BANGABASI EVENING COLLEGE

GREEN , ENERGY & ENVIRONMENT AUDIT REPORT

2020-2021

REPORT PREPARED BY
BLISS & INRC

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Memo…… Date-10/12/21

GREEN, ENERGY AND ENVIRONMENT AUDIT CERTIFICATE

ACADEMIC YEAR 2020-2021

This is to certify that BLISS and Institute of Nature Research and Conservation (INRC) has jointly conducted the Energy Audit, Green Audit and Environment Audit of BANGABASI EVENING COLLEGE, 19 Rajkumar Chakraborty Sarani, Kolkata-700009, West Bengal for the Academic year 2020-2021 and submitted report under their policy for the Green Campus of the Institute. The initiatives that has been taken for the betterment environment and of the college campus by different stockholders of the college i.e. Honorable Principal Sir, IQAC members, Teachers, Teaching staff and also Students is highly commendable. BLISS and INRC jointly appreciate their all over support during the Audit programme.

College Name: BANGABASI EVENING COLLEGE

Affiliated to: UNIVERSITY OF CALCUTTA

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ACKNOWLEDGEMENT

The BLISS Green, Environment, and Energy Audit Team, along with the Institute of Nature Research and Conservation (INRC), express their heartfelt thanks to the management of Bangabasi Evening College for giving us the important responsibility of conducting a Green, Energy & Environmental audit. We are especially grateful to the Principal for his unwavering support.

We deeply appreciate the cooperation extended to our team throughout this study and the valuable insights provided, which greatly facilitated our audit activities. We also extend special thanks to the IQAC members, teaching staff, and supportive non-teaching staff, whose dedicated involvement was crucial to the successful completion of this project.

AREAS OF CONCERN

GREEN AUDIT

- Floral Diversity
- Faunal Diversity

ENVIRONMENT AUDIT

- Water Management
- Waste Management
- Air quality
- e-waste management

ENERGY AUDIT

- Energy consumption
- Energy management
- Carbon footprint

RECOMMANDATIONS

- To reduce energy consumption and management
- Find out potential areas for environment management and green development

- Reduce biodiversity loss
- Find out potential areas for increase species richness in the campus

A team of specialists and scientists from esteemed institutions carried out an in-depth audit. They developed a questionnaire for the audit, ensuring it met both national and state regulatory standards. The team gathered and meticulously analysed crucial data.

The audit results reveal a positive environmental status at Bangabasi Evening College. The team has proposed both immediate and long-term strategies to further elevate environmental standards. The college authorities and all stakeholders have pledged their commitment to addressing these recommendations and pursuing the suggested improvements.

AUDIT COMMITTEE MEMBERS

An expert committee of 3 members was formed to conduct the Green, Environment and Energy Audit from different field of expertization such as Biodiversity, Taxonomy, Physics (Energy Science and management) and Conservation Biology.

The Committee members are listed below:

SL No.	NAME	Area in interest	Designation
1.	Dr. Sumit Manna	Ecology, Environment, Biodiversity Economics and Conservation	Assistant Professor HOD. Dept. of Botany and IQAC coordinator Moyna College And Secretary Auditor INRC
2.	Dr. Amit Manna	Energy management, green synthesis of Nano particle and characterization, Spectroscopic analysis	Vice President Institute of Nature Research and Conservation & Former Project Scientist Spectroscopic Analysis Team NASA
3.	Prof. Nilanjan Sadhukhan	Molecular Taxonomy and Biodiversity	Faculty, Dept of Botany Moyna College

The Audit team started the audit at the Bangabasi Evening College Campus from 1st August, 2021

Important dates and of Initiative

SL NO	PURPOSE	DATE	REMARKS
1	Communication with College authority	January 14, 2020	Discuss about term and condition
3	Collection information about the College	August 1, 2021	Introduced to Administrative Officer
4	Campus visit and observation	August 31, 2021	Outdoor observation with Photo camera and GPS coordinates
5	Campus enquiry	August 31, 2021	Physically enquiry with expert
6	Departments visit and enquiry	September 17, 2021	Laboratory enquiry
7	Interview with other stake holder	September 17, 2021	Meet with others stake holder
8	Interview with staff	September 17, 2021	Collected different information
9	Review data and Assessment	September 20, 2021	Data generate and drown figures
10	Pre-Closing meeting	September 20, 2021	Meeting with IQAC
11	Closing Meeting	September 22, 2021	Pre-submission of the Report
12	Submit audit report	December 10, 2021	Submit of the Report

ABOUT THE BANGABASI EVENING COLLEGE

Principal Prasanta Kumar Bose, a distinguished descendant of Acharya Girish Chandra Bose—the visionary founder of Bangabasi College and a celebrated educator in Bengal—initiated the evening section of Bangabasi College in 1940. His aim was to provide Commerce education to employed students who required flexible study options.

In 1944, Principal Bose expanded the evening section to include Arts and Science faculties, notably opening the doors to employed women. The college gained independent status on April 11, 1965, following the University Grants Commission's Phase Reduction Scheme, which required a reduction in student numbers. This led to the division of Bangabasi College into three separate entities, with the evening section becoming Bangabasi Evening College, governed independently under Principal Bose's leadership.

During World War II, in 1942, Bangabasi College established a branch in Kushtia (now in Bangladesh) to provide refuge to Kolkata residents amid Japanese bombing raids, though this branch ceased operations post-war.

Situated near Sealdah Station in Kolkata, Bangabasi Evening College boasts a rich cultural heritage, tracing its roots back to Bangabasi School, founded by Acharya Girish Chandra Bose in 1855. The college moved to its present location at 19, Scott Lane (now Raj Kumar Chakraborty Sarani) in 1903.

The name "Bangabasi" originates from the patriotic newspaper founded by Acharya Girish Chandra Bose in 1887 at 16, Bowbazar Street. Starting with just five teachers and twelve students, the institution has flourished into a significant educational establishment under Bose's visionary guidance, now serving thousands of students and employing hundreds of dedicated teachers and staff.

During the colonial period, Bangabasi College became a haven for those persecuted for their political beliefs, with students and faculty actively participating in movements such as the protest against the partition of Bengal in 1905 and the Civil Disobedience Movement. Renowned educators like Ladly Mohan Mitra and Satyananda Roy pioneered evening classes at Bangabasi Evening College, providing education to working students unable to attend daytime classes due to their employment commitments.

ACADEMIC DEPARTMENTS

SL NO	Department of Arts	Department of Science	Department of Commerce
1	Bengali	Anthropology	Commerce
2	English	Botany	
3	Geography	Chemistry	
4	Hindi	Economics	
5	History	Mathematics	
	Philosophy	Physiology	
	Political Science	Physics	
	Sanskrit	Zoology	

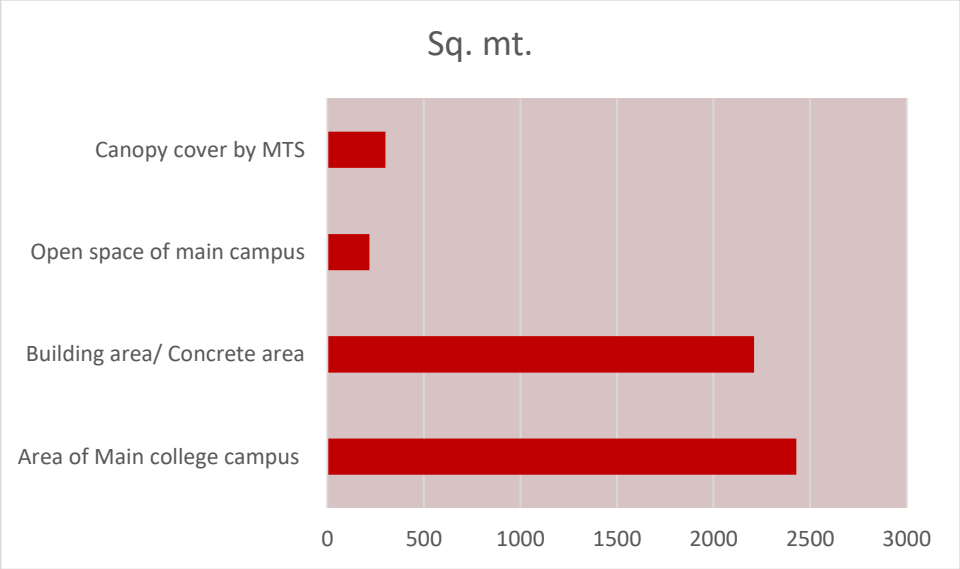
CLASSIFICATION AND AREA OF COVERAGE COLLEGE CAMPUS

Arial View of the main Campus of Bangabasi Evening College depicting the Canopy cover, concrete and building Areas. (Canopy cover 301.66 m^2) 22°34'09"N 88°22'05"E

Playground and Tent area of Bangabasi Evening College

Area distribution and area use pattern of Bangabasi Evening College

Area	Sq. mt.
Area of Main college campus	**2428.123**
Building area/ Concrete area	2209.58
Open space of main campus	218.543
Canopy cover by MTS	301.66



Apart from this area of main campus, Bangabasi Evening College also use a playground and a tent for the players provided by KMC.

PURPOSE OF GREEN AND ENVIRONMENT

Environmental Compliance: Ensure the college adheres to all local, regional, and national environmental laws related to waste disposal, energy use, and other relevant regulations.

Resource Management: Evaluate the efficient use of resources on campus, including water, energy, and materials, and identify opportunities for conservation and sustainable resource allocation.

Waste Reduction and Recycling: Assess current waste management practices and recommend measures to minimize waste production, promote recycling, and ensure proper disposal.

Energy Efficiency: Examine campus energy consumption patterns and suggest strategies to improve efficiency, including the adoption of renewable energy sources.

Biodiversity and Green Spaces: Assess the impact of campus development on local biodiversity and promote the creation and preservation of green areas, gardens, and natural habitats.

Transportation and Commuting: Evaluate the environmental impact of campus transportation and encourage sustainable commuting options to reduce carbon emissions.

Curriculum Integration: Integrate environmental and sustainability themes into academic programs to raise awareness and understanding of environmental issues among students and faculty.

Community Engagement: Involve the campus community in environmental initiatives and educational campaigns, fostering a culture of environmental stewardship among students, faculty, and staff.

Infrastructure Development: Ensure new construction and development projects comply with green building standards and sustainable design principles.

Climate Change Mitigation: Develop strategies to reduce the college's contribution to climate change, including lowering greenhouse gas emissions and implementing carbon reduction measures.

Cost Savings: Identify cost-effective strategies to enhance environmental performance, leading to long-term financial savings through energy efficiency, waste reduction, and sustainable practices.

Institutional Reputation: Boost the college's reputation as an environmentally conscious institution, positively impacting enrolment, partnerships, and community relationships.

Regulatory and Funding Compliance: Ensure compliance with environmental regulations and explore funding opportunities through environmentally friendly initiatives.

PURPOSE OF ENERGY AUDIT

- In any organization, the top three operational expenses typically include energy (both electricity and heating), labor, and materials. Among these, energy management consistently emerges as a critical area for cost reduction.
- An Energy Audit is essential for understanding how energy and fuel are used within an institution. It identifies areas of waste and opportunities for improvement, providing insights that help reduce energy costs, enhance preventive maintenance, and improve quality control programs crucial for production and utility operations.
- This audit program allows for a detailed examination of energy cost fluctuations, energy supply reliability, decisions regarding energy sources, identification of energy-saving technologies, and the upgrade to energy-efficient equipment. The Energy Audit translates conservation concepts into practical solutions, offering technically feasible recommendations while considering economic and organizational factors within a specific timeframe.
- The primary goal is to develop strategies to reduce energy consumption per unit of output or lower operational expenses. The Energy Audit acts as a benchmark for managing energy within the organization and forms the foundation for planning more efficient energy utilization across the institution.
- The eco-campus concept emphasizes efficient energy utilization and conservation, aiming for sustainable savings. It also seeks to reduce carbon emissions, calculate carbon footprints, endorse the procurement of energy-efficient equipment, promote energy conservation in all buildings, decrease overall energy consumption, minimize landfill waste, and integrate environmental considerations into contracts and services with significant environmental impacts.
- Energy Management, examined through audits, focuses on energy savings and potential opportunities. While energy itself is intangible, its effects are visible through heat, light, and power in wires, pipes, and other materials. Energy management indicators include aspects such as energy consumption, sources, monitoring, lighting, vehicle usage, electrical appliances, and transportation. Energy usage is fundamental to campus sustainability and is assessed accordingly.
- Despite the widespread use of energy, attention to energy-saving options remains crucial. For example, a standard incandescent bulb consumes 60W to 100W, whereas an energy-efficient LED bulb uses less than 10W, highlighting the significant potential for energy

savings. Energy auditing is vital for conservation efforts and implementing measures to reduce consumption, thereby mitigating environmental harm

Site Visit:

- We carried out a detailed survey of the campus to examine and document various environmental features such as waste disposal areas, energy systems, green spaces, and water management facilities.
- We cataloged the plant biodiversity on campus, identifying and photographing a variety of plant and animal species. Our inspection also covered areas including the medicinal garden, canteen, library, all departments, office spaces, buildings, and parking lots to collect relevant data.
- Air quality measurements were taken at multiple locations within the college, including classrooms, offices, the Principal's chamber, corridors, open spaces, the canteen, the students' common room, the seminar room, and various laboratories.
- We documented the number and types of vehicles used by campus stakeholders and checked the fuel consumption of each vehicle by consulting with the users. Additionally, we counted the usage of LPG cylinders in laboratories, the canteen, and hostel kitchens.
- During a thorough inspection of water taps, we identified several leaking taps and overflowing tanks.

Different types of Survey are conducted in College Campus:

Energy Usage Evaluation:

Analyze energy consumption patterns in different campus buildings. Recommend methods for energy conservation and efficiency improvement.

Water Management Review:

Assess water sources, usage patterns, and wastewater treatment facilities. Propose strategies for water conservation and sustainable water practices.

Waste Management Assessment:

Investigate waste generation and disposal practices. Suggest ways to reduce waste, promote recycling, and ensure proper disposal.

Transportation and Commuting Analysis:

Examine the travel habits of students and faculty. Suggest eco-friendly transportation options and improvements to transportation infrastructure.

Green Space and Biodiversity Evaluation:

Evaluate the condition of green areas, gardens, and natural habitats. Offer recommendations to enhance biodiversity and protect green spaces.

Environmental Education Review:

Assess how environmental topics are incorporated into academic programs. Evaluate the environmental awareness among students and faculty.

Sustainability in Development Projects:

Review the eco-friendly features of upcoming construction projects.

Community Engagement Survey:

Evaluate community involvement in environmental initiatives. Collect feedback from campus residents on environmental awareness efforts.

Regulatory Compliance Check:

Ensure compliance with environmental laws and guidelines. Identify areas needing adjustments to meet regulatory standards.

Steps of data collection:

- Initially, the audit team divided into two groups. The first group, consisting of skilled members, started collecting data for the energy audit, while the second group focused on gathering data for the green and environmental audits.

- Members of each group explored the entire college campus, including the gardens, canteen, kitchen, library, and all departments with their respective laboratories.
- A detailed questionnaire covering all aspects of the green, environmental, and energy audits was created and distributed to stakeholders to collect data before the visit.
- Data was collected through observations, personal interviews, and group discussions with various stakeholders.
- Environmental parameters across different locations within the college premises were assessed using various electronic devices such as atmospheric TVOC and HCOC meters, SPM level meters (PM 1, PM 2.5, and PM 10), water TDS meters, and water salinity meters. All measurements were recorded systematically

Data Analysis:

- Calculation of green space, concrete area, and aquatic land within the college campus.
- Measurement of DBH (Diameter at Breast Height) and F% (Frequency Percentage) of various MTS (Multi-Trunked Species).
- Analysis of biodiversity and taxonomic diversity.
- Assessment of energy consumption and generation from renewable energy sources. Evaluation of groundwater and rainwater storage and reuse procedures.
- Examination of waste generation and disposal methods.
- Measurement of air quality levels, including TVOC and HCOC, at various locations (Principal's office, faculty rooms, administrative offices, classrooms, laboratories, canteen, and open spaces) on the college campus. Calculation of the campus biodiversity index using standard indices.
- Measurement of TDS (Total Dissolved Solids) and salinity levels of water from different tanks and filters across the campus.

Bangabasi Evening College is a distinguished institution committed to academic excellence and holistic development. The college acknowledges the urgent need to adopt

sustainable practices in its operations. To this end, the initiation of a Green Audit has become a crucial step in promoting environmental responsibility and resilience.

GREEN AUDIT

IMPORTANCE OF GREEN AUDIT AT BANGABASI EVENING COLLEGE:

In today's global landscape, the significance of conducting a Green Audit at Bangabasi Evening College cannot be overstated. With communities worldwide grappling with climate change, diminishing resources, and environmental degradation, educational institutions play a pivotal role in fostering sustainable mindsets and behaviors. Bangabasi Evening College, serving as a beacon of knowledge and societal influence, acknowledges its responsibility in this regard.

The Green Audit serves as a comprehensive assessment tool, examining the college's environmental impact, resource utilization, waste management practices, and overall ecological footprint. Through this meticulous evaluation, the college aims to identify areas for improvement and embrace sustainable approaches that align with its commitment to environmental stewardship.

Furthermore, the Green Audit at Bangabasi Evening College goes beyond mere regulatory adherence; it serves as a catalyst for instilling environmental awareness among students, faculty, and staff. By integrating sustainable principles into the institution's ethos, the college not only contributes to the global sustainability movement but also cultivates a culture of environmental responsibility within its community.

METHODOLOGY ADAPDTED FOR GREEN AUDIT

The Green Audit team conducted a thorough survey of the Bangabasi Evening College campus, documenting all aspects of biodiversity, including flora and fauna. Species were identified onsite, and specimens were collected for further identification when necessary.

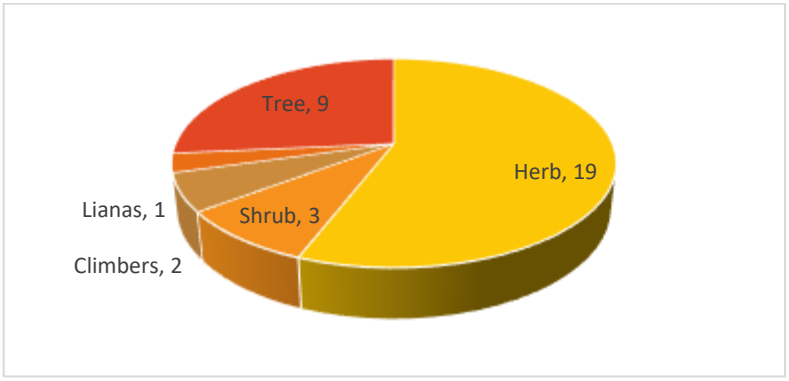
Many of the existing species were photographed during the fieldwork. The flora was classified into major tree species (MTS), shrubs, and herbs. Additionally, various insects, soil fauna, butterflies, dragonflies, birds, amphibians, reptiles, and mammals were observed and identified during the field visit.

Floral diversity at the campus of Bangabasi Evening College

During the study, researchers documented a total of 34 flowering plant species and 1 pteridophyte. Among these, 9 species were classified as Major Tree Species (MTS), 3 species were shrubs, 19 species were herbs, 2 species were climbers, and 1 species was identified as a liana. Interestingly, 35% of the plant species observed exhibited medicinal potential, as supported by existing literature (Fig. 1).

This study presents a comprehensive inventory of plant species within the surveyed area, encompassing a variety of flowering plants and one pteridophyte. The categorization of species into different groups, such as Major Tree Species (MTS), shrubs, herbs, climbers, and lianas, provides valuable insights into the diversity and composition of the plant community. Furthermore, the identification of medicinal potential in a significant proportion of the observed plant species highlights the ecological and potential economic importance of the area. This information contributes to our understanding of local biodiversity and underscores the need for conservation efforts to protect these valuable plant resources.

Fig.1 Classification of flora of Bangabasi Evening College based on habit



It's intriguing to observe that all 9 species of major tree species (MTS) come from 6 distinct taxonomic families, indicating a moderate level of taxonomic diversity within the college campus (Table 1). Due to the limited open space on campus, the majority of MTS such as Mangifera indica, *Azadirachta indica*, and *Citrus maxima* were observed to be clustered in this small area, creating a highly competitive environment. Others were found either potted or clinging to the edges of buildings and damp walls.

This observation underscores the diverse range of plant species present within the college campus, with representatives from multiple taxonomic families contributing to the overall biodiversity. The limited open space has led to an interesting dynamic, where certain species, particularly those like *Mangifera indica, Azadirachta indica*, and *Citrus maxima*, compete for resources in a compact environment. Additionally, the adaptability of other species to thrive in pots or along building edges highlights their resilience and ability to colonize various niches within the campus ecosystem. Overall, this analysis sheds light on the intricate interactions between plant species within the campus environment.

Table 1. Diversity of Major Tree Species (MTS) in the Campus of Bangabasi Evening College.

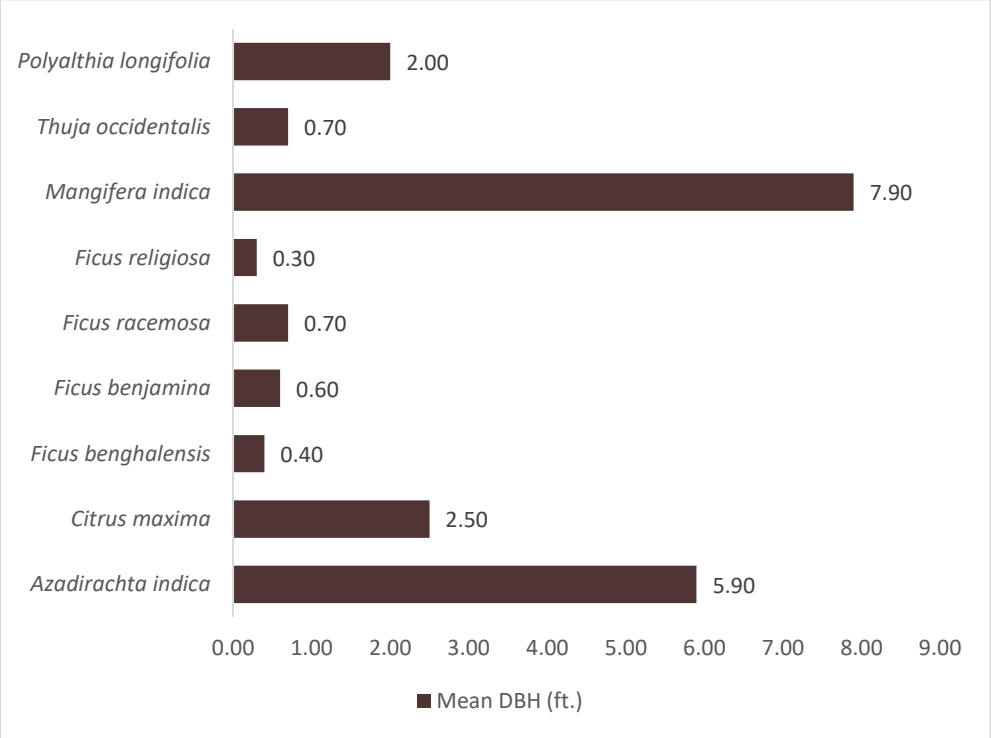
MTS	Family	No. of individuals	Mean DBH (ft.)	Phenological condition	Canopy cover	F%
Azadirachta indica	Meliaceae	1	5.90	1 M	H	5.263
Citrus maxima	Rutaceae	1	2.50	1 M	M	5.263
Ficus benghalensis	Moraceae	2	0.40	2 IM	VL	10.526
Ficus benjamina	Moraceae	1	0.60	1IM	VL	5.263
Ficus racemosa	Moraceae	1	0.70	1IM	VL	5.263
Ficus religiosa	Moraceae	5	0.30	5 IM	VL	26.316
Mangifera indica	Anacardiaceae	1	7.90	1 M	VH	5.263
Thuja occidentalis	Cupressaceae	1	0.70	1 M	L	5.263
Polyalthia longifolia	Annonaceae	6	2.00	6 M	M	31.579

VL: Very low, L: Low, M: Medium, H: High, VH: Very high

The majority of these Major Tree Species (MTS) exhibit arborescent characteristics, with the exception of two tree species, although many struggled to find adequate space for proliferation. Mangifera Indica stands out as the dominant species, closely followed by *Azadirachta indica*, contributing significantly to the green canopy coverage of the college campus (measuring 301.66 m2). Despite being arborescent, species like *Ficus religiosa* and *Ficus benghalensis* were observed growing along the edges of buildings. Remarkably, the extension of the canteen area was executed without compromising a large MTS, Citrus maxima, showcasing a positive attitude towards campus biodiversity among various stakeholders, including the college authority. Additionally, six individuals of *Polyalthia longifolia*were found growing at the front of the campus, albeit planted, reflecting a commendable initiative by the college authority.

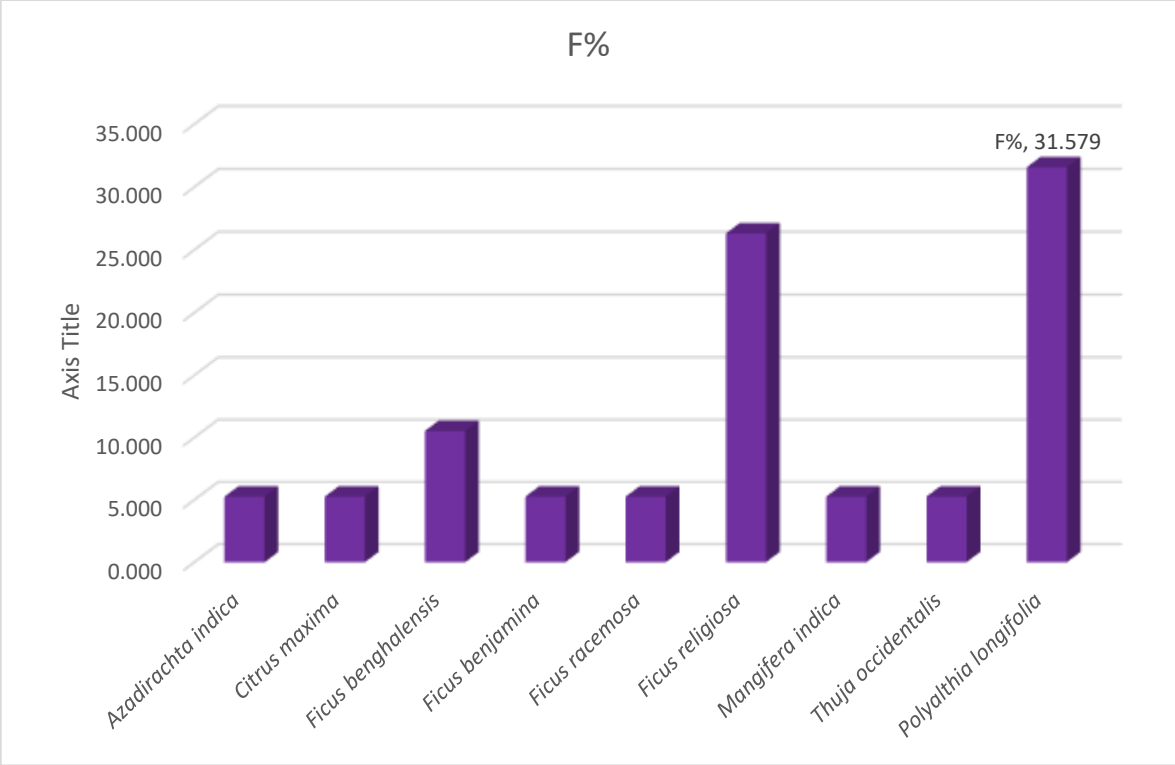
Out of these 9 MTS *Mangifera Indica* has shown its highest diameter at breast Height (DBH) (7.90 ft.) followed by *Azadirachta indica* (5.90 ft) (Fig. 2).

Figure 2. Mean DBH of the MTS



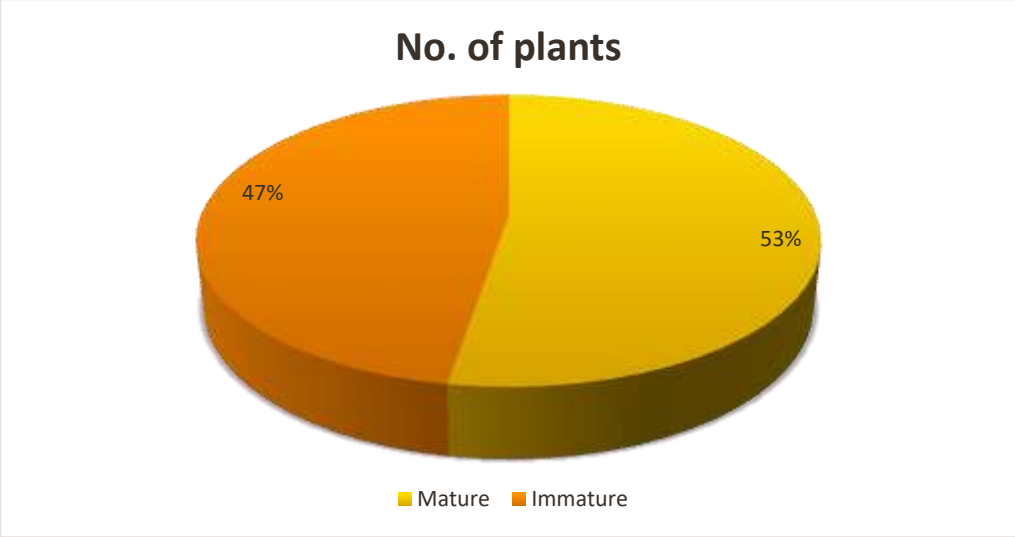
When the frequency percentage of these MTS was calculated it was observed that the F% of *Polyalthia longifolia*(31.579 %) was highest (Though planted) followed by *Ficus religiosa* and *Ficus benghalensis* (Fig. 3).

Figure 2. Frequency percentage of different Major Tree Species (MTS)



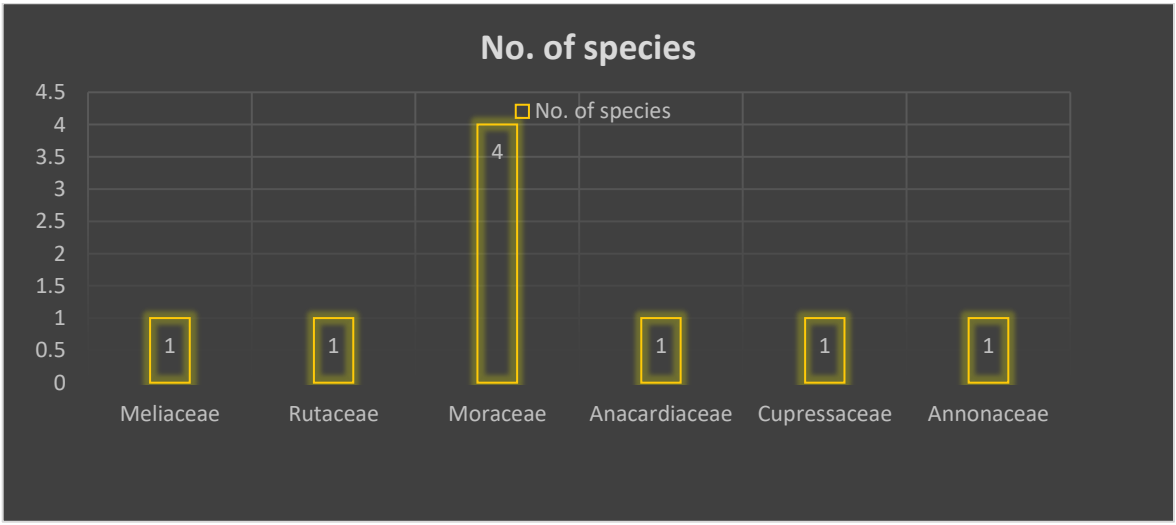
It was noted that 53 % of the MTS achieved their phenological stage which represents that the MTS community is considerable mature and causes high carbon sequestration and their control over different niche of the ecosystem. Specifically, the two species *i.e. Azadirachta indica* and *Mangifera indica* provide a diverse habitat for different kinds of insects, birds and other organisms (Fig 4).

Figure 4. Phenological status of different MTS



Out of 6 taxonomic families on which these 9 MTS belongs from, Moraceae is the family dominant family (4 species of MTS belongs from this family). One species from each was found to be belonged from the rest of the 5 families of MTS (Fig 5).

Figure 5. Number of Genus under different Taxonomic Family



Considering the species richness and evenness when the Simpson's Diversity Index of the MTS was calculated using the formula (EQ-1)

$$D = 1 - (\sum n(n-1)/N(N-1)) \ldots\ldots\ldots\ldots\ldots\ldots \text{(EQ-1)}$$

It was observed that the diversity of MTS in the campus of Bangabasi Evening College was not very high (**D =0.035**). As the college is situated at a very congested urban settlement of the mega city (Kolkata), there is very constrains of open spaces for arborescent trees.

Mangifera indica *Azadirachta indica*

Diversity of Shrubs, Herbs, Climbers and Lianas in the Bangabasi Evening College Campus

A total of 25 species of Shrubs, Herbs, Climbers and Lianas were recorded from College Campus which were found to be distributed from 17 different taxonomic families (Table 2). Among these plants *Lindenbergia muraria,* and *Turneria ulmifolia* were the most dominant species. Though most of these herbs and shrubs were found to be grown in pot, and Cornish of the buildings.

Table 2 Diversity and use of herbs, shrubs, climbers and trees in the college campus

Herbs Shrubs, Climbers and lianas	Fanuly	Habit	Use as/Use in
Achyranthes aspera	Amaranthaceae	Herb	Wild
Aloe vera	Asparagaceae	Herb	Medicinal
Parthenium hysterophorus	Asteraceae	Herb	Alien invasive
Catharanthus roseus	Apocynaceae	Herb	Medicinal, Ornamental
Eragrostis tenella	Poaceae	Herb (Grass)	Wild grass
Crinum viviparum	Amaryllidaceae	Herb	Ornamental, Medicinal
Cynodon dactylon	Poaceae	Herb (Grass)	Wild
Dracena sp	Asparagaceae	Herb	Ornamental
Epipremnum aureum	Araceae	Climber	Ornamental
Hibiscus rosa-sinensis	Malvaceae	Shrub	Ornamental
Cyperus rotundus	Cyperaceae	Herb (Grass)	Wild grass
Kyllinga brevifolia	Cyperaceae	Herb (Grass)	Wild
Lindenbergia muraria	Orobanchaceae	Herb	Medicinal
Tabernaemontana divaricata	Apocynaceae	Shrub	Ornamental
Mikania scandens	Asteraceae	Climber	Medicinal, Alien invasive
Ocimum sanctum	Lamiaceae	Herb	Medicinal
Eleutheranthera ruderalis	Asteraceae	Herb	Alien invasive
Pouzolzia zeylanica	Urticaceae	Herb	Wild
Pteris sp.	Pteridoideae	Pteridophyt (Herb)	Wild
Quisqualis indica	Combretaceae	Lianas	Ornamental
Rhoeo discolor	Commelinaceae	Herb	Ornamental
Sansevieria trifasciata	Asparagaceae.	Herb	Medicinal
Scoparia dulcis	Plantaginaceae	Herb	Medicinal
Turneria ulmifolia	Passifloraceae	Shrub	Medicinal
Tridax procumbens	Asteraceae	Herb	Alien invasive

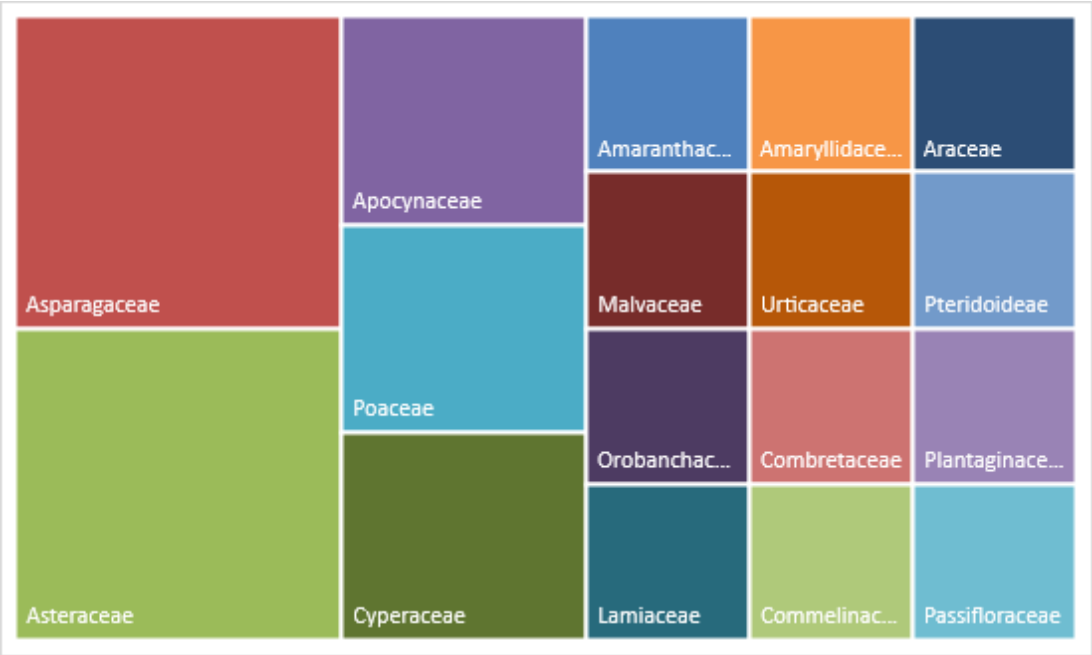
Crinum viviparum *Quisqualis indica*

Biodiversity documentation *Dracena* sp. And *Aloe vera*

Aloe vera, Scoparia dulsis *Turneria ulmifolia* *Phyllanthus niruri & Pouzolzia zeylanica*

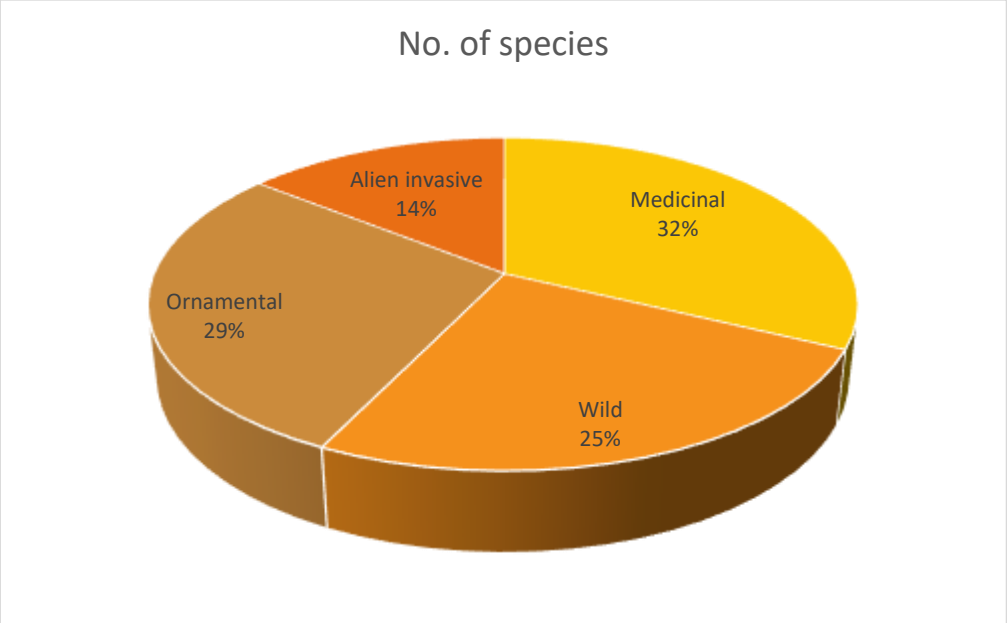
Observation of the family diversity of the floral composition highlights the taxonomic diversity present within the surveyed plant species, with a total of 17 different families which represented the taxonomic diversity was moderately high. Notably, the families Asperagaceae and Asteraceae emerged as the most dominant, each accounting for 4 species. Following closely behind were the families Apocynaceae, Poaceae, and Cyperaceae. The remaining families each contributed 1 species to the overall composition. This distribution underscores the varied botanical makeup of the area, providing valuable insights into the ecological dynamics and species richness within the surveyed habitat. (Fig. 6).

Fig. 6 Dominance of different taxonomic families



Out of these 25 species of herbs, shrubs climbers and trees present in the Bangabasi Evening College Campus, 32% were have medicinal properties, 29% were ornamental, 25% of them were found to be grown in wild fallow lands and 14% have economic importance (Fig. 7).

Fig. 7 Use pattern of different plant species present in the college campus



Pteris sp. And Scoparia dulcis

Faunal diversity at the campus of Bangabasi Evening College

As the college is situated at the most congested area of Calcutta, there is no such wild habitat present in the college campus. Here in this green audit the total fauna of the college campus has been categorized into **1. Soil fauna, and Fauna on and within wooden furniture, wooden stairs Cupboards, and wooden walls & in books (31 species recorded) 2. Butterflies, Moth, Dragon flies and other flies (15 species recorded) 3. Birds and 4. Mammals (6 species from each group has been recorded), (reflected in Table 1)**

The diverse array of soil fauna detailed in the table highlights the intricate web of life that sustains soil health and ecosystem functionality. From nematodes and annelids to soil arthropods, insects, and reptiles, each group plays a vital role in processes such as decomposition, nutrient cycling, and soil aeration. This biodiversity is crucial for maintaining fertile and productive soils, which are foundational to both natural ecosystems and agricultural systems.

Understanding and preserving the diversity of soil fauna is essential for sustainable land management and environmental conservation. As these organisms collectively contribute to soil structure, fertility, and overall ecosystem health, their protection and study should be prioritized. This knowledge can inform practices that enhance soil quality, support biodiversity, and ensure the resilience of ecosystems in the face of environmental challenges.

Table 1. Soil fauna, and Fauna on and within wooden furniture, wooden stairs Cupboards, and wooden walls & in books

Name of the of the soil fauna and fauna on and within wooden furniture, wooden stairs Cupboards, and wooden walls & in books too	Family
Camponotus compressus	Formicidae
Acerentomata sp.	Acerentomidae
Apogonia ferruginea	Scarabaeidae

Calotes versicolor	Agamidae
Camponotus compressus	Formicidae
Cornu aspersum	Helicidae
Deroceras reticulatum	Agriolimacidae
Eutyphoeus incommodus	Octochaetidae
Gryllus sp.	Gryllidae
Hemidactylus	Gekkonidae
Heterodera ssp.	Heteroderidae
Hypogastrura nivalis	Hypogastruridae
Janetaescincus sp.	Scincidae
Lampito mauritii	Lumbricidae
Limax sp Slugs	Limacidae
Mabuyia sp.	Scincidae
Meloidogyne ssp.	Heteroderidae
Metaphire postuma	Megascolecidae
Nopoiulus kochii	Blaniulidae
Odontotermes feae	Termitidae
Oniscus asellus	Oniscidae
Orchisella sp.	Entomobryidae
Scolopendra hardwickii	Scolopendridae
Solenopsis invicta	Formicidae
Stemmiulus vagans	Stemmiulidae
Suncus murinus	Soricidae
Diplatys sp.	Diplatyidae
Lepisma sp.	Lepismatidae
Nephila sp	Nephilidae
Odontotermes feae	Termitidae
Periplaneta americana	Blattidae

Apart from the diverse faunal composition in the soil and within wooden furniture, wooden stairs Cupboards, and wooden walls & in books of the college campus, A total of two species of butterflies, one species of moth, grasshopper, honey bees, flesh fly, common

green bottle fly, lesser fruit fly, Syrphid-flies and Robber flies were also noted along with two species of house flies, different types of mosquitoes (Table 2).

Table 2 offers a glimpse into the diverse insect life inhabiting various ecosystems. Each species listed fulfills crucial roles, whether in pollination, decomposition, predation, or as part of the food chain. Understanding the behaviors and functions of these insects is essential for effective ecosystem management, particularly in agriculture and conservation efforts.

Insects such as Indian honey bees play a vital role in pollination services, benefiting both wild plant populations and agricultural crops. Conversely, species like Aedes aegypti and Anopheles mosquitoes are targeted for control measures due to their role in disease transmission.

The coexistence of beneficial insects, such as bees and predatory flies, alongside pests like mosquitoes and house flies, underscores the intricate web of ecological interactions. Effective management strategies must navigate this complexity to maintain ecological equilibrium and safeguard both human interests and biodiversity.

The findings underscore the pivotal role of insects in upholding ecological functions and emphasizes the ongoing importance of studying and conserving these essential organisms.

Table 2 Diversity of Butterflies, Moth, Dragon flies and other flies

Butterflies, Moth, Dragon flies and other flies	Family
Acraea violae	Nymphalidae
Aedes aegypti	Culicidae
Anophelese sp.	Culicidae
Apis indica	Apidae
Catopsilia pomona	Pieridae
Cepora nerissa	Pieridae

Dysmachus trigonus	Asilidae
Lucilia sp.	Calliphoridae
Musca domestica	Muscidae
Omocestus viridulus	Acrididae
Orthetrum Sabina	Libellulidae
Papilo demoleus	Papilionidae
Plodia interpunctella	Pyralidae
Urothemis signata	Libellulidae
Vespa sp.	Vespidae

Table 3 documents a total of 6 bird species observed within the college campus. Each species plays a distinctive role within its ecosystem. For instance, owls and crows aid in pest control, while mynas and parrots facilitate seed dispersal, and pigeons contribute to nutrient cycling in urban settings. Additionally, birds like owls and parrots hold cultural and symbolic significance, with owls often associated with wisdom and mystery, and parrots admired for their beauty and mimicry.

Despite their adaptability and prevalence, these birds are still vulnerable to threats such as habitat destruction, pollution, and human activities. Therefore, conservation efforts should prioritize protecting their habitats and mitigating the impacts of human intervention.

Table 3. Diversity of birds at the campus of Bangabasi Evening College

Birds	Family	Common name/English name/ Vernacular name
Bubo bengalensis	Strigidae	Owl/Pancha
Corvus domesticus	Corvidae	Crow/ Kak
Psittacula sp.	Psittaculidae	Parrot/Tia
Corvus splendens	Corvidae	Crow/ Kak
Acridotheres tristis	Sturnidae	Common moyna/Salik
Columba domestica	Columbidae	Pigeon/ Payra

A total of 6 species of mammals were recorded from the college campus of which 1 is domestic. *Craseonycteris thonglongyal* was noted to be dwell in the *Mangifera indica* tree.

Chip-munk was also found to be occur in the two arborescent tree species present at the college campus (Table 4).

Table 4 Diversity of mammals at the college campus

Mammels	Family	Common name/English name/ Vernacular name
Bandicoota bengalensis	Muridae	Rat
Craseonycteris thonglongyal	Craseonycteridae	Bat
Felis domesticus	Felidae	Cat
Funambulus palmarum	Sciuridae	Chip-munk
Mus booduga	Muridae	Mice
Suncus murinus	Soricidae	Chucho

Acridotheres tristis

Columba domestica

Psittacula sp.

Bandicoota bengalensis

Funambulus palmarum

Craseonycteris thonglongyal

Papilo demoleus

Papilio polytes

Urothemis signata

Apis indica

Musca domestica

Periplaneta americana

Cornu aspersum

Odontotermes feae

CONCLUSION

The Green Audit at Bangabasi Evening College goes beyond a routine check; it signifies a strategic pledge to foster a greener and more sustainable future. This initiative showcases the college's commitment to environmental responsibility and its role in equipping stakeholders to tackle the challenges of an evolving environmental landscape. By embarking on this transformative journey, Bangabasi Evening College sets a benchmark for other educational institutions, encouraging a collective movement towards a more sustainable and resilient world.

ENVIRONMENT AUDIT

CAMPUS SURVEY AND ENQUIRY

Conducting an environmental audit on a college campus is vital for promoting sustainability, ensuring regulatory compliance, and achieving financial savings. By identifying inefficiencies in resource use and waste management, the college can implement measures to reduce consumption and enhance recycling, contributing to a more sustainable campus. Regular audits help ensure compliance with environmental laws and regulations, preventing legal penalties and maintaining necessary permits. Financially, reducing energy and resource inefficiencies lowers operational costs and creates opportunities for sustainability grants. Moreover, a proactive environmental strategy enhances the institution's reputation, attracting students and funding while fostering positive community relationships. Environmental audits also offer educational opportunities, integrating real-world data into the curriculum and involving students in sustainability initiatives. Additionally, they contribute to the health and well-being of the campus community by identifying and mitigating environmental hazards. Regular audits enable the college to benchmark performance, set improvement goals, and adopt innovative practices, thereby enhancing overall efficiency and sustainability. Finally,

audits help identify environmental risks and improve crisis preparedness, ensuring the campus is equipped to handle potential environmental challenges responsibly.

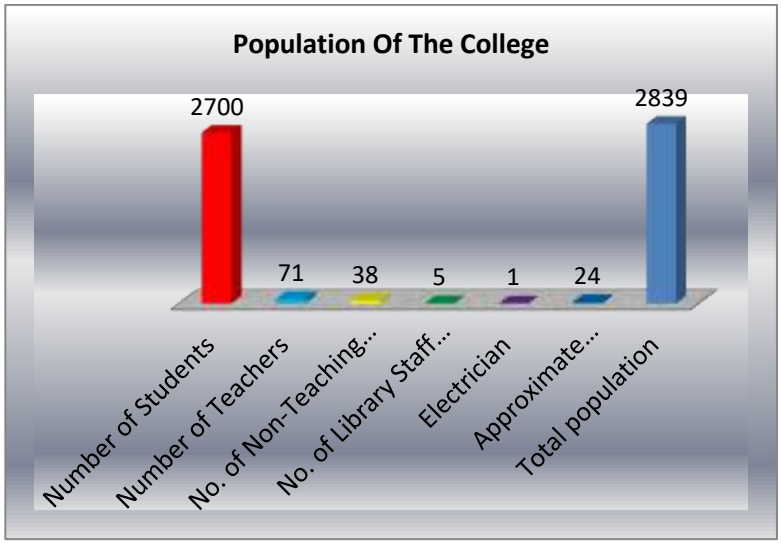
The Audit covered the following major areas:

- Average Foot fall
- Water Efficiency and Water Management
- Air Quality and Carbon foot print and Management
- Waste and Waste Management
- E-waste management
- Environmental disaster management
- Biodiversity and Green Zone and management

TOTAL POPULATION OF THE COLLEGE CAMPUS – FOOT FALL

Number of Students	**2700**
Number of Teachers	**71**
No. of Non-Teaching Staff including Casual Staff	**38**
No. of Library Staff including Casual Staff	**5**
Electrician	**1**
Approximate Number of visitors	**24**
Total population	**2839**

FOOT FALL BASED ON TOTAL POPULATION



75% of the footfall of the total population may be considered as the average footfall in the college per day. This represent the footfall is moderate considering the total space of the college campus.

WATER EFFICIENCY AND WATER MANAGEMENT

Water, the essence of life, is a precious and limited resource vital for supporting ecosystems, livelihoods, and human well-being. Essential for human survival, water plays a critical role in maintaining health and well-being. It is a fundamental component of our bodies, necessary for numerous physiological processes, including digestion, absorption, circulation, and temperature regulation. Water is also crucial for maintaining ecosystems, supporting diverse plant and animal life, and contributing to biodiversity by sustaining natural habitats and balancing ecological processes.

However, in today's world, characterized by population growth, urbanization, and climate change, there is increasing pressure on water sources. This necessitates a collective effort towards adopting water-efficient practices and effective water management techniques to address modern water challenges.

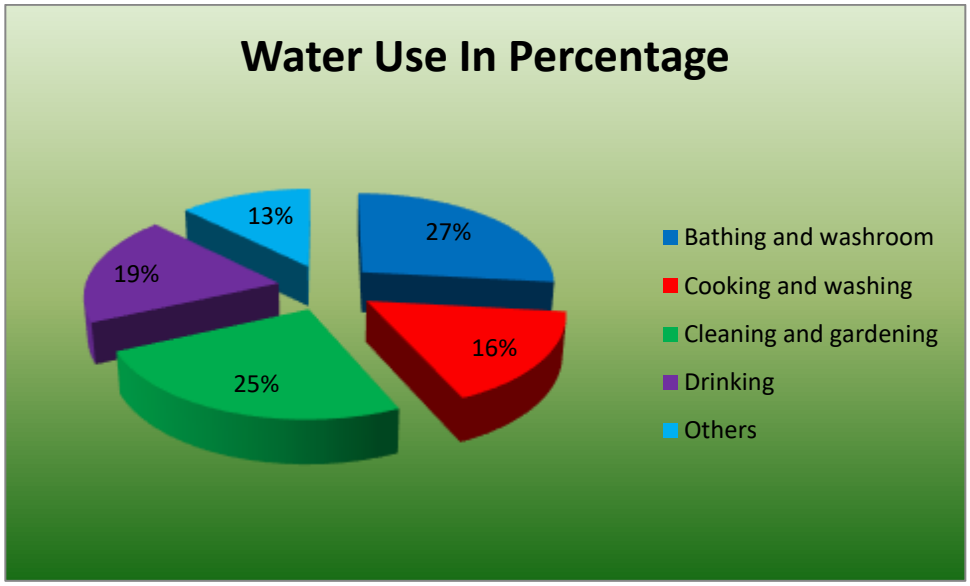
For college campuses, water management and water audits are essential to ensure the efficient and sustainable use of this vital resource. By managing water effectively, colleges can significantly reduce waste and lower operational costs, contributing to both environmental and financial sustainability. Regular water audits help identify inefficiencies, leaks, and areas of excessive use, allowing for timely interventions that save water and money. These practices also ensure compliance with regulatory standards, preventing legal issues and demonstrating the institution's commitment to environmental stewardship.

Additionally, proper water management supports the health and hygiene of the campus community by ensuring a safe and reliable water supply. It also offers educational opportunities, integrating practical learning experiences into the curriculum and raising awareness about water conservation among students and staff. Overall, water management and audits promote a sustainable, cost-effective, and health-conscious campus environment, setting a positive example for the broader community.

USE OF WATER IN DIFFERENT PURPOSE OF COLLEGE PREMISES

USE OF WATER IN DIFFERENT PURPOSE PER DAY	USE IN PERCENTAGE
Bathing and washroom	26.75
Cooking and washing	16.5
Cleaning and gardening	24.95
Drinking	19.2
Others	12.6

PERCENTAGE OF USE OF WATER AT THE COLLEGE CAMPUS



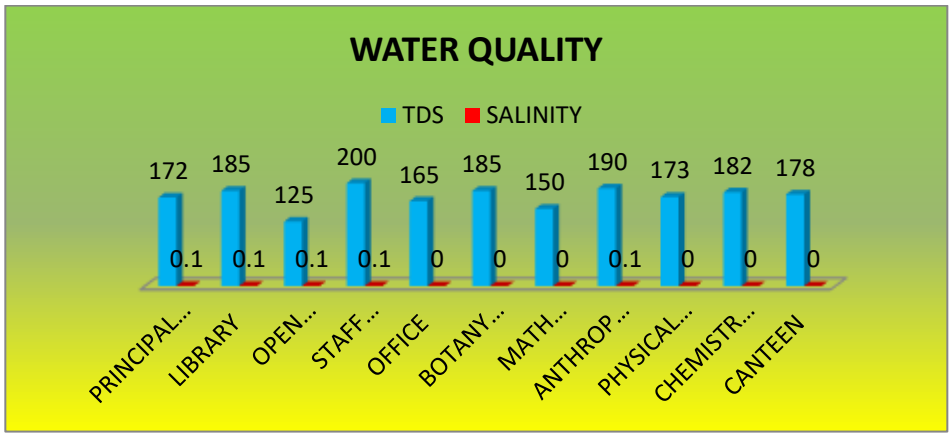
In this college maximum percentage of water was found to be used in bathing and washroom (26.75%) followed by cleaning and gardening (24.95%). 19.2% of the total used water is used for drinking purpose after proper purification. Though a few amount was drained out in this process.

WATER QUALITY IN COLLEGE CAMPUS

The drinking water we consume today is often treated with hazardous chemicals at various water treatment plants, leading to the removal of natural minerals. Therefore, it is crucial to employ proper filtration processes to eliminate contaminants and ensure the water is safe for consumption. One major contaminant in water is total dissolved solids (TDS), which remain after standard filtration. TDS are contaminants larger than 2 microns. A fine filter typically removes particles that are 0.45 microns in size and can come from various sources.

WATER TDS AND SALINITY LEVEL AT DIFFERENT REGION OF COLLEGE CAMPUS

ROOMS	TDS	SALINITY
PRINCIPAL ROOM	172	0.1
LIBRARY	185	0.1
OPEN SPACE	125	0.1
STAFF ROOM -1	200	0.1
OFFICE	165	0
BOTANY LAB	185	0
MATH DEPARTMENT	150	0
ANTHROPOLOGY LAB	190	0.1
PHYSICAL SCIENCE LAB	173	0
CHEMISTRY LAB	182	0
CANTEEN	178	0



REFERENCE RANGE OF TOTAL DISSOLVED SOLIDS (TDS)

TDS LEVEL	COLOUR BAR	HAZARD LEVEL	REMARKS
<50	Orange	Serious	Unacceptable as it lacks essential minerals
50-150	Green	Very safe	Excellent for drinking. The TDS level is ideal for areas where the water polluted by sewage or industrial waste
151-250	Light green	Safe	Good. The water is ideal for people with cardiovascular disease
251-350	Yellow	Normal	Good. The water is ideal for people with cardiovascular disease

351-500	Light orange	Medium	Fairly acceptable
501-900	Orange	Serious	Less acceptable
901-1200	Light red	Danger	Least acceptable. Avoid drinking water that has a tds level of 900
1201-2000	Red	Danger	Water is not acceptable for drinking.
Above 2000	Dark red	Danger	Unacceptable

Water salinity, the concentration of dissolved salts in water, significantly impacts both human life and ecosystems. In human life, salinity levels are critical for drinking water quality. High salinity in drinking water can cause health issues such as hypertension, cardiovascular diseases, and kidney problems. It is also a concern for agriculture, as crops are sensitive to salinity; excessive salt levels in irrigation water can reduce crop yields and soil fertility, threatening food security. Furthermore, industries that rely on water, such as food processing and manufacturing, require water with controlled salinity levels to maintain product quality and operational efficiency.

In ecosystems, salinity profoundly influences the distribution and health of aquatic life. Many freshwater organisms are sensitive to salinity changes and can suffer physiological stress or mortality if exposed to high salt levels. This can lead to a decline in biodiversity and disrupt aquatic food webs. In estuarine environments, where freshwater and seawater mix, salinity gradients are essential for the survival of various species adapted to specific salinity ranges. Mangroves, salt marshes, and seagrass beds, which provide crucial habitat for many species, also depend on stable salinity conditions.

Moreover, salinity impacts soil health and plant communities. High soil salinity can inhibit plant growth by affecting water uptake and nutrient availability, leading to reduced agricultural productivity and loss of vegetation cover. This, in turn, affects wildlife habitats and soil erosion patterns.

Overall, maintaining appropriate salinity levels in water bodies is essential for human health, agricultural productivity, industrial processes, and the health of aquatic and terrestrial ecosystems. Addressing salinity issues requires integrated water management strategies that consider the needs of diverse stakeholders and the complex interactions within ecosystems.

REFERENCE RANGE OF WATER SALINITY

SALINITY STATUS	SALINITY (%)	SALINITY (PPT)	COLOR BAR	HAZARD LEVEL	USE
FRESH	< 0.05	< 0.5	BLUE	SAFE	Drinking and all irrigation
MARGINAL	0.05 – 0.1	0.5 – 1	DEEP BLUE	NORMAL	Most irrigation, adverse effects on ecosystems become apparent
BRACKISH	0.1 – 0.2	1 – 2	DARK BLUE	LIGHT	Irrigation certain crops only; useful for most stock
SALINE	0.2 – 1.0	2 – 10	LIGHT ORANGE	MEDIUM	Useful for most livestock
HIGHLY SALINE	1.0 – 3.5	10 – 35	ORANGE	SERIOUS	Very saline groundwater, limited use for certain livestock
BRINE	> 3.5	> 35	RED	DANGER	Seawater; some mining and industrial uses exist

Overall, the water quality level within the college campus is well maintained and water quality of the open space area of the college is best within the college campus.

PERFORMANCE AUDIT OF WATER MANAGENENT

Factors	Weightage
Quality of Water	H
Re-use of water	L
Water Harvesting & Recharge	L
Use of Surface Water	M

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

Following examinations utilizing Water salinity meters and TDS meters, we've established that the drinking water quality on campus is excellent for human health, earning a high rating (H) for Water Quality. A single water harvesting unit was also noticed in the college campus which was found to be performed efficiently. The stored water was found to be used in the toilets and washing purpose in the ground floor of the college campus. Moreover, there was some initiatives noticed in management of water and its reuse and utilization of surface water within the campus premises was noticed. As a result, the effectiveness of the current water management policy is evaluated as moderate (M).

AIR QUALITY LEVEL IN THE COLLEGE CAMPUS

Air quality on college campuses is a critical aspect of environmental health and overall well-being for students, faculty, and staff. Poor air quality can result from various sources, including vehicle emissions, nearby industrial activities, construction projects, and indoor pollutants like mold, dust, and chemicals used in cleaning or laboratory settings. Effective air quality management involves monitoring pollution levels, identifying sources of contamination, and implementing strategies to maintain and improve air purity.

Data collection for Environment Audit

To monitor air quality, campuses often install air quality sensors and conduct regular assessments to track pollutants such as particulate matter (PM1.0, PM2.5, and PM10), formaldehyde (HCHO), carbon monoxide (CO), and total volatile organic compounds (TVOCs). These sensors provide real-time data, helping campus authorities respond quickly to air quality issues.

Vehicle emissions are a significant contributor to outdoor air pollution on campuses. To mitigate this, colleges can promote alternative transportation options like biking, walking, and public transit. Implementing carpooling programs, providing electric vehicle charging stations, and encouraging the use of campus shuttles can also reduce vehicle emissions. Additionally, establishing no-idle zones and restricting vehicle access to certain areas can further enhance air quality.

Indoor air quality is equally important and can be managed through several measures. Ensuring proper ventilation in buildings helps reduce the concentration of indoor pollutants. Regular maintenance of HVAC systems, the use of air purifiers, and the selection of low-emission materials and furnishings contribute to healthier indoor environments. Managing indoor humidity levels prevents mold growth, while strict protocols for handling chemicals in laboratories and cleaning supplies minimize exposure to harmful substances.

Construction activities on campus can also impact air quality by releasing dust and other pollutants. Effective management includes scheduling construction during off-peak times, using dust suppression techniques, and installing barriers to contain construction-related emissions. Engaging in green building practices, such as using environmentally friendly materials and ensuring proper site management, further supports air quality goals.

Educational initiatives play a vital role in air quality management. Raising awareness about the importance of air quality and encouraging the campus community to adopt sustainable practices can lead to long-term improvements. Programs that educate about the health impacts of poor air quality and promote actions like reducing energy

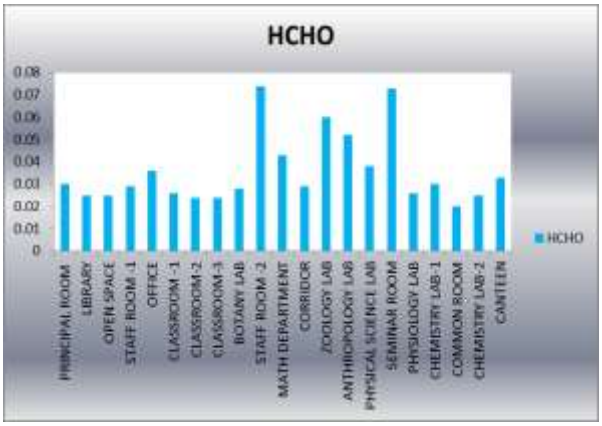
consumption, planting trees, and maintaining clean surroundings can significantly contribute to better air quality.

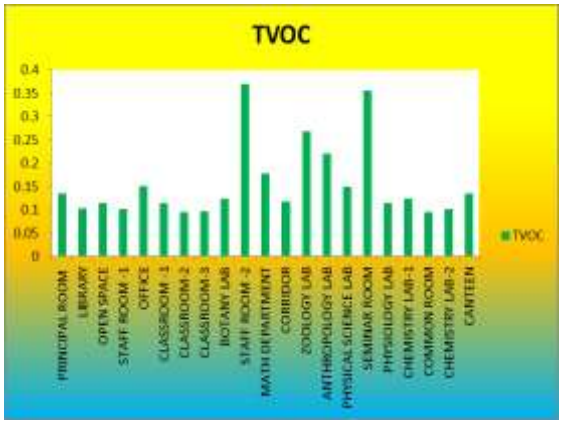
In summary, managing air quality on college campuses involves a combination of monitoring, mitigating sources of pollution, and promoting sustainable behaviors. By addressing both outdoor and indoor air quality, implementing effective transportation and construction policies, and engaging the campus community, colleges can create a healthier and more sustainable environment for everyone.

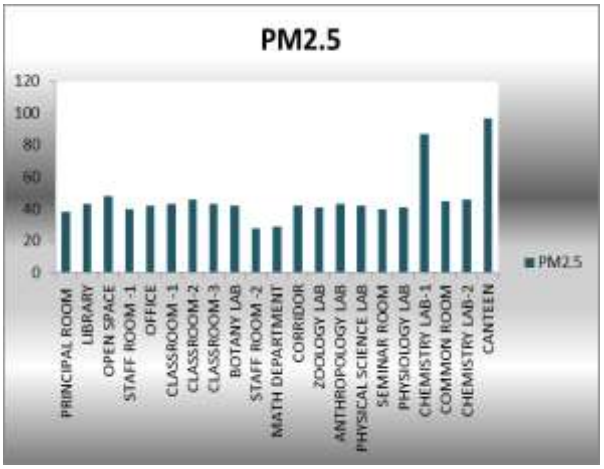
DIFFERENT PARA METERS OF AIR QUALITY LEVEL AT DIFFERENT REGION OF COLLEGE CAMPUS

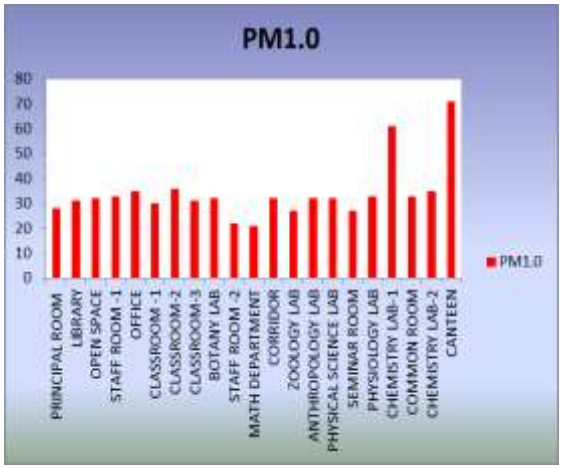
ROOMS	HCHO	TVOC	PM2.5	PM1.0	PM10	APL
PRINCIPAL ROOM	0.03	0.135	38	28	44	14
LIBRARY	0.025	0.102	43	31	47	17
OPEN SPACE	0.025	0.114	48	32	55	17
STAFF ROOM -1	0.029	0.101	40	33	43	15
OFFICE	0.036	0.15	42	35	53	16
CLASSROOM -1	0.026	0.114	43	30	46	14
CLASSROOM-2	0.024	0.095	46	36	54	19
CLASSROOM-3	0.024	0.096	43	31	53	16
BOTANY LAB	0.028	0.123	42	32	51	18
STAFF ROOM -2	0.074	0.369	28	22	33	18
MATH DEPARTMENT	0.043	0.177	29	21	34	13
CORRIDOR	0.029	0.117	42	32	46	15
ZOOLOGY LAB	0.06	0.267	41	27	44	17
ANTHROPOLOGY LAB	0.052	0.22	43	32	47	15
PHYSICAL SCIENCE LAB	0.038	0.149	42	32	53	18
SEMINAR ROOM	0.073	0.355	40	27	46	21
PHYSIOLOGY LAB	0.026	0.114	41	33	43	17
CHEMISTRY LAB-1	0.03	0.123	87	61	95	33
COMMON ROOM	0.02	0.094	45	33	52	16
CHEMISTRY LAB-2	0.025	0.101	46	35	52	19
CANTEEN	0.033	0.135	97	71	110	39

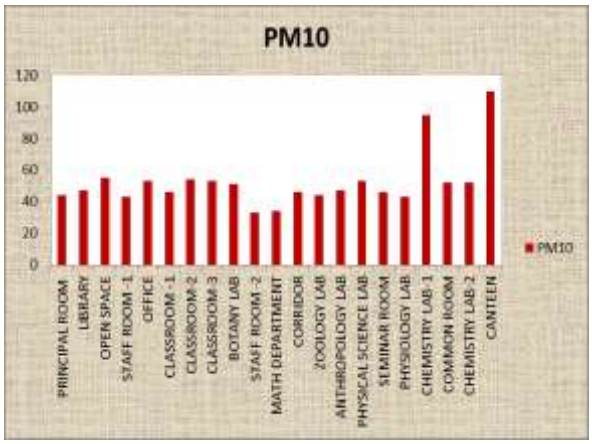
GRAPHICAL REPRESENTATION OF DIFFERENT PARAMETER OF AIR QUALITY LEVEL

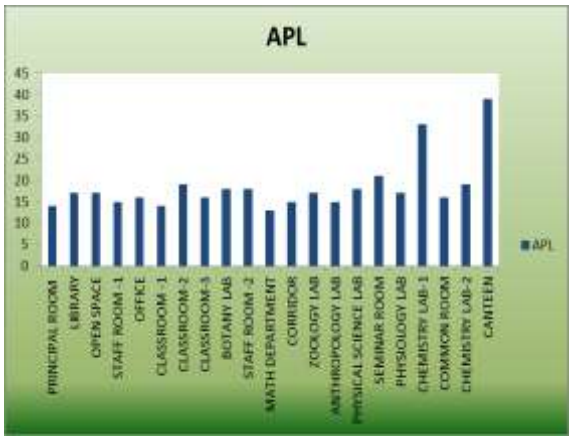












The highest levels of HCHO are found in Staff Room - 2 (0.074), while the highest TVOC levels are also observed in this room (0.369). Both metrics are notably elevated, indicating

potential indoor air quality concerns. These levels could be attributed to the presence of new furniture, cleaning products, or poor ventilation. Chemistry Lab-1 shows the highest levels of PM2.5 (87), PM1.0 (61), and PM10 (95). This suggests significant particulate pollution likely resulting from experimental activities and chemical reactions. Immediate action is necessary to address these high levels, such as implementing effective ventilation systems and ensuring proper handling of chemicals.

The canteen exhibits the highest APL (39), indicating poor overall air quality. This finding aligns with the high levels of particulate matter observed in this area. Interventions such as improved ventilation and source control are essential to mitigate the pollution levels.

Recommendations

Enhanced Ventilation:

Canteen and Chemistry Lab-1: Install advanced ventilation and air purification systems to reduce particulate matter and improve air quality.

Staff Room -2, Zoology Lab, Seminar Room: Increase ventilation to lower HCHO and TVOC levels. Consider using air purifiers with activated carbon filters that can absorb volatile organic compounds.

Source Control:

Canteen: Implement better exhaust systems in cooking areas to capture and filter out smoke and particulate emissions. Encourage the use of electric stoves over gas stoves to reduce emissions.

Laboratories (Chemistry, Zoology, Physical Science): Ensure proper fume hoods and exhaust systems are used during experiments. Regularly maintain and inspect laboratory ventilation systems to ensure optimal performance.

Material and Product Selection:

General Indoor Areas: Use low-emission materials and products, such as low-VOC paints, adhesives, and cleaning supplies, to reduce indoor air pollutants.

Construction and Renovation Projects: Ensure that construction activities are performed with dust suppression measures and that materials used are certified for low emissions.

Regular Monitoring and Maintenance:

Conduct regular air quality assessments in all rooms, especially those with previously high pollutant levels, to track improvements and ensure sustained air quality. Maintain HVAC systems regularly to ensure they are functioning correctly and efficiently.

Educational Programs:

Raise Awareness: Implement educational initiatives to inform students, faculty, and staff about the importance of maintaining good air quality and how they can contribute. This can include workshops, posters, and informational sessions.

Sustainable Practices: Encourage sustainable practices such as reducing energy consumption, proper waste disposal, and minimizing the use of pollutants.

REFERENCE RANGE OF DIFFERENT PARAMETERS TO MEASURE AIR QUALITY

HCHO RANGE	TVOC RANGE	PM2.5 RANGE	PM1.0 RANGE	PM10 RANGE	APL RANGE	COLOR BAR	AIR POLLUTION LEVEL	Hazard Level
<0.061	<0.3	<35	<10	0-50	0-50	GREEN	SAFE	LIVABLE (FRESH)
<0.100	0.3-1.0	<75	<20	51-100	51-100	LIGHT GREEN	NORMAL	TEMPORARY STAY(NORMAL)
<0.370	1.0-3.0	<115	<30	101-150	101-150	YELLOW	LIGHT	DON'T STAY LONG(POOR)
<0.775	3.0-6.0	<150	<40	151-200	151-200	LIGHT ORANGE	MEDIUM	SHOULD NOT STAY(HARMFUL)
<1.181	6.0-10	<250	<50	201-300	201-300	ORANGE	SERIOUS	LEAVE ASAP(SERIOUS)
>1.181	>10	>250	>50	301-400	>300	RED	DANGER	LEAVE NOW(DANGER)

GENERATION OF WASTE AND WASTE MANAGEMENT

Efficient waste management is crucial on college campuses to foster sustainability and preserve environmental well-being. Colleges generate diverse waste streams, including municipal solid waste (MSW) comprising everyday items like food waste, packaging, and paper. Recyclable materials such as paper, cardboard, glass, metals, and select plastics necessitate robust recycling programs and educational initiatives for proper segregation and processing. Organic waste, primarily food scraps and yard waste, can be repurposed through composting projects, providing valuable fertilizer for campus landscapes. Hazardous waste, encompassing chemicals, batteries, and electronic waste (e-waste), requires stringent disposal procedures and collaborations with specialized services to mitigate health and environmental risks. Construction and demolition waste from campus building projects can be minimized through on-site sorting and material reuse strategies. Laboratory waste, including chemical reagents and biological materials, demands strict safety protocols and secure disposal methods to prevent contamination. Campuses employ various tactics such as source reduction, recycling programs, composting, and waste audits to effectively manage these waste types. Educational campaigns play a pivotal role in cultivating awareness and encouraging sustainable practices among students, faculty, and staff. Additionally, sustainable procurement practices and green building initiatives aid in reducing waste generation and enhancing overall campus sustainability. Through concerted efforts, colleges can significantly diminish their environmental impact and cultivate a culture of environmental stewardship within the campus community.

Different source of waste Generation in College Campuses:

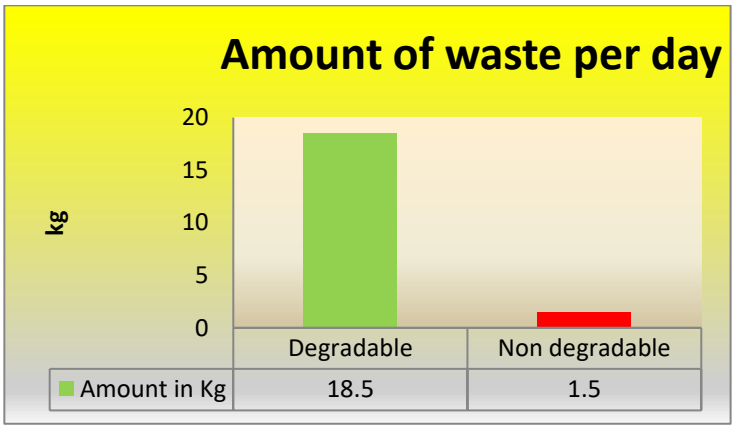
- **Academic Waste:** Includes paper waste, discarded textbooks, notebooks, and other educational materials.
- **Food Waste:** Generated from dining facilities, cafes, and student activities.
- **E-waste:** Arises from the use and disposal of electronic devices in computer labs and personal electronics.

- **Plastic and Packaging Waste:** From products, promotional materials, and campus events.
- **General Waste:** Includes everyday waste from offices, maintenance activities, and residential areas.

TYPES OF WASTES:

TYPE OF WASTAGE IN PER DAY	AMOUNT IN KG
Degradable	18.5
Non degradable	1.5

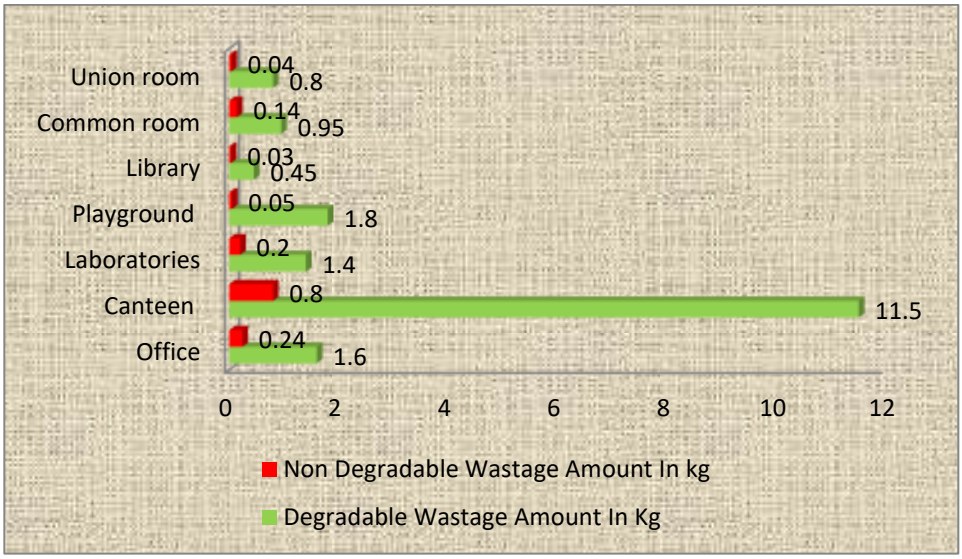
AMOUNT OF WASTE PER DAY



SOURCE OF WASTAGE IN DIFFERENT SECTOR (PER DAY IN KG):

Source of Wastage in Different Sector(per day in Kg)	Degradable Wastage Amount In Kg	Non Degradable Wastage Amount In kg
Office	1.6	0.24
Canteen	11.5	0.8
Laboratories	1.4	0.2
Playground	1.8	0.05
Library	0.45	0.03
Common room	0.95	0.14
Union room	0.8	0.04

SOURCE OF WASTAGE IN DIFFERENT SECTOR (PER DAY IN KG):



PERFORMANCE AUDIT OF WASTE ISSUES:

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

*** H denote- Taken management policy level above 60%**

**** M denote- Taken management policy level 40%-60%**

***** L denote-Taken management policy level below 40%**

- ✓ No e-waste management in the college was recorded.
- ✓ No such disaster management cell and infrastructure was noted at the Bangabasi Evening College.

Energy Audit

Introduction: A thorough analysis involves a detailed scrutiny of power consumption within an organization, aiming to reduce energy use. It necessitates examining methods and systems to lower energy consumption while maintaining functionality. Recommendations for various strategies to enhance energy efficiency are provided. With conventional energy sources like fossil fuels dwindling, there is a need to explore alternatives and prioritize energy conservation. The primary goal is to deliver goods or services at the lowest possible cost while minimizing environmental impact. Performing an energy assessment helps identify potential savings, understand fuel consumption trends, locate inefficiencies, and find opportunities for improvement. It is crucial for educational institutions to implement sustainable energy-saving practices. The assessment process includes developing surveys, inspecting facilities, reviewing records, conducting interviews, analysing data, taking measurements, and providing suggestions. Energy auditing evaluates the potential for energy savings, management practices, and alternative energy options. Specific objectives include evaluating sustainability management systems and ensuring compliance with regulations. The results of the assessment significantly affect operational costs and environmental impact. Initiatives such as the Energy Conservation Building Code and the Bureau of Energy Efficiency encourage energy-efficient practices. Energy labels and ratings enable consumers to make informed decisions. The Energy Audit serves as a benchmark for energy management, helping to develop more effective strategies. It is a systematic evaluation of energy sources aimed at protecting the environment and conserving natural resources. At Bangabasi Evening College, affiliated with the University of Calcutta, the audit begins with identifying, measuring, recording, reporting, and analysing energy components.

Need for an Energy Audit: In every establishment, the three main operational expenses usually include power (both electrical and thermal), workforce, and materials. Among these, power consistently emerges as a critical element in cost management and potential savings, making power management essential for cost reduction. An Energy Audit is crucial in comprehending power and fuel consumption within an industry, pinpointing wasteful areas and those with improvement potential. It provides insights that help lower energy expenses, enhance preventive maintenance, and improve quality control programs, all vital for manufacturing and utility functions. This audit initiative allows for a detailed examination of power cost variations, power supply reliability, decisions regarding power sources, identification of power conservation methods, and retrofitting for energy-efficient equipment. Essentially, the Energy Audit translates conservation ideas into actionable solutions, offering technically viable recommendations that consider financial and organizational factors within a specified timeframe. The primary objective is to develop strategies for reducing power usage per unit of product output or lowering operational costs. Serving as a benchmark, the Energy Audit establishes a baseline for managing power within the establishment and lays the groundwork for strategizing more efficient power use throughout the facility. The eco-friendly campus concept emphasizes efficient power use and conservation, aiming for sustainable savings. Additionally, it targets reductions in carbon emissions, involves calculating carbon footprint, promotes acquiring energy-efficient machinery for cost-effective and safe power supply, advocates for power conservation in all buildings, seeks to decrease overall power consumption, minimize waste sent to landfills, and integrates environmental considerations into contracts and facilities with significant environmental impacts. Evaluating Power Management through audits focuses on power savings and potential opportunities. While power itself is intangible, its presence is evident in cables, conduits, and other materials through visible effects like heat, light, and efficiency. Power management assessments cover power consumption, sources, monitoring, lighting, transportation, electrical appliances, and distribution. Power use is a critical aspect of campus sustainability, requiring inclusion in assessments without further explanation. Despite the widespread

use of power, attention to power-saving potential remains crucial. For instance, a traditional incandescent bulb consumes 60W to 100W, whereas an energy-efficient LED uses less than 10W, highlighting significant power savings. Power auditing is essential for conservation efforts and the adoption of methods to reduce consumption, thereby mitigating environmental degradation. Moreover, audits provide invaluable suggestions and recommendations for efficient power-saving practices. Environmentally conscious institutions are encouraged to review their power practices at least once every two years, utilizing both internal and external auditors. Conducting power assessments, facilitated by both internal and external auditors, plays a significant role in organizational power management. These assessments effectively evaluate the power potential within an establishment, identifying more efficient approaches to reduce environmental impact.

Aims and Objectives of an Energy Audit: An energy audit is a crucial tool for developing and implementing thorough energy management plans within an organization. Its primary goal is to methodically identify opportunities for improving energy efficiency, conservation, and cost savings at the audit location. The evaluation process includes the following steps:

- Reviewing the energy-saving initiatives and measures currently in place at the audit sites.
- Identifying various opportunities for energy conservation measures and additional avenues for cost savings.
- Exploring alternative energy sources to assess potential energy savings and guide decision-making in energy management.
- Providing technical advice on establishing an energy balance and offering precise, application-focused guidance.
- Conducting a comprehensive examination of energy usage, reviewing recent electricity bills for the location, and understanding the tariff structures offered by the central and state electricity boards.

- Listing the various ways energy is utilized, including electricity for appliances such as stoves, kettles, microwaves, and other sources like LPG, diesel, and more.
- Evaluating the use of different devices and equipment, including incandescent (tungsten) bulbs, CFL bulbs, fans, air conditioners, cooling devices, heaters, computers, photocopiers, inverters, generators, and laboratory equipment. This assessment involves calculations based on factors such as wattage and duration of use (e.g., 60-watt bulb x 5.5 hours x number of bulbs = kWh).
- Assessing the adoption of alternative energy sources/non-traditional energy sources within the organization, such as photovoltaic cells for solar power, energy-efficient appliances, biogas, etc. Additionally, implementing initiatives to raise awareness among stakeholders regarding energy conservation and efficient use. In essence, energy auditing in the institutional setting is a multi-faceted approach that not only aims for efficiency in resource utilization but also emphasizes the importance of sustainable practices, cost savings, and collective responsibility for the well-being of the organization and its environment.

Methodology and Survey Schedules: To perform an energy audit, various techniques are employed at the audit sites, focusing primarily on an in-depth site inspection analysis. This process involves matching overall energy inputs with total energy outputs and mapping all energy flows within a facility. Physical verification of different components, such as lighting, roofing, tables, ventilation fans, air conditioning units, solar panels, heaters, generators, uninterruptible power supply units, and air circulation systems, is conducted during the audit. This includes verifying the effectiveness of installed energy-efficient systems. The audit emphasizes examining the costs or potential cost savings associated with each of these components, with energy consistently emerging as a crucial area for cost reduction. Energy management becomes vital in achieving cost-saving goals. Additionally, the energy bill from the utility company is collected for analysis. This assessment involves evaluating load requirements and efficient energy use. Stakeholders are engaged during the audit to explore

opportunities for improvement in energy management. Potential areas for energy conservation and cost-saving opportunities are identified and recommended for implementation within the facility. Energy audits can be categorized into the following types: I. Initial Energy Audit II. Comprehensive Energy Audit III. Scope and Scale of Energy Audit IV. Detailed Energy Audit.

Survey Form for data collection:

1. Enumerate the ways the college consumes energy (Electricity, electric stoves, pots, microwaves, LPG, wood, gasoline, diesel, and others).
2. Summarize the total electricity bills for the past two/three years.
3. Account for the overall expenditure on LPG cylinders over the previous year.
4. Calculate the cost of gasoline/diesel/other fuels for power generators.
5. State the number of CFL bulbs installed and specify their operational duration.
6. Determine the energy consumed by each bulb monthly.
7. Identify the number of LED bulbs used within college premises (with detailed operational duration).
8. Count the quantity of incandescent (tungsten) bulbs installed.
9. Total the number of fans in place (with detailed operational duration).
10. Record the number of air conditioners in place (Hours used per day, for how many days monthly).
11. Calculate the energy consumed by each electrical appliance monthly (kWh).

12. Specify the number of operational computers and their usage (Hours used per day, for how many days monthly).
13. State how many photocopiers are installed.
14. Count the quantity of cooling devices installed.
15. Determine the energy consumed by each inverter monthly (kWh).
16. List the number of electrical appliances used in different laboratories along with their power ratings.
17. Specify how many heaters are used in the cafeteria (with usage details, hours used per day, and number of days monthly).
18. Confirm if any alternative energy source modules are installed and provide detailed specifications.
19. Indicate if computers and additional devices are set to energy-saving mode.
20. Identify if machines (TVs, ACs, computers, weighing scales, printers, etc.) frequently operate on standby mode and specify the duration in hours if applicable.
21. Outline the energy conservation methods the college follows.
22. Count the number of panels displayed to promote energy conservation awareness.

To assess the environmental impact, carbon dioxide levels were measured at various locations across the campus using a portable CO_2 analyser. This measurement aimed to evaluate the carbon footprint and identify areas with significant carbon emissions, providing valuable insights for reduction strategies. The college's energy bill was reviewed and analysed to understand kilowatt-hour

(kWh) requirements and the efficiency of energy usage. Engaging with various stakeholders was crucial in familiarizing them with energy assessment procedures, ensuring a successful and results-oriented energy audit. Opportunities for energy conservation and savings were identified during the audit, laying the groundwork for potential implementation steps. The assessment methodology involved gathering information through various channels, including on-site visits, group discussions, campus surveys, inquiries, observations, perception analyses, and feedback. All these elements contributed to the comprehensive audit report.

Detailed Energy Audit Methodology: A comprehensive evaluation provides a detailed energy management strategy for a facility by examining all major energy-consuming systems. This type of evaluation delivers the most precise assessment of both energy efficiency and costs. It considers the cumulative effects of all initiatives, takes into account the energy consumption of key appliances, and involves meticulous calculations for both energy cost savings and project expenses. In an in-depth evaluation, the energy balance is a vital element, relying on an inventory of energy-consuming systems, assumptions about current operational conditions, and calculations of energy usage. This estimated usage is then compared with charges on utility bills. Preliminary site visits and preparations are essential stages before detailed analysis. An initial site visit typically lasts a day, allowing the Energy Auditor/Engineer to interact with relevant personnel, familiarize themselves with the surroundings, and assess the procedures necessary for conducting the energy evaluation.

7. Source of Energy: Through the enquiry process it is noted that the mostly used energy source is conventional but institution has taken notable steps to develop non-conventional energy sources in terms of solar energy module and it is found to be nearly 20% of the total unit consumption is drawn from solar module.

Figure 1. Power house and energy distribution module of Bangabasi Evening College

Figure 2. Electrical energy distribution system of Bangabasi Evening College

Energy Cost:

Total electricity consumption(conventional)- 19226.6 U (80%)

Total electricity consumption (non-conventional)-4806.5 U (20%)

Fossil fuel consumption per year-

a. Number of LPG gas cylinders used for cooking (Canteen)-102PCs (Approx.)

b. Number of LPG used in Laboratories-37PCs (Approx.)

c. Diesel used for green Generator- 120 (Approx.) litter

Table 1 represents the percentage use of conventional and non-conventional uses of energy and its corresponding plot is depicted in figure 3.

Table 1: Percentage use of conventional and non-conventional sources of energy.

Source of energy	In Percentage
Conventional	**80%**
Non -Conventional	**20%**

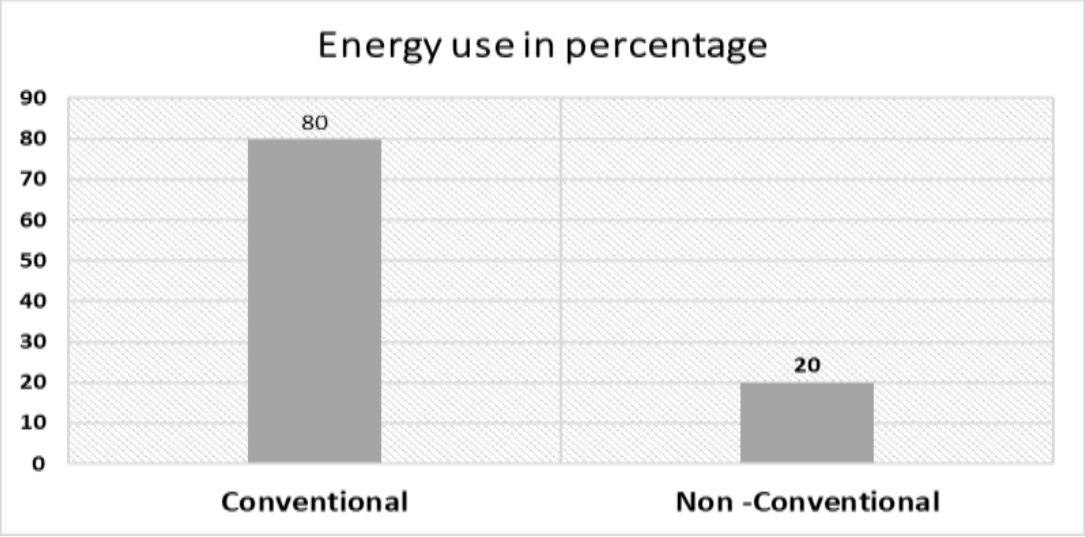


Figure 3. Mode of energy used in college campus (conventional and non-conventional)

Figure 4. Solar energy module at Bangabasi Evening College

Figure 5. A.C. installed at Bangabasi Evening College

Figure 6. LED enabled well-equipped conference hall at Bangabasi Evening College

During the survey different electrical appliances are recorded with its corresponding power rating. In table 2 the calculated daily approximate consumption of electrical energy is shown below.

Table 2: The detail calculation of energy consumption.

SlNo	**Particulars**	Power consumption per hour	Quantity	Consumption (KWh/day)
1.	Tube/Bulb light	40W/100W	327	25.56
2.	LED light	20/40W	128	9.5
3.	Fan	50W	269	26.5
4.	Air Conditioner	1.5/2KW	65	28.5
5.	Computer	300W	82	12.3
6.	Xerox Machine	500W	03	4.0
7.	Printer	65W	15	1.2
8.	Projector	500W	08	0.1
9.	Electric kettle	850W	02	0.1
10.	Refrigerator	500W	05	10
11.	Water pump	1KW	10	12
12.	Sound system	50W	05	0.2
13.	Other Laboratory instruments	500W	28	8
14.	Streetlight	500W	02	4.6

15.	Router	5W	04	0.4
16.	T.V	40W	01	0.1

Figure 7. Data collection at Bangabasi Evening College

For precaution, a maximum Demand Controller (DC) can be installed at the main LT panel to avoid the maximum demand penalty. In case the running maximum demand

increases, the demand controller will switch off some non-essential load like Air-conditioning load etc. and simultaneously it will also give alarm for further action.

The corresponding plot of energy consumption from calculation is depicted in figure 8.

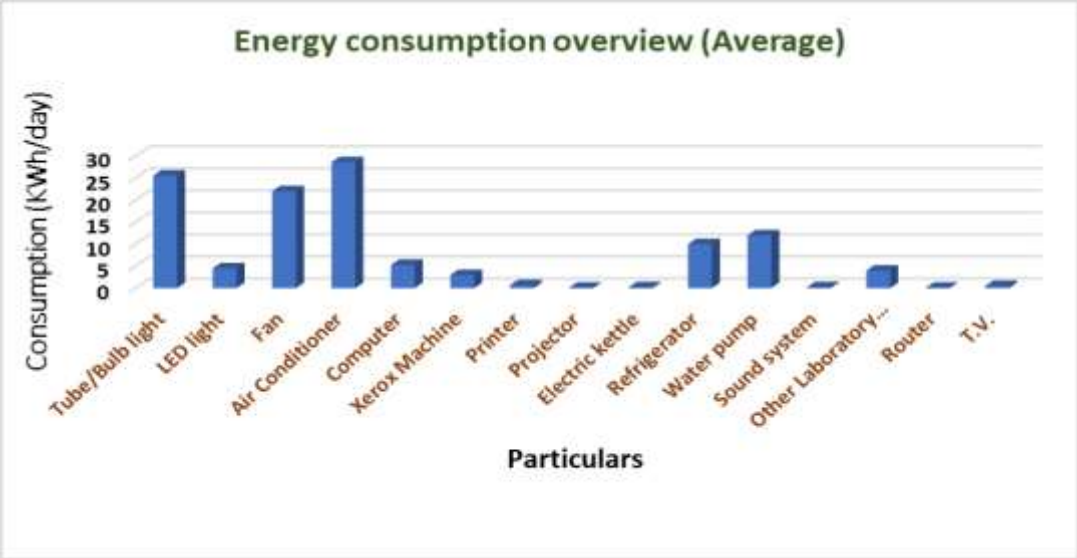
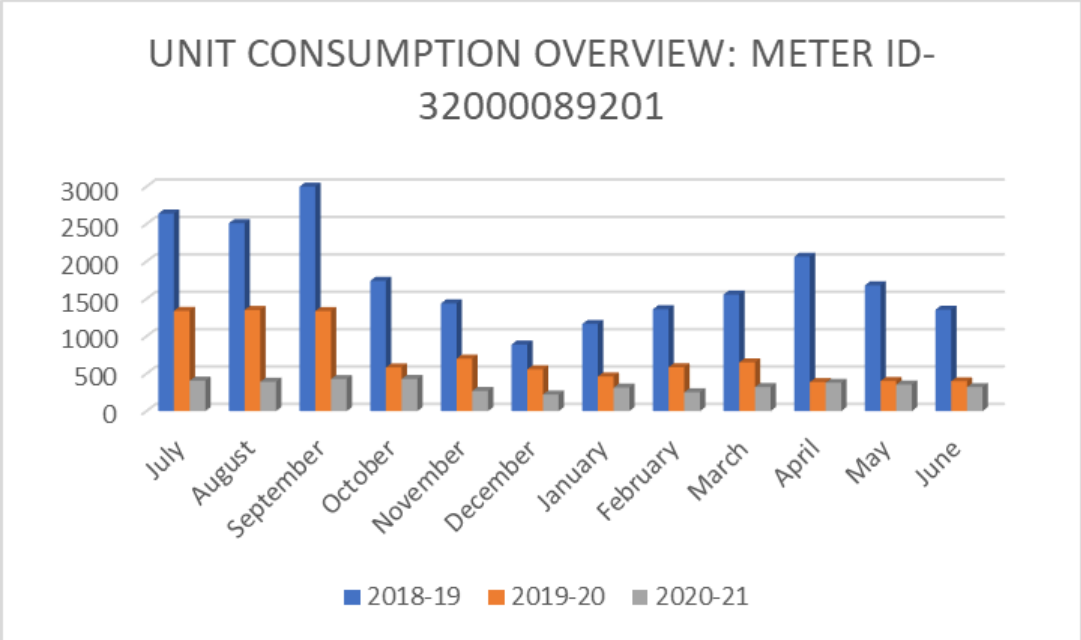


Figure 8: Bar diagram to represent the energy consumption rate.



Month	2018-19	2019-20	2020-21
July	2639	1339	406
August	2511	1351	391
September	3000	1336	428
October	1741	583	429
November	1439	701	269
December	889	557	221
January	1164	463	313
February	1361	586	251
March	1558	651	321
April	2063	388	378
May	1681	401	354
June	1355	398	320

Figure 9: Unit consumption overview for the academic year 2018-19, 2019-20 & 2020-21

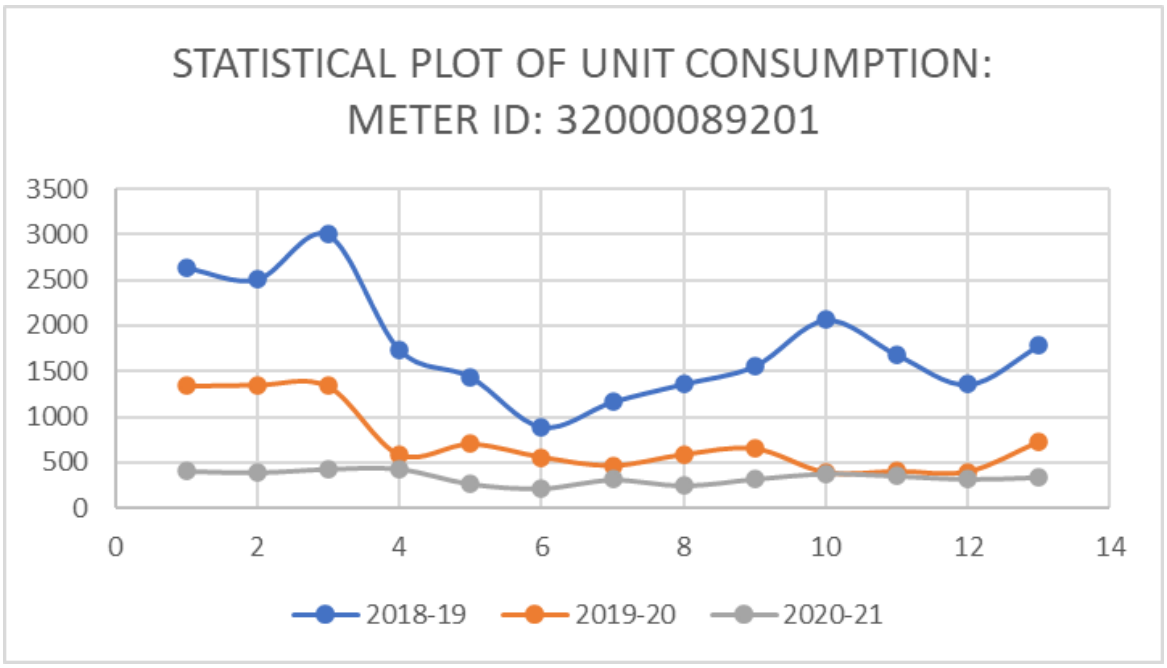


Figure 10. Statistical interpretation of unit consumption for the academic year 2018-19, 2019-20 & 2020-21

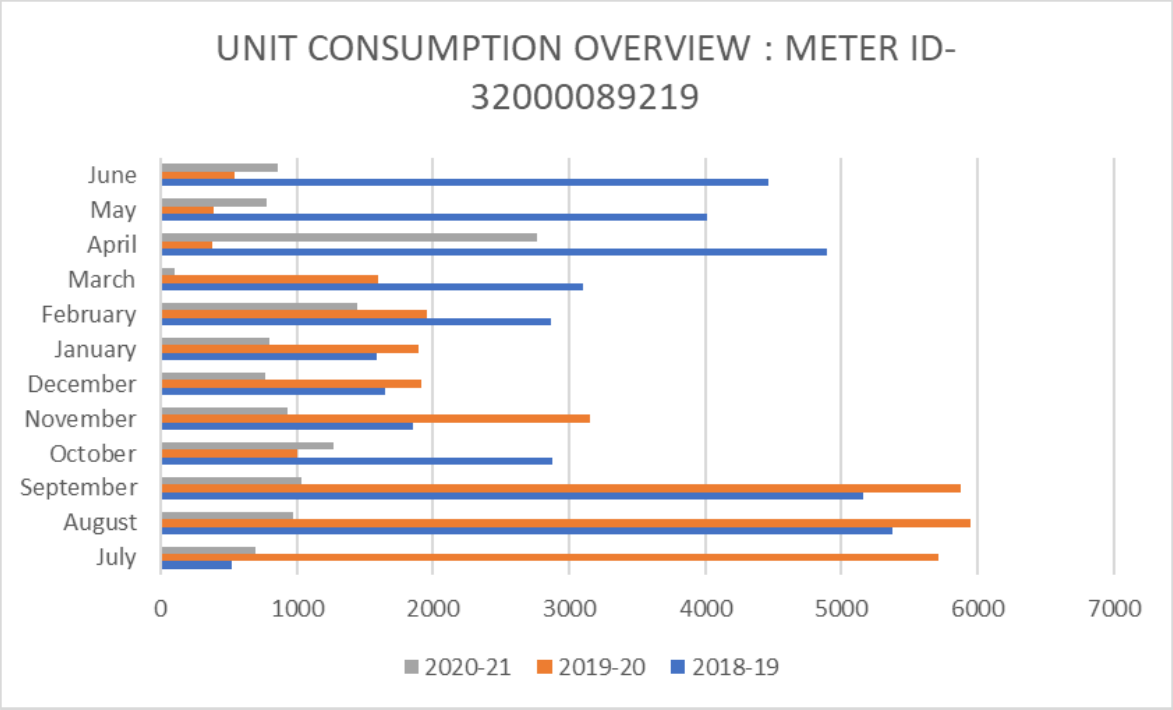


Figure 11. Unit consumption overview for the academic year 2018-19, 2019-20 & 2020-21

Month	2018-19	2019-20	2020-21
July	518	5714	692
August	5380	5944	973
September	5160	5872	1035
October	2874	1000	1264
November	1856	3158	935
December	1650	1917	769
January	1590	1894	794
February	2862	1960	1438
March	3098	1596	100
April	4894	380	2763
May	4010	389	776
June	4464	542	864
Average	3196.33333	2530.5	1033.6

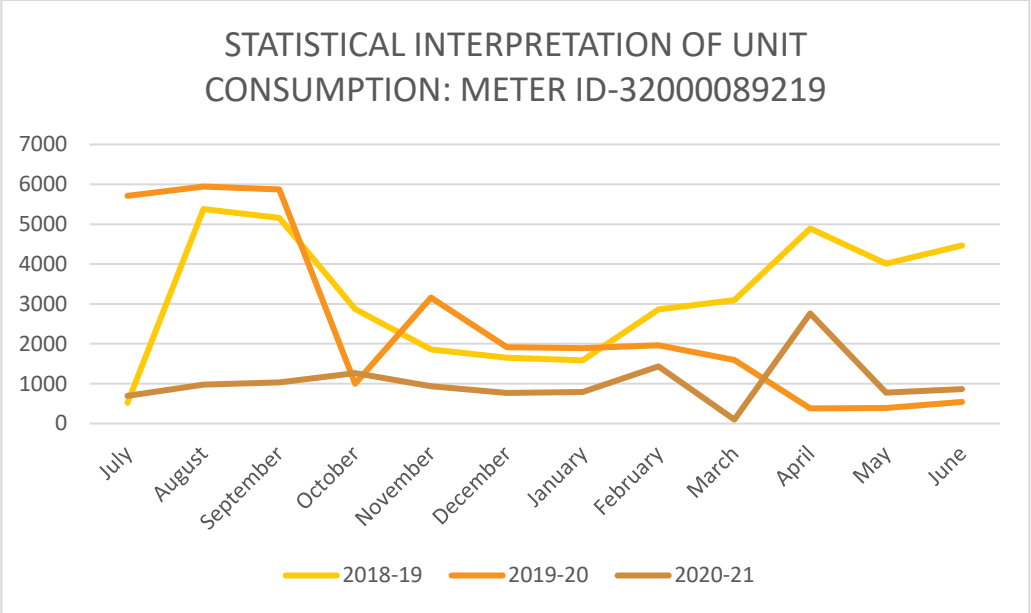


Figure 12. Statistical interpretation of unit consumption for the academic year 2018-19, 2019-20 & 2020-21

Figure 13. Laboratory (random sample photo) of Bangabasi Evening College

The amount of CO_2 (ppm) in different places is depicted in table 3 and its corresponding pie diagram is shown in figure 14.

Table 3. Amount of CO2 (ppm) in different places

Locations inside college campus	CO2 (ppm) in air	Remarks
Class room (sample1)	400	CO_2 level is low
Class room (sample 2)	420	CO_2 level is low
Class room (sample 3)	415	CO_2 level is low
Staff Room	360	CO_2 level is low
Office (New)	420	CO_2 level is low
Library	350	CO_2 level is low
Office 2	420	CO_2 level is low
Laboratories	478	CO_2 level is low
Conference Hall	330	CO_2 level is low
Canteen	670	CO_2 level is low
Parking	415	CO_2 level is low

Thermometer

Solar radiation measuring unit

CO2 Level Reference Ranges:

- 350-1000 ppm: Typical levels found in occupied spaces with efficient air exchange and clean air.
- 1000-2000 ppm: Moderate levels associated with reports of drowsiness and diminished air quality.

- 2000-5000 ppm: Critical levels linked to symptoms such as headaches, sleepiness, and a sensation of stagnant, stale air. Additionally, reduced concentration, attention span, elevated heart rate, and mild nausea may occur

Different instruments to measure CO2 (ppm) in different places

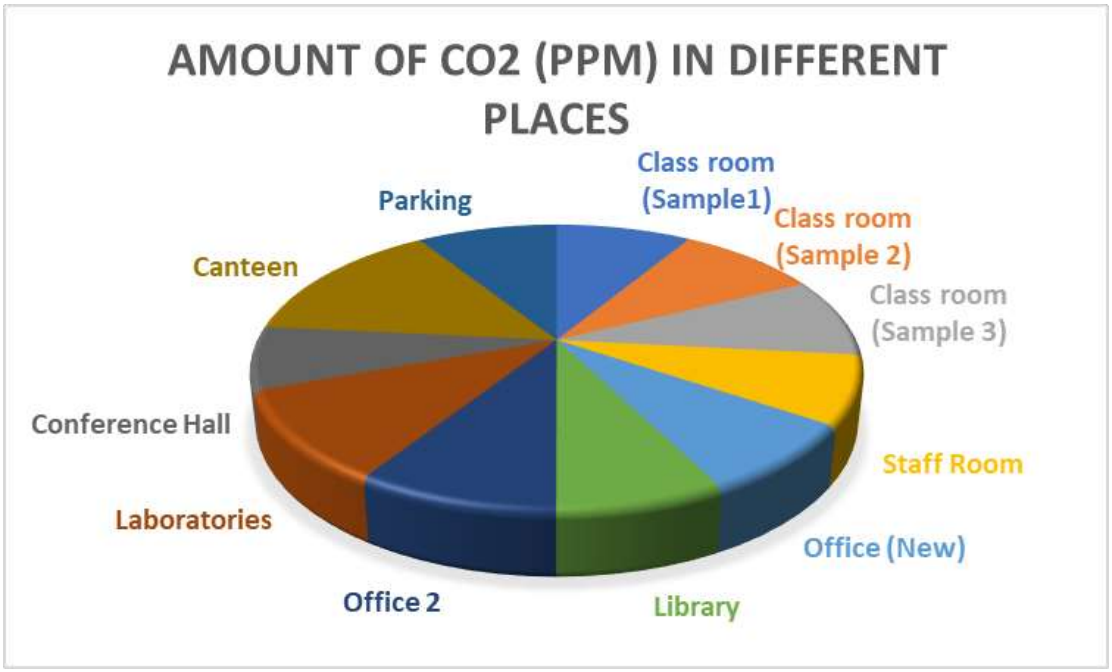


Figure 14. Amount of CO_2 (ppm) of the Air in Different location of the college Premises.

The calculation of carbon footprint can be carried out according to the method outlined on www.carbonfootprint.com, which involves summing the annual electricity usage. The CO_2 emissions from electricity are calculated using the formula:

CO_2 emission from electricity = (electricity usage per year in kWh / 1000) x 0.84

Substituting the given values: = (19226.6 kWh / 1000) x 0.84 = 16.15 metric tons

Note:

- Annual electricity usage: 19226 kWh
- 0.84 is the conversion coefficient from kWh to metric ton

Major audit observation:

SL. No.	Sectors	Weightage
1	Applied to NCE	L
2	Tendency to use LED and CFL bulb	M
3	Reduce of AC Uses	H
4	Awareness	L
5	Management of CHG_s	H

 # H denotes management policy level > 25%

 # M denotes management policy level > 15%--25%

 # L denotes management policy level < 15%

Best Practices followed in the Organization

- Transformers, generators, and UPS systems are securely enclosed and marked with awareness boards displaying 'Danger' and 'Warning' signs.
- 'Switch ON' and 'Switch OFF' signs are strategically placed in most areas to encourage energy-saving practices among stakeholders.
- Electrical wires, switch boxes, and stabilizers are properly shielded to prevent potential hazards to staff and students.
- LED lights and solar street lights are utilized.

- The power factor is maintained close to unity using Automatic Power Factor Correction (APFC).
- Variable Frequency Drives (VFDs) are employed for elevators and air conditioners.
- Old-generation monitors and TVs have been replaced with LED monitors.
- Electric vehicles are available on campus.
- Star-rated equipment is used where applicable.

Energy Conservation Proposals: The energy audit provided recommendations for reducing energy costs, implementing preventive maintenance measures, and enhancing quality assurance activities, all crucial for the efficient operation of utilities at the audit sites.

- Consider investing in energy-efficient equipment (4-5 star rated) when replacing old equipment.
- Install sub-meters in all buildings to monitor energy usage and consumption per building.
- Implement efficient water usage and temperature settings through automated processes to achieve energy savings.
- Establish continuous monitoring and analysis of energy usage with a dedicated campus team.
- Regularly conduct energy conservation awareness campaigns (ECON) among stakeholders through associations, clubs, forums, and chapters.
- Encourage the practice of switching off electrical equipment when not in use.
- Ensure maintenance and replacement of outdated appliances in all laboratories.
- Activate power-saving mode on computers and electronic devices.
- Install a biogas plant for the hostel kitchen and canteen.

- Deploy automatic switches with occupancy sensors in common areas.
- Significantly reduce high monthly electricity consumption in the college through frequent energy assessments.
- Upgrade outdated and inefficient fans with new energy-efficient models.
- Regularly monitor equipment in all laboratories and promptly address any issues.
- Offer value-added, non-formal, certificate, or diploma courses on 'Energy and Environment Management Audits' to benefit students and research scholars seeking certification as Lead Auditors.

Introducing Energy-Saving Circuits for Air Conditioners: These systems intelligently reduce compressor runtime by utilizing timing or temperature variance logic while maintaining human comfort. This innovation can result in electricity savings of 15% to 30%, depending on weather conditions and temperature settings. With a total of 7 split-type air conditioners, it is advised to gradually replace older units with new, energy-efficient models rated 5 Stars by the Bureau of Energy Efficiency (BEE). Considering an average compressor ON time of 5 hours per day, this transition ensures significant energy savings.

Recommendations on Carbon Footprint in the Organization:

- ✓ Improve the cooking setup in the hostel kitchen and cafeteria to conserve gas.
- ✓ Encourage moderation in the routine use of generators, inverters, and UPS systems.
- ✓ Enforce the habit of turning off lights, fans, air conditioners, devices, and tools when not in use.
- ✓ Implement adequate ventilation and exhaust systems in theatres, lecture halls, and meeting rooms to reduce carbon dioxide levels among students, faculty, and staff.

Conclusions: Given the organization's widely recognized reputation and resilience, there exists a significant opportunity to bolster energy-saving initiatives and propel the campus toward self-sufficiency. The institution has already made commendable progress in this area by integrating energy-efficient lighting, raising stakeholder awareness, and ensuring reliable backup power systems. Furthermore, the organization adheres to high standards for energy assessment, including appropriately securing transformers, generators, and UPS systems with fencing and warning signs. Prominent signage encourages energy-conserving behaviours, complemented by diligent electrical infrastructure maintenance, which reinforces energy preservation efforts and prioritizes the well-being of faculty and students. The implementation of sprinkler irrigation on campus to reduce energy consumption is laudable. However, additional recommendations could further enhance the organization's energy conservation capabilities, leading to a brighter future characterized by an eco-friendly campus and sustainable community progress in the years ahead.

RECCOMMANDATION

To reduce energy consumption and management

Given the esteemed reputation and long-standing presence of the institution, there is ample opportunity to enhance energy conservation efforts and shift the campus towards self-sufficiency. The organization has already taken significant steps in this direction by introducing energy-efficient lighting, raising stakeholder awareness, and ensuring reliable power backups. Moreover, following energy auditing best practices, such as properly securing transformers, generators, and UPS systems with fencing and informative signage, demonstrates a dedication to safety and sustainability.

The adoption of sprinkler irrigation for campus maintenance is a commendable step in reducing energy usage. However, there are additional suggestions to further improve the organization's energy-saving capabilities. Implementing these measures can lead to a

prosperous future marked by an energy-conscious campus and sustainable environmental and communal advancement for stakeholders in the years ahead.

Potential areas for environment management and green development.

 Another rainwater harvesting unit should be installed to utilize it for garden irrigation, as well as for washroom and cleaning purposes. This can be achieved through the development of a green project, reducing groundwater consumption to some extent.

 An auto-regulating device should be connected to the submersible pump to prevent overflow from the rooftop tank.

 Auto-regulating sprinklers should be installed to ensure sufficient irrigation in the rooftop plant garden, even during the summer months.

 Bangabasi Evening College possesses a considerable area of building blocks, so during the rainy season, a significant amount of water from the rooftop can be diverted to a groundwater recharge system. This should be considered by the college authority within a specific environmental project framework.

 A bio-remediation plant should be established on the college campus to treat water contaminated with various harmful chemicals from the chemistry laboratory. Specific aquatic hydrophytes and algae capable of absorbing chemicals and heavy metals from the water should be utilized for treatment. The treated water can then be released into the common drainage systems.

 Some wastewater is directly discharged into natural water bodies through drainage systems, which should be redirected after passing through a water treatment plant.

 Separate bins for degradable and non-degradable waste should be installed on each floor of all buildings to facilitate proper waste management. Degradable waste can be transferred to a plant where organic fertilizer can be produced and applied as green manure in the garden.

 An e-waste management committee should be formed by the college authority to maintain proper documentation of waste and the percentage of e-waste. The college authority may collaborate with other organizations for the proper management of e-waste

For better conservation of Biodiversity

- Since there is very little unused land in the college campus, the college authority could designate some vertical space for a hanging medicinal plant library. This space could serve for both study purposes and the conservation of locally threatened tree species.
- Additionally, there is a noticed provision for a hanging garden, which could be utilized to create a green and healthy environment for the college's students and staff.
- Name plates for all existing MTS (Multi-Tasking Staff) should be created and installed for educational purposes.