forms at all levels of biological systems (i.e., molecular, organism, population, species and ecosystem). It may be classified as genetic diversity, species diversity and ecological diversity.

India is considered as mega biodiversity region because 7-8% of the species in the world are recorded here. Further, the state Assam is located within the Eastern Himalayan Biodiversity Region, one of the two biodiversity “Hot Spots” in the country. The climatic condition, geographic location and its diverse ecosystem, help to abundant growth of a number of plant communities, which harbor large numbers of animal species from lower invertebrate to higher mammalian species.

Abhayapuri, the head quarter of the North Salmara subdivision, is a small town and is located 21 km far away from Bongaigaon District of Assam. The town is recognized as “Debadaru Nagari” as the town is covered by Debadaru plants. This town is surrounded by natural hills, forests and wetlands, which enhance the natural beauty of the place and make the region a habitat for different plants and animals.

All living organisms play an important role in conservation of nature. It would not be possible to maintain ecosystem balance without the healthy growth of the living organisms. All the animals are part of a food chain and if any one of them will be extinct, automatically the chain will break down causing environmental problem. Further, they provide us food, medicines, and other essential commodities for livelihood. Animals also help to maintain the Earth's natural environments by predated upon plants and other animals, pollinating various plants and exhaling carbon dioxide, which green plants use for photosynthesis. Moreover, animals help to fertilize plants by their droppings, which provide nutrition for plants, and seed-dispersal tendencies, which help plants to disperse through habitats. After the death of the animal, they provide food for microorganisms and supplemental minerals for plants.

Aim of the Audit

Animals are the integral part of the ecosystem and their abundance reflects the health of the ecosystem. But it has been observed that very few scientific works have been carried out to record the faunal diversity of the areas. Therefore, this work is undertaken to record the faunal diversity in the Abhayapuri College Campus.

Audit Area

The study was carried out in the Abhayapuri College Campus. Abhayapuri College is situated in the heart of Abhayapuri Town. This college has three different campuses; one is main campus,

situated in the middle of the town. The other two are Stadium and Hostel Campuses (Boys' and girls'), located at the Sahitya Sabha path, Abhayapuri. All the campuses are rich with varieties of flora and fauna.

Objectives

1. To identify the animal species found in the three different campuses of the college.
2. To prepare the database of the different fauna.

Methodology

The study was carried out primarily by following survey method in the fields. Photographs were taken for identification purpose. Secondary data was also collected by using literatures and different internet journals and references.

Findings

In the present study 108 number of animals were identified in the study sites belonging to different phylum and class. Among them highest number of Arthropods were recorded belonging to three different classes. After continuous visits, it is observed that the campuses of Abhayapuri college is rich in faunal biodiversity. All the campuses are very beautiful with large number of natural vegetation, which enrich the animal species. There are 5 nos of annelida, 49 species of Arthropods and 3 nos of Mollusca species were recorded belonging to invertebrate. 3 nos of amphibia and 11 nos of reptiles were identified. 26 birds are identified in the three sites. Mammalian diversity is represented by 9 species, where golden langur, an endangered species of Assam also is observed in the Bamungaon site as this site is very adjacent to Bamulgaon hill. Recorded animals are listed in the **table-1**.

SI No	Phylum	Class	Common Name	Scientific name	
Invertebtara					
1	Annelida	Clitellata	Leech	<i>Hirudinariamannillensis</i>	
2		Clitellata	Leech	<i>H. granulosa</i>	
3		Clitellata	Earth worm (Pheretima)	<i>Pherotimaprostuta</i>	
4		Clitellata	Earthworm	<i>Eudriluseuginiae</i>	
5		Clitellata	Bonda kechu	<i>Metaphirehouletti</i>	
6	Arthropoda	Diplopoda	Milliped	<i>Trigoniuluscorallinus</i>	
7		Chilopoda	Centiped	<i>Rhysida nuda emarginata</i>	
8		Chilopoda	Centiped	<i>Scutigeraoleoptrata</i>	
9		Arachnida	Spider	<i>Telamoniadimidiata</i>	
10			Spider	<i>Hyllus semicupreus</i>	
11			Signature spider	<i>Argiope pulchella</i>	
12		Insecta	Drosophila	<i>Drosophila melanogaster</i>	
13			Mosquito		<i>Culex quinquefasciatus</i>
14					<i>Aedes spp</i>
15					<i>Anopheles spp</i>
16			Dragon fly (common hooktail)	<i>Paragomphuslineatus</i>	
17			Dragon fly (wandering glider)	<i>Pantalaflavescens</i>	
18			House fly	<i>Musca domestica</i>	
19			Scorpio	<i>Heterometrusspp</i>	
20			Cockroach		<i>Periplanta americana</i>
21					<i>P orientalis</i>
22				Ant	<i>Formica spp</i>

23				<i>Solenopsis</i>
24			Weaver ant	<i>Oecophyllasmaragdina</i>
25			Ant	<i>Myrmicariabrunnea</i>
26			Termite	<i>Isoptera spp</i>
27			Hornet	<i>Vespa affinis</i>
28			Vespa	<i>Vespa orientalis</i>
29				<i>Harmonia axyridis</i>
30			Ladybug beetle	<i>Micraspidicolor</i>
31				<i>Coccinella species</i>
32			Fire fly	<i>Photurisluccrescens</i>
33			Fire fly	<i>Lampridaespp</i>
34			Honey bee	<i>Apis indica</i>
35				<i>Apiscerna</i>
36			Red slug caterpillar	<i>Eterusiaaedeia</i>
37			Praying mantis	<i>Mantis religiosa</i>
38			House Cricket	<i>Acheta domestica</i>
39			Mole cricket	<i>Gryllotalpa brachyptera</i>
40			Grass hopper	<i>Ducetia japonica</i>
41			Grass hopper	<i>Trigonocorypha unicolor</i>
42			Common field grasshopper	<i>Chorthippusbrunneus</i>
43			Gundhi bug	<i>Macrocheraia grandis</i>
44			Gundhi bug	<i>Leptocorisavericornis</i>
45				<i>Scarabaeus spp</i>
46			Cow dung beetle	<i>Carabusconvexus</i>
47				<i>Onthophagus species</i>
48			Psyche	<i>Leptosianina</i>
49			Lemon Pansy	<i>Junonialemonias</i>
50			Grey Pansy	<i>J.atlites</i>
51			Blue Tiger	<i>Tirumala limniace</i>
52			Jester	<i>Symbrenthialilaea</i>
53			Chocolate Pansy	<i>Jumoniaiphita</i>
54			Common Indian crow	<i>Euploeacora</i>
55			Handmaiden moth	<i>Syntomoidesimaon</i>
56	Mollusca		Pila	<i>Pila globusa</i>
57		Gastropod	Snail	<i>Cryptozonasspps</i>
58			Acatina	<i>Acatinafulica</i>
Vertebrate				
59			Bamunvekuli	<i>Rana tigrina</i>
61		Amphibia	Chuk Bhekuli	<i>Bufo melanotictus</i>
61			Pat beng	<i>Hyla</i>
62			Lizard	<i>Hemidactylus frenatus</i>
63			Oriental garden lizard	<i>Calotes versicolor</i>
64			Little shink	<i>Eutropismaularia</i>
65			Common Indian shink	<i>E. carinata</i>
66		Reptilia	Spectacled cobra	<i>Najanaja</i>
67			Monocled cobra	<i>Najakaouthia</i>
68			Python	<i>Python bivittatus</i>
69			Common wolf snake	<i>Lycodonaulicus</i>
70			Indian rat snake	<i>Ptyas mucosa</i>
71			Branded krait	<i>Bungarus fasciatus</i>
72	Chordata		Checkered keelback	<i>Xenochrophis piscator</i>

73			Red vented bulbul	<i>Pycnonotuscafer</i>
74			Common Myna	<i>Acridotheres tristis</i>
75			Jungle Myna	<i>Acridotheresfuscus</i>
76			Striated babbler	<i>Turdaidesearlei</i>
77			Spot belled owl	<i>Bubo nepalensis</i>
78			Crow	<i>Corvus splendens</i>
79			Spotted Dove	<i>Streptopeliachiinensis</i>
80		Aves	Asian pied starling	<i>Gracupica contra</i>
81			Rose ringed parakeet	<i>Psittaculakrameri</i>
82			White throated king fisher	<i>Halcyon smyrnensis</i>
83			Blue throated barbet	<i>Psilopogon asiaticus</i>
84			Grey headed wood pecker	<i>Picuscanus</i>
85			Common tailorbird	<i>Othotomussutorius</i>
86			Crimson sunbird	<i>Aythopygasiparaja</i>
87			Purple sunbird	<i>Cinnyris asiaticus</i>
88			House sparrow	<i>Passer domesticus</i>
89			Great Egret	<i>Ardea alba</i>
90			Asian koel	<i>Eudynamysscolopaccus</i>
91			Asian open bill stork	<i>Anastomusocitans</i>
92			Black drongo	<i>Dicrurusmacrocercus</i>
93			Pigeon	<i>Columbia livia</i>
94			Yellow wattled lapwing	<i>Vanellusmalabaricus</i>
95			Chestnut tailed starling	<i>Sturniamalabarica</i>
96			Black hooded oriole	<i>Oriolusxanthornus</i>
97			Oriental magpie robin	<i>Copsychussaularis</i>
98			Indian white eye	<i>Zosterospalpebrosus</i>
99			Asian Brown Flycatcher	<i>Muscicapadaaurica</i>
100		Mammalia	Assamese macaque	<i>Macaca assamensis</i>
101			Golden langur	<i>Trachypithecus gee</i>
102			Squirrel	<i>Scicurus carolinensis</i>
103			Schrew	<i>Suncus murinus</i>
104			Rat	<i>Rattus norvegicus</i>
105			Bat	<i>Pipistrellus coromandra</i>
106			Mouse	<i>Mus musculus</i>
107			Mongoose	<i>Herpestededwadsii</i>
108			Indian fox	<i>Velpes bengalensis</i>

Table No: 1: Identified animals' species of the study sites

Remarks

The present study revealed that these areas are rich habitat of the animals from Invertebrate to mammalian species. The animals of the sites play a very important role in biodiversity conservation. Different insect and animal species having medicinal property may be used as a nutritious food and butterflies play an important role in pollination of plants. Butterflies are also considered as bioindicator. All the animals have aesthetic important and help in the growth of the revenue of the state. Considering all the importance, further extensive study will be required.

Photo Plate-1



Leech



Milliped



Centipede



Spider



Dragon fly



Lady bird beetle



Mole cricket



Handmaiden moth



Chocolate Pansy

PLATE-2



Blue tiger



Common Indian crow



Lemon Pansy



Grey Pansy



Waiver ant



Termite



Honey bee



Common Jester



House Lizard

PLATE-3



Oriental garden Lizard



Spotted Dove



Asian Koel



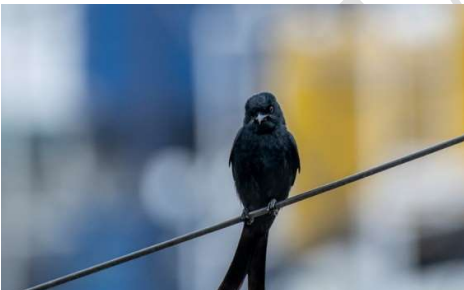
Asian Openbill



Oriental Magpie Robin



Crimson sunbird



Black Drongo



Common Myna



Indian White eye

PLATE-4



Asian Brown Flycatcher



House Sparrow



Fruit Bat



Rhesus macaque

Recommendation

1. The study is a pioneer study from the department of Zoology. It is recommended to carry on this type of research work yearly for the identification of the available species in the campus.
2. Student's engagement is also very necessary to develop the academic skill of the students.
3. Hands on training and workshop will be arranged by the department for the taxonomic view point.
4. Good quality camera and binocular will be made available in the department.
5. Extensive plantation should be done to maintain environment friendly habitat for the animals.
6. Maintenance of flower garden is very essential for the nourishment of butterflies and other insects like bees.

6. Health Audit

To explore the knowledge, practices and sources of information regarding chronic diseases, physical and mental stress, health and hygiene within the college campus a set of questionnaire is prepared separately for all the employees (teaching & non-teaching including sanctioned and contractual) and Degree students of the college and distributed among all through google form. A total of 700 students and employees were targeted for the study.

Objectives: The following Objectives were undertaken for the study-

1. The aim of the Health Audit is to identify common health issues of the employees and students of the college.
2. To examine illicit substance use in eating and knowledge of nutritional requirements for health among the college students and employees.
3. To study the physical and mental stress related to academic load.
4. To find out the prevailing practices for menstrual hygiene among girl students and employees of the college.
5. To find out what improvements could be made to the existing facilities in the college that would encourage the students and employees to use them more.
6. To suggest short term and long term preventive measures to overcome health related emergency situation in the college by the authority.

Out of 700 Questionnaire 50 employees and 545 students of Abhayapuri College have responded to the questions we have distributed. The following are the facts received by monitoring the responses –

Data Analysis of Employees of the college

Sl No	Category of Study	50 (Male : 36, Female : 14)
1	Health Issues(chronic disease)	Out of 50 responses 1. 38% of respondents are suffering from Gastritis, 15% suffering from Back pain, 20% from Skin Disease, 12% from High Blood pressure, 10% in Low Blood Pressure and Stomachache, 8% from Diabetes, 6% from Heart Diseases and Migraine 4% from Arthritis etc.

		<p>2. Out of Physical disabilities mentioned in the questionnaire, 14% of the employees of college have poor visual impairments.</p>
2	Physical /mental stress and working Environment in the College.	<p>A. Physical stress:</p> <p>Due to excessive use of ICT equipmentsand other electronics for official purpose, few of them face severe headache, Backpain and mental stress.</p> <p>B. Working Environment:</p> <ol style="list-style-type: none"> 1. 58% of the respondents are able to cope up with the amount and complexity of work in the college while 42% are not able cope up due to various reasons. 2. 52% of respondents agree that there is a two-way good communication/Relationship in the college among the authority and employees. 3. 67% of employees states that there is supportive environment from the authority and they feel valued for the work they does and are able to acknowledge problems and ask for any kind of help.
3	Health and Hygiene	<p>A. Illicit Addiction use</p> <ol style="list-style-type: none"> 1. 8% of employee respondents are addicted to smoking cigarette, 4% in drinking alcohol, 4% in consuming Tobacco. Most of the employees keep themselves out of the mentioned addictions in the questionnaire. <p>B. Menstrual Hygiene:</p> <ol style="list-style-type: none"> 1. All the female respondents use sanitary pad during Menstruation and dispose pads either in dustbins or in toilets.
4	Healthy Eating	<ol style="list-style-type: none"> 1. 30% of college employees responded that the college has free drinking water facility in the campus.

		<p>2. 22% responds that there are suitable facilities for hand-washing in the campus before eating anything.</p> <p>3. Only 6% responds that there is canteen facility in the campus.</p>
5	Physical Activities and Interested Health Topics of Employees	<p>A. Physical Activities: Students practice physical activities like walking, jogging, running, practicing yoga, bi-cycling, involvement in sports, gardening etc. to keep themselves healthy and fit.</p> <ol style="list-style-type: none"> 1. The study shows that out of the above mentioned physical activities 52% of employees are Walking/Jogging/Running on daily basis. 28% does yoga practice 20% are cycling everyday, 16% are interested in sports etc. 2. 36% of respondents agree that due to heavy work schedules they are not able to exercise fully to keep themselves fit. Financial limitations also stand as a barrier in maintaining good health. 3. 80% of employee agrees that the organization actively encourage them to participate in its health promotion programmes. <p>B. Health Topics of Interest: The college employees are interested in the following Health Topics mentioned below.</p> <ol style="list-style-type: none"> 1. Physical Activity/Fitness=58% 2. Healthy Eating=50% 3. Weight Management=36% 4. Disease Management=16% 5. Preventative screenings=10% 6. Smoking Cessation=8% 7. Complementary and Alternative Therapies=4%

6	Improvements to the existing facilities in the college.	<p>In order to encourage teaching –learning environment in the class, the following facilities provided by the college authority must be improved.</p> <ol style="list-style-type: none"> 1. 76% out of studied populations states that Cleanliness must be maintained within the college campus or in the class. 2. 48% of employees say that toilets must be cleaned everyday and there should be proper running water. 3. 38% states that Seating arrangements in Departments/Office Rooms/Common rooms requires improvement. 4. 20% of female employees would like the college authority to install Incinerators/Vending machine in Toilets for waste disposal pads.
7	Availability of communication channels in your workplace to promote physical activity	<p>The employees have responded as mentioned below regarding the availability of communication channels to promote physical activity-</p> <ol style="list-style-type: none"> 1. E-mail= 47% 2. Intranet=23% 3. Weekly e-notices=2% 4. Notice Boards Displays/Signs=29% 5. Training=12%
8	Availability of written policies of Health issues	<p>As per the response of the employees there is no proper written policies stating the health issues in the college in regard to health and safety, healthy eating, physical activity, stress in the workplace, work-life balance eg-flexible working and family-friendly practices, drugs and alcohol in the workplace etc.</p>
9	Facilities to handle Emergency situation related to health	<p>There is no such measure or facilities to handle emergency situation related to health in the college.</p>
10	Safety measure facilities adopted	<ol style="list-style-type: none"> 1. 70% of responded stated that they are being provided sanitizer in the college. Moreover, 36% respondents say that there is a

	by the college to prevent Covid-19	provision of thermal scanning for the employees and students of the college.
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Data Analysis of student respondents

Sl No	Category of Study	Total Response: 545 (Male : 230, Female : 315)
1	Health issues (chronic disease)	<p>Out of 545 responses</p> <ol style="list-style-type: none"> 20% students' respondents are having Gastritis problem, 14% are suffering from skin disease, 10% from Dental problem, 6% are having Headache problem and others have some other chronic disease as mentioned in the questionnaire. Majority of the students have no physical disability. However 2.6% students are having Poor Visibility
2	Physical and mental stress	<p>A. Physical stress: Students come to college by different means of communication. So Depending on the distance covered, students get physical stress.</p> <ol style="list-style-type: none"> 51% come on foot, 25% come by bicycle, 18% by Motor bike/Scooty and 6% come by car/van/bus etc. <p>B. Mental Stress:</p> <ol style="list-style-type: none"> 60% of students do not feel stress while studying but 40% feel stress. 80% students feel free in communicating with their teachers in the college while 40% do not feel free with their teacher. In using ICT in the classes, 74% of students are able to cope up with the ICT

		<p>based teaching and 26% find it difficult either to follow or due to various reasons.</p> <p>4. The study also shows that some students has felt stressed and undergone extreme depression and thought for committing suicide. The reason behind this depression-</p> <p>Financial situation 10% and family problems 7%.</p> <p>5. 5% of the study even responded that they have</p> <p>Faced sexual harassments which led to mental stress.</p>
3	Health and Hygiene	<p>A. Use of Illicit substance within the College campus:</p> <p>1. 94% of students are not addicted to any addiction. 2% mentioned about consuming Tobacco and 2% in drinking alcohol.</p> <p>B. Menstrual Hygiene:</p> <p>Out of 315 female respondents-</p> <p>1. 65% of girl's students use commercial Sanitary Pads, 18% use reusable and washable cloth pads and very few countable students use Tampoons and Menstrual cups during menstruation.</p> <p>2. In regard to disposal wastes during menstruation only 19% use Incinerator/Vending Machine in college Girls common room/toilets. 28% of girls student use dustbin and 25% use toilet to dispose their used pads.</p> <p>3.</p>
4	Healthy Eating	<p>1. 48% of students stated that the college provides Free Drinking facility to them within the college campus. 6% of students agrees that they have canteen within the college</p>

		<p>and 5% says that there is hand washing facility in the college before they eat anything.</p> <p>2. In regard to idea about balanced diet 66% of the students are not aware of the balanced diet to be followed to be healthy and fit.</p>
5	<p>Activities, Interested Health Topics of students</p>	<p>A. Physical Activities: Students practice physical activities like walking, jogging, running, practicing yoga, bi-cycling, involvement in sports, gardening etc. to keep themselves healthy and fit.</p> <p>4. The study shows that out of the above mentioned physical activities 20% of students are Walking/Jogging/Running on daily basis. 11% are cycling everyday, 7% does yoga practice, 4% are involved in gardening and only 3% of the students are interested in sports activities.</p> <p>B. Health Topics of Interest: The College students are interested in the following Health Topics mentioned below.</p> <p>8. Healthy Eating=28% 9. Physical Activity/Fitness=23% 10. Weight Management=3% 11. Preventative screenings=0.8% 12. Disease Management=0.8%</p>
6	<p>Improvements to the existing facilities in the college.</p>	<p>In order to encourage teaching –learning among the students in the class, the following facilities provided by the college authority must be improved.</p> <p>1. 13% of the students out of studied populations states that Cleanliness must be maintained within the college campus or in the class.</p> <p>2. 7% states that Seating arrangements in the class and campus needs improvement</p>

		<p>3. 6% of students say that toilets must be cleaned everyday and there should be proper running water.</p> <p>4. 3% of girls students states that awareness programmes on use of Incinerators (Disposal machine for Menstruation Pads) must conducted on regular intervals for more usage.</p>
7	Covid-19 Preventive Measures	<p>1. 86% Of students responded that the college provides safety measure facilities and awareness to overcome Covid-19 pandemic as per state and central SOP norms.</p>

Recommendations/Suggestions:

1. Time to Time Preventative Screenings of life-threatening health diseases /conditions of the Employees and students of the college may be reduced.
2. As per study, Gastritis being more common chronic ailment in college, awareness programmes on Healthy life style, food and nutrition through seminars, classes and workshops which promotes eco-friendly living may be organised the authority at an earliest for both students and employees of the college. Health Check Up with health officials may also help respondents in this regard.
3. Depending on the dimensions and/or specific hazards of the workplace, Doctors, Nurses and trained occupational first aiders may be engaged.
4. Necessary arrangements according to the medical emergencies may be made with external doctors who are available in the case of severe emergencies in the college.
5. The study shows that a small size of students is suffering from mental health problems among the college students which lead to depression and anxiety. So strategies for treatment seeking students from mental health providers inside and outside the campus may be organised from time to time.
6. Providing health, nutrition related courses and using technology as a means to educate the new generation could be effective and used for future learning.
7. College canteen with nutritional foods may be served for the students and employees of the college to avoid unhealthy eating.
8. Awareness programmes based on prevention of drug and alcohol misuse may be organised for the students of the college. Providing students with factual information about drugs and alcohol, fear-arousal techniques designed to attract attention and frighten individuals into not using drugs may be organised through classroom lectures as well as educational pamphlets and other printed

materials, and short films that impart information to students about different types of drugs and the negative consequences of use.

9. Awareness programs having police officers to discuss law-enforcement issues, including drug-related crime and penalties for buying or possessing illegal drugs may give a better knowledge to the students in illicit use of substance and prevention.
10. Doctors or other health professionals may be invited to talk about the severe, often irreversible, health effects of drug use and drinking.
11. In order to encourage teaching –learning environment in the class, the following facilities provided by the college authority may be improved. The study shows that priority attention should be paid to Cleanliness within the college campus or in the class. Toilets must be cleaned everyday and there should be proper running water. Seating arrangements in Departments/Office Rooms/Common rooms requires improvement. Proper Lightings may be arranged in the classrooms and common rooms in the college to have proper visibility.
12. There is a need to provide education and equip our girl students of the college with skills regarding safe and hygienic practices in using appropriate napkins and make them to lead a healthy reproductive life and prevent the risk for reproductive tract infections.
13. Awareness programmes on use of Incinerators (Disposal machine for Menstruation Pads) may be conducted on regular intervals for more usage for girls students.
14. New Incinerators/Vending machine in Toilets for waste disposal pads may be installed in the toilets of lady employees of the college.
15. Organising Fitness programmes in the colleges may result in greater productivity, reduced absenteeism, lower health care costs, and greater job satisfaction among employees and students. So the college may evolve the program which involves sports activity in colleges among staff and students, combined with regular exercise.
16. Gymnasium centre in the college campus may be built for conducting physical activities of the students as well as for the staff of the college.
17. There may be First Aid Team in the college to give first aid to handle emergency situation in the workplace. This may help those who need urgent care, or prevent further serious injury until a nurse, doctor, or another person, such as a trained emergency medical technician, can take over the situation.
18. Engagement of Part-time nurse in medical cell of the college may prevent chronic ailments sufferers of the college.

19. There may be arrangement for preventive screening tools to identify the current challenges encountered and to overcome them. Tools like. preventive screening tools like, Manometer (Blood Pressure Monitor), first aid kit, thermometer, Harmful alcohol use screening, Gas cylinder(as a supply of oxygen, nitrous oxide, carbon dioxide, etc.) , Oxygen Masks and Tubes, Gauze sponge, Pulse Oximeter, Nebulizer, weighing Machine, Mobility Equipment(Wheelchairs, Crutches) etc.
20. In case of emergency medical situation arrangement may be made for ambulance facility to carry an emergent patient to the Hospital.
21. There may be enhancement in use of communication channels in your workplace to promote physical activity among the staff, students and authority of the college. Newsletter, E-bulletin boards may be published. Email and Weekly e-notices, Notice Boards Displays/Signs may be circulated widely to promote physical activities, training programmes etc.
22. Healthcare, policies may be set for safe and cost-effective quality care in the Institution. They help us to standardise clinical practice, test and improve our services, and achieve greater understanding and co-operation among staff.
23. Written Policies stating the health issues in regard to health and safety such as Preventative action, Emergency management, Smoking, Drug-free workplace, Harassment and violence, work-life balance eg-flexible working and family-friendly practices may be implemented with proper guidelines for the betterment of the students and employees

7. Renewable Energy Audit

Introduction

Renewable energy is the energy that is sustainable and is derived from a source that can supply energy endlessly. The factors underlying the choice of energy sources depends of parameters such as cleanliness, cost effectiveness, stability, efficiency and environmental effects. The world is still dependent on fossil fuels for generation of power for domestic as well as industrial uses. However, such fuels are likely to be runout due to their limited availability and extensive use. Despite of their effectivity in power production, it is not a very good choice in long run. Moreover, these fossil fuels pose a huge threat to environmental balance and are a cause of many ecological hazards. Thus, renewable energy sources are a potential alternate of the conventional energy sources.

The most popular renewable energy sources currently available are [1]:

1. Solar energy
2. Wind energy
3. Hydro energy
4. Tidal energy
5. Geothermal energy
6. Biomass energy

As far as Abhayapuri College is concern, only the solar energy appears to be feasible, considering its location, campus area and requirements. Setting up of Hydro energy, Tidal energy and Geothermal energy sources is not at all possible in the college campus as the location of the college not at all fulfill the basic requirements for setting up such energy plants. Further, the Abhayapuri College is located at a region where the flow of wind is not uniform and not unidirectional i.e. it does not satisfy the basic requirement of setting up the wind energy plants. Apart from this wind energy plants require large open area which is not available in the college. Thus, wind energy as a renewable energy source of energy in contrast of Abhayapuri College is not feasible. The biomass developed in the college is used up in the Vermi-Compose plant available in the college. Thus, there is no sufficient biomass available in the college campus for generation biomass plant.

Harvesting of renewable energy carried out in Abhayapuri College:

S. N.	Type of energy source	No. of units available	Amount of power generated	Remarks
1.	Solar energy	0	0	Feasible
2.	Wind energy	0	0	Not feasible
3.	Hydro energy	0	0	Not feasible
4.	Tidal energy	0	0	Not feasible
5.	Geothermal energy	0	0	Not feasible
6.	Biomass energy	0	0	Not feasible

Proposed plane of harvesting renewable energy:

1. Solar Energy Harvesting:

India is a home of 1.33 billion people with per capita electricity consumption of 1075 KWh. The total electricity consumption is around 1.43 PWh (1.43×10^{15} Wh) per year. The average solar irradiance in India is around 5.97 KWh/m²/day. The average solar irradiance in the lower Assam is around 5 KWh/m²/day. The solar energy can be converted into usable electricity by using solar panels.

The most popular commercially available solar panels have the efficiency of around 15%. So, the output we can get from solar panel is around 0.89 KWh/m²/day. However, there are losses like impedance mismatch, soiling, shading, wiring, light induced degradation, inverter inefficiency, DC to AC size ratio etc. which is around 25%. This leads to usable AC output of 0.67 KWh/m²/day i.e. 245 KWh/m²/year.

Area Needed for Solar Panels:

With the present technology, we get 245 KWh of AC electricity per square meter per year from solar energy. 1 MW solar plant produces around 1570 MWh of electricity annually. **Area Needed for**

Storage System:

In order to have one day autonomy, the total storage capacity should be around 1.43PWh/365=3.92 TWh. Considering the depth of discharge to be 50%, the needed storage capacity should be around 7.84 TWh. The typical dimension (l×b×h) of conventional 12 V-150 Ah battery is around 500 mm×188 mm×422 mm and weights around 65 Kg i.e. a battery of capacity 1800 Wh requires space of 0.094 m². Total area needed to store 7.84 TWh is around 409×10⁶ m² (or 409 Km²), i.e. an area of around 20 Km×20 Km. So, the storage system needed for 1 day autonomy is around 0.01% of the total land area of India. The total number of households in India is around 275 million. So, a 3.5 KW rooftop solar system is good enough to meet all the electricity demand of India and it will take only 6 m×6 m space on each roof.

Rainwater Harvesting:

India received an average annual rainfall of 34.9 mm during the period 01-03-2021 to 18-04-2021 against the normal annual average rainfall of 52.4 mm which is lower by 33% against normal annual rainfall according to India Meteorological Department, Ministry of Earth Science, Government of India. According to the report, the average annual rainfall in Assam during the period was 93.6 mm against the normal annual average rainfall of 169.2 mm which is lower by 45%. However, the Bongaigaon district received almost a normal average annual rainfall of 135 mm, over the above-mentioned period, against its normal annual average of 148 mm which is lower by only 9% [1].

The amount of rainfall is measured with the help of an instrument called Rain gauge. It comprises a collection container and is to be placed in an open space. The rain precipitation is measured in terms of the height of the water accumulated in the container within a predefined time and is generally expressed in millimetres. Since rain precipitation is assumed to occur uniformly around the container, the area of collection is not a factor. However, it should not be too small, neither should it be too large. Due to

spatial uniformity of rainfall, 1 mm of measured precipitation is the equivalent of 1 L of precipitated rain water volume per metre squared [2].

Rainwater harvesting (RWH) is a simple method by which rainfall is collected for future usage. The collected rainwater may be stored, utilised in different ways or directly used for recharge purposes. With depleting groundwater levels and fluctuating climate conditions, RWH can go a long way to help mitigate these effects. Capturing the rainwater can help recharge local aquifers, reduce urban flooding and most importantly ensure water availability in water-scarce zones. Though the term seems to have picked up greater visibility in the last few years, it was, and is even today, a traditional practice followed in rural India. Some ancient rainwater harvesting methods followed in India include madakas, ahar pynes, surangas, taankas and many more.

This water conservation method can be easily practiced in individual homes, apartments, parks, offices and temples too, across the world. Farmers have recharged their dry borewells, created water banks in drought areas, greened their farms, increased sustainability of their water resources and even created a river. Technical know how for the rooftop RWH with direct storage can be availed for better implementation. RWH An effective method in water scarce times, it is also an easily doable practice.

ANNEXURE-1

POWER CONSUMPTION AND BILLING DETAILS FOR 2018-19, 2019-20 & 2020-21 (UP TO FEB'21)

Period of bill	Unit Consum'd (billed) (KWh)	Max. deman- d recorde d	PF as per bill	Rebate on power factor (KWh)	Amount billed (Rs)	Surcharge on arrear (Rs)	Total amount (Rs)
2018-19							
03-04-18 to 07-05-18 (34 days)	3396 (3396)	NA	NA	Nil	29,453	610	30,063
07-05-18 to 06-06-18 (31 days)- Assessed	3096 (3096}	NA	NA	Nil	27,429	---	27,429
06-06-18 to 03-08-18 (58 days)	5793 (5793)	NA	NA	Nil	50,212	4,543	54,755
03-08-18 to 03-09-18 (31 days)	3096 (3096)	NA	NA	Nil	26,835	6,737	33,572
03-09-18 to 03-10-18 (30 days)- Assessed	2996 (2996)	NA	NA	Nil	26,715	-----	26,715
03-10-18 to 05-04-19 (184 days)	18135 (18135)	NA	NA	Nil	1,57,594	27,251	1,84,845
Total (2018- 19)	36512 (36512)				3,18,238	39,141	3,57,379
2019-20							
05-04-19 to 01-02-20 (302 days)	30140 (30140)	NA	NA		2,66,437	32,601	2,99,038
01-02-20 to 11-03-20 (39 days)	1400 (1386)	NA	0.95	14	16,644	41,948	58,592
11-03-20 to 01-04-20 (21 days)- Assessed	760 (760)	NA	NA	NA	8,993	----	8993

Total (2019-20)	32300 (32286)			14	2,92,074	74,549	3,66,623
2020-21 (up to Feb'21)							
01-04-20 to 01-06-20 (61 days)	3140 (3140)	NA	0.85	0	32,429	13290	45,719
02-06-20 to 31-07-20 (60 days)	6048.81 (6043.4)	13.92	0.99	186.91	54,266	--	54,266
01-08-20 to 31-08-20 (31 days)	3559.20 (3556)	23.36	0.99	109.98	31,042	3,000	34,042
01-09-20 to 30-09-20 (30 days)	2356.00 (2353.9)	21.72	0.985	72.80	22,505	3810	26,315
01-10-20 to 31-10-20 (31 days)	2292.00 (2289.9)	23.52	0.984	70.82	22,269	--	22,269
01-11-20 to 04-12-20 (34 days)	2002.2 (2000.4)	20.37	0.976	61.87	20881	--	20,881
05-12-20 to 01-01-21 (28 days)	1834.6 (1832.95)	9.28	0.971	56.69	18,482	313	18,795
02-01-21 to 31-01-21 (30 days)	1916.4 (1914.67)	9.28	0.971	59.22	19,462	--	19,462
01-02-21 to 28-02-21 (28 days)	2061.2 (2101.81)	13.72	0.922	21.23	20,346	--	20,346
Total- 2020-21 (up toFeb'21)	25210.41 (25233.03)			639.52	2,41,682	20,413	2,62,095

Notes-

1. Bills for the period 07-05-18 to 06-06-18 and 03-09-18 to 03-10-18 have not been found on record. The data against the bills shown are on the basis of the average consumption as per which all the bills in 2018-19 were served (as the meter was defective during the period). However, surcharge on arrear has not been shown in absence of actual record.
2. Bill for the period 11-03-20 to 01-04-20 has not been found on record. The data shown against the period is based on consumption calculated by deducting present meter reading of the previous bill from the previous meter reading of the next bill and amount found on the basis of prevailing tariff. The power factor, rebate/ penalty on power factor and surcharge on arrear have not been shown in absence of actual data.



Digboi Stores Building, New Market
 Digboi, Assam - 786 171
 Ph: 03751-264414, 9435008657, 8876028672
 E-mail: envirocon@rediffmail.com
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Report No.: ENV/Misc/BNG/20-21/N-01
 Date : 25/03/2021

Order No.: Verbal
 Date :

Report issued To: **Abhayapuri College**
 Main Road, Abhayapuri, P.O: Abhayapuri, Dist: Bongaigaon, Assam
 (GPS - N 26°20'23.76", E 90°39'41.07")

AMBIENT NOISE LEVEL MEASUREMENT RESULTS

Sl. No.	Location(s)	Date Of Measurement	Day Time L_{eq} (dB-A)	Limit Day Time L_{eq} (dB-A)	Night Time L_{eq} (dB-A)	Limit Night Time L_{eq} (dB-A)
1	Near College Entrance Gate	15.03.2021	47.6	50	32.4	40
2	College Playground	15.03.2021	41.8	50	32.1	40



Checked By: Mr. Pankaj Baroi, ENVIROCON

NOTE:

1. Results reported are valid at the time of and under the prevailing conditions of measurement.
2. Results refer only to the particular parameters tested.
3. This test report shall not be reproduced except in full, without the written permission of ENVIROCON, Digboi Stores Building, New Market, Digboi - 786171, Assam.

Core Services: Environmental Monitoring & Data Generation, EIA & EMP, Environmental Audit & Allied Environmental Management jobs
Associate Services: Certification by Competent Person (CIF), NDT, Hydraulic Testing, Chartered Engineer Services etc.

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Department of Chemistry
(Member)

END OF THE REPORT

GREEN AUDIT, ABHAYAPURI COLLEGE, 21-22