REPORT OF

GREEN AUDIT

Based on International Standards
ISO 14001: 2015, 50001: 2018, 46001: 2019, 14046: 2014, 14067: 2018, ISO 45001:2018

St. Aloysius College Elthuruth

Thrissur, Kerala, India.

TIES

LIFT UP YOUR HEARTS

REPORT OF GREEN AUDIT

Based on International Standards

ISO 14001: 2015, 50001: 2018, 46001: 2019, 14046: 2014, 14067: 2018, ISO 45001:2018

Auditee

St. Aloysius College

Elthuruth, Thrissur Kerala, India, Pin - 680 611

Phone: +91 94001 37800; E mail: sac@staloysiuselt.edu.in

Affiliated to the University of Calicut and Aided by the Govt. of Kerala

Auditor

Tropical Institute of Ecological Sciences

ISO 9001:2015 Certified organization; ISO 17020:2012 Certification body

Ecological Research Campus, K.K. Road, Velloor P.O., Kottayam, Kerala - 686501

Affiliated Research Centre of Mahatma Gandhi University, Kottayam

Tel: - 9497290339, 9633723305, 0481- 2957050

isogreenaudit@ties.org.in; www.ties.org.in

September, 2024

Disclaimer

This report is meticulously crafted by the Environment Management Committee of St. Aloysius College, Elthuruth, Thrissur, Kerala with invaluable guidance and support from the ISO Green Audit Consultancy division of the Tropical Institute of Ecological Sciences (TIES: www.ties.org.in), located in Kottayam, Kerala.

As an integral component of the Green Audit initiative conducted within the college premises, the data presented herein has been diligently collected by a team of certified internal auditors. Furthermore, the Report and Manual of Documented Information have undergone rigorous

Scrutiny by external auditors from TIES, ensuring alignment with ISO standards.

Published on 20th September 2024
St. Aloysius College, Elthuruth, Thrissur.

TIES wish to acknowledge respective contributor's photographs and graphics are given in the pages 01, 19, 29, 79, 107, 118, 119, 120, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 197, 199, 205, 211 & 215

Preface

We are pleased and excited to present the Green Audit Report of St. Aloysius College, Elthuruth, Thrissur, Kerala. This report represents the result of extensive research, careful analysis, and committed efforts to thoroughly assess the Environmental Management System (EMS) of our institution. As a college dedicated to educational excellence, St. Aloysius College understands the vital role of environmental stewardship and sustainability. In alignment with these values, we conducted a comprehensive review of our environmental practices, identifying strengths and areas for improvement in various aspects of our operations.

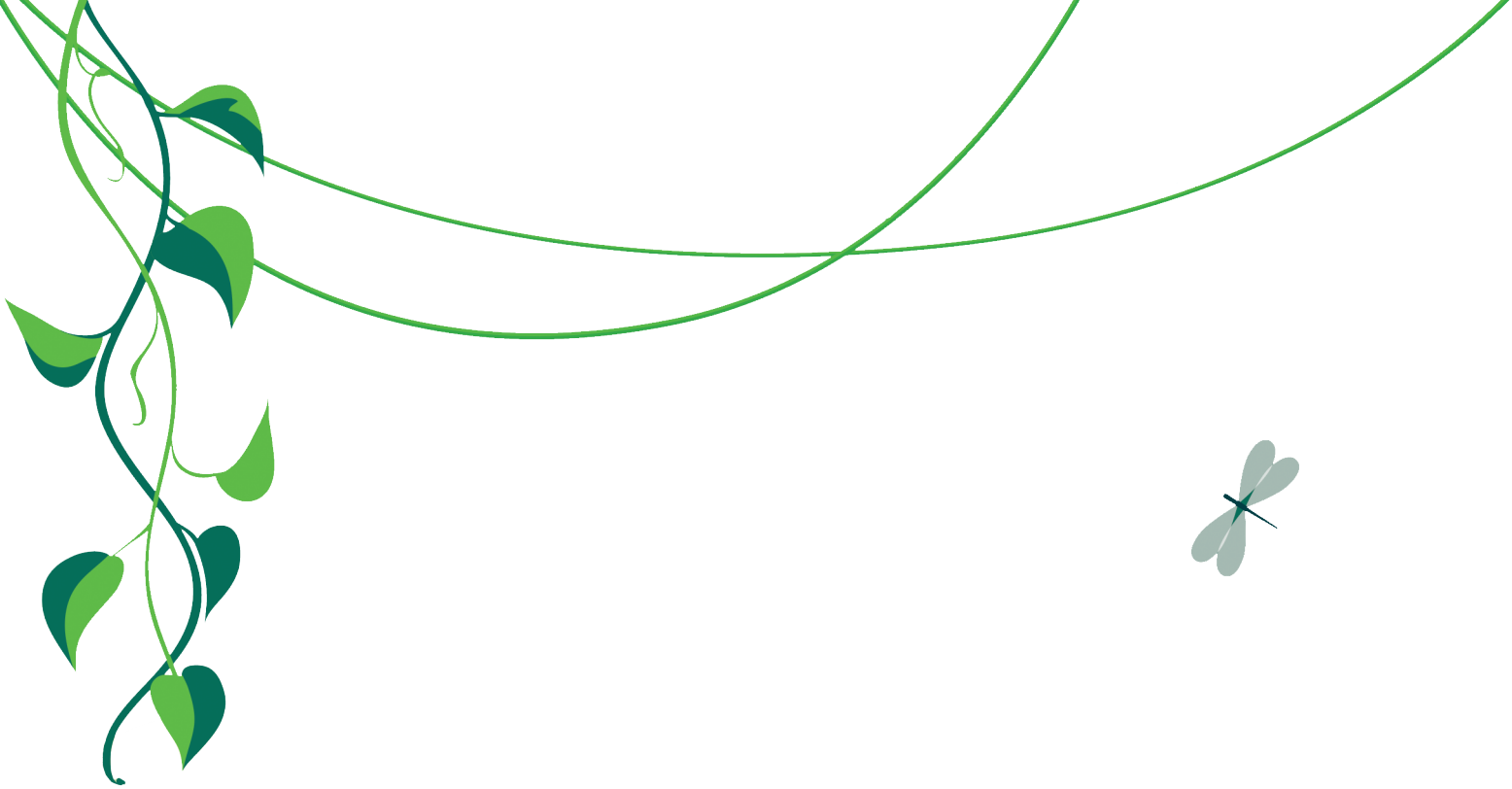
The report provides a detailed overview of our environmental performance, including an Energy Audit, Water Efficiency Management Audit, Waste Management Audit, Biodiversity Audit, Occupational Health & Safety and Carbon Footprint Data. Each section offers valuable insights into our resource use, conservation initiatives, and environmental impact, demonstrating our commitment to creating a greener and more sustainable campus.

The findings in this report not only highlight our dedication to environmental responsibility but also set the foundation for strategic initiatives to further enhance our sustainability efforts. By implementing the recommendations outlined here, we aim to continuously improve our environmental performance, reduce our ecological footprint, and inspire positive change both within our campus community and beyond.

We sincerely thank all those who contributed to this report, including faculty, staff, students, and external stakeholders. Your collective efforts have been crucial in advancing our environmental objectives and reinforcing our commitment to sustainability. As we continue on this journey, we remain dedicated to the principles of sustainability, innovation, and excellence, working together toward a greener and more resilient future for everyone.

Environment Management System Committee
St.Aloysious College, Elthuruth, Thrissur

20.09.2024



In every walk with nature,
one receives far more than he seeks

- John Muir -

Table of contents

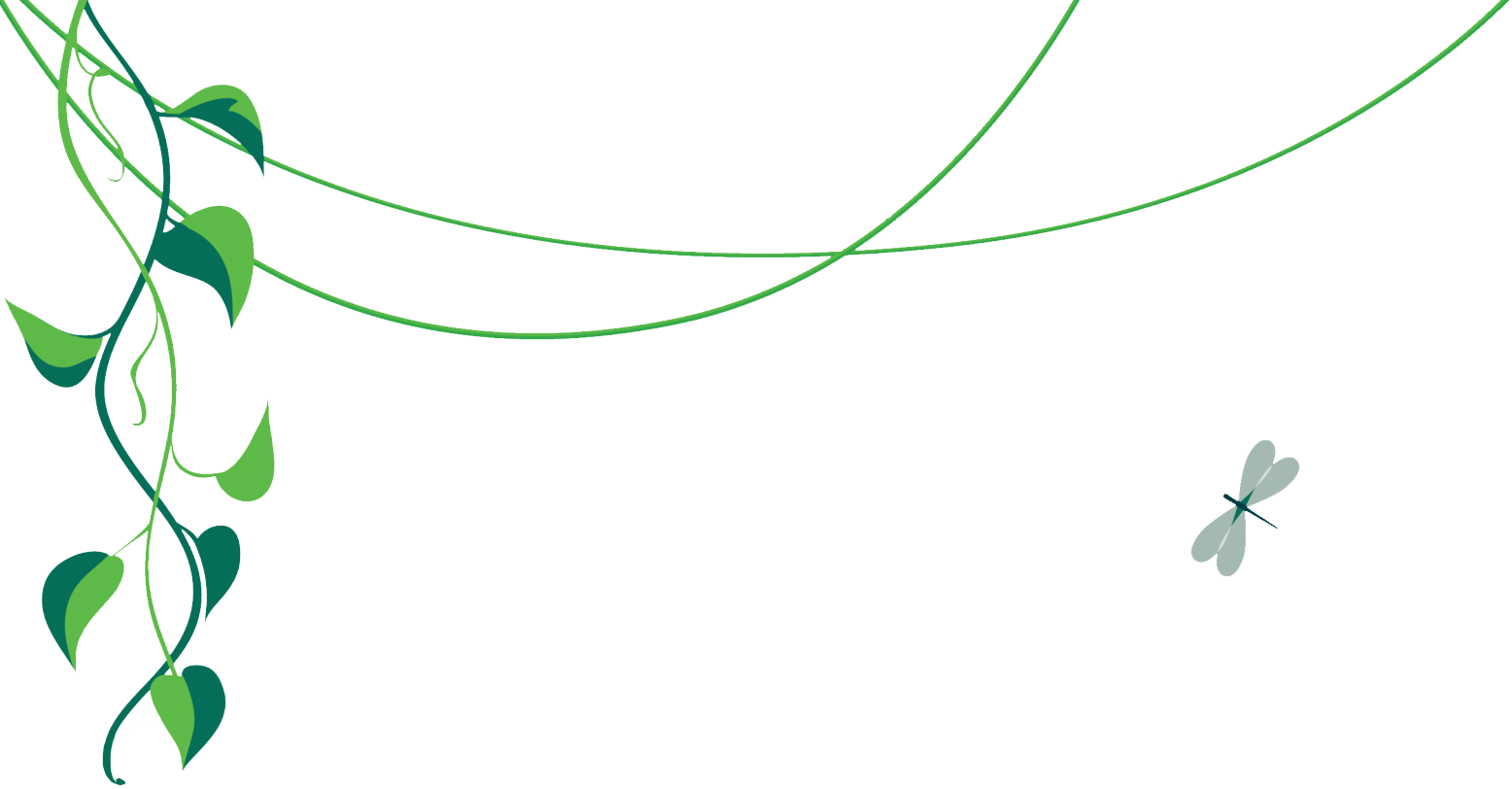
Chapter I

GREEN AUDIT AT ISO STANDARDS FOR COLLEGES & UNIVERSITIES

An Introduction

TIES

LIFT UP YOUR HEARTS



The Earth does not belong to us.
We belong to the Earth

- Marlee Matlin -

1

Green audit at ISO Standards

1.1. INTRODUCTION

Green audit in colleges, also known as an environmental audit or sustainability audit, is a systematic examination of an educational institution's operations, practices, and facilities to assess their environmental impact and identify opportunities for improvement in sustainability efforts.

During a green audit, various aspects of the college's operations are typically evaluated, including energy consumption, waste management, water usage, transportation, procurement practices, and overall environmental policies. The audit may involve gathering data, conducting interviews with key stakeholders, and assessing compliance with environmental regulations and standards.

The goal of a green audit in colleges is to promote environmental responsibility, reduce the institution's ecological footprint, and foster a culture of sustainability among students, faculty, and staff. By identifying areas for improvement and implementing targeted strategies, colleges can enhance their environmental performance and contribute to broader efforts toward sustainability and climate action.

1.2. HIGHER EDUCATION AND SUSTAINABLE DEVELOPMENT

The 2030 Agenda, powered by the UN Sustainable Development Goals (SDGs), goals encompass a broad view of development, spanning environmental, social, and economic sustainability.

The SDGs serve as a compass for nations, institutions, and civil society to navigate their journey towards lasting peace and prosperity for both people and the planet. In this monumental task, every individual and organization have a role to play. Among them, higher education institutions (HEIs) occupy a unique and pivotal position.

Firstly, HEIs have a primary mission to educate and train the future leaders, equipping them with the skills and knowledge necessary to contribute to sustainable societies.

Secondly, HEIs undertake a significant and innovative role in research, generating cutting-edge knowledge and technology that can drive societal progress.

Thirdly, HEIs directly benefit communities by sharing their knowledge and technology and forging alliances with other stakeholders in the Quadruple Helix, which includes governments, industry, and societal groups.

Moreover, the management and administration of HEIs offer an opportunity to lead by example, promoting ethical and sustainable governance, strategies, and operations.

This distinctive position empowers HEIs not only to participate in but to lead the charge toward sustainable economic, social, and environmental development. However, this potential comes hand in hand with a significant responsibility to do everything possible to advance sustainable development. While many HEIs already contribute to the SDGs in various ways and to varying degrees, these efforts are often scattered and lack a comprehensive institutional-level sustainability approach or strategy.

In this era of unprecedented global challenges, it's time for HEIs to unite their efforts, align their strategies, and take a leadership role in driving sustainable development forward. Together, they can be the change-makers, guiding us towards a brighter, more sustainable future for all.

[Adapted from "General guidelines for the implementation of sustainability in Higher Education Institutions", 2023. UNESCO & UN Academic Impact].

1.3. UN SD GOALS AND ISO STANDARDS

The UN-SD goals, an ambitious action plan to enhance peace and prosperity, eradicate poverty and protect the planet is recognized globally as essential for the future sustainability of our world. To be successful, the process requires consensus, collaboration and innovation. ISO has published more than ¬¬ 22000 International Standards and related documents that represent globally recognized guidelines and frameworks based on international collaboration. Built around consensus, they provide a solid base on which innovation can thrive and are essential tools to help governments, industry and consumers contribute to the achievement of every one of the SDGs.

ISO standards support the three pillars of sustainable development :

Economic - ISO standards promote economic sustainability by facilitating international trade, improving a country's national quality infrastructure and supporting sustainable business practices. They cover everything from efficient farming methods to anti-bribery management systems.
Social - ISO Standards promote social sustainability by helping countries and communities to improve the health and well-being of their citizens. They cover all aspects of social welfare, from healthcare systems and related products to social inclusion and accessibility.

Environmental - ISO International Standards promote environmental sustainability by helping businesses and countries manage their environmental impact. They cover such aspects as implementing an environmental management system, measuring and reducing greenhouse gas emissions and energy consumption, and encouraging responsible consumption.

1.4. GREEN AUDIT AT ISO STANDARDS- WHY?

Green Audits are not merely an obligation for NAAC accreditation; they are in alignment with the broader canvas of Sustainable Development Goals. This dynamic form of environmental scrutiny reveals compliance gaps and pinpoints areas for bolstering management systems, all while proposing viable corrective actions.
Green audit helps to reduce negative impacts on environment and enhancing conservation in college and university campuses. Its main objectives are:

- A systematic examination to assess an institution's environmental responsibility
- Aims to identify environmental compliance, gaps or lapses in implementation of conservation activities
- Checking whether they meet stated institutional objectives and complied with including environmental management laws and ISO standards
- Suggesting corrective measures for improvement
  It is highly significant for every academic institutions in the present scenario:
- Mandatory as per the NAAC advisory
- Essential for complying with SD Goals

- It can help to improve the quality of academic and research processes, by complying environmental quality standards which are at par with international standards.
  Help to identify areas where improvement could be possible.
- It can exhibit your university/college as an institution of international standards.
- It will help to bring more accreditations and awards easily.
- ISO certification will help to save money by streamlining your processes and making them more efficient.

1.5. GREEN AUDIT CERTIFICATION BODY

The present audit report is evaluated and external audit is conducted by Tropical Institute of Ecological Sciences (TIES- www.ties.org.in), following relevant ISO standards.

TIES, a trailblazing and professionally managed environmental research organization, holding the prestigious ISO 9001:2015 accreditation and a certification body with ISO 17020, the singular accredited agency in South India dedicated to conducting Green Audits in academic and research institutions. With an illustrious track record encompassing 25 colleges, spanning arts, science, and professional institutions, as well as two prestigious
universities in South India, TIES brings a wealth of experience to every audit it undertakes.

TIES have developed a unique Green Audit protocol based on relevant ISO standards. The Green audit certification for academic and research institutions by TIES is based on the following international standards:
1.5. Steps of green audit as per ISO standards.

No.	Phase	Major activities
1	Pre Audit Period	Questionnaire survey Pre audit visit to assess the facilities/infrastructure available Identify the key persons/system personals- organize for the audit
2	Audit activities at the site	Collection and collation of information (review of records) Conducting audit, Monitoring and verification
3	Post audit period	Draft report, Final report

Table 1.1. Stages of Green Audit

1.6. GREEN AUDIT AS PER ISO STANDARDS AT St. ALOYSIUS COLLEGE, ELTHURUTH, THRISSUR

1.6.1. Process of green audit as per ISO standards

The Green audit programme as per ISO standards and developed by TIES is a ccustomized package for universities and colleges in India, considering prevailing specific academic and social environment. It is relatively simple and easy to implement and practice.
A PLAN-DO-CHECK-ACT System is implemented.

Fig.1.1. PDCA cycle of Green Audit

1.6.2. Green Audit at St. Aloysius College

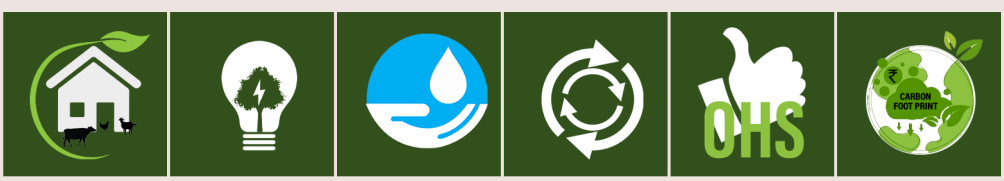
The IQAC chairman and the Principal of the college requested Tropical Institute of Ecological Sciences (TIES) to conduct a green audit at the college on 27.02.2024. TIES initiated the formal proceedings of the audit by requesting the prerequisite data for green audit from the college, on 29.02.2024. The college has submitted required information on 26.06.2024. Subsequently, the MoU for green audit was signed between the Principal of the college and Secretary, TIES on 02.07.2024 for a period of three months for the completion of the audit process and valid for three years. Experts from TIES ISO Green Audit Consultancy division had given a full day training for internal auditors on 02.07.2024. All participants who passed the evaluation process were given with certificate as Internal auditor.

Internal auditors aggregated to various committees like Environment Management System Committee (EMS), Energy Management System Committee (EnMS), Water Efficiency Management System (WEMS), Waste Management System(WMS), Biodiversity Management Committee (BMC) and Occupational Health and Safety Management Committee (OHSM). The internal audit process have been implemented and carbon foot print of the college was estimated by EMS of the college. They collected data on various audit components and documented, analyzed and prepared the report.

The final external audit by assessee from TIES was conducted on 13.09.2024
The first surveillance audit is scheduled for Septem' 2025.

GREEN AUDIT
Based on ISO Standards

Environment Management System

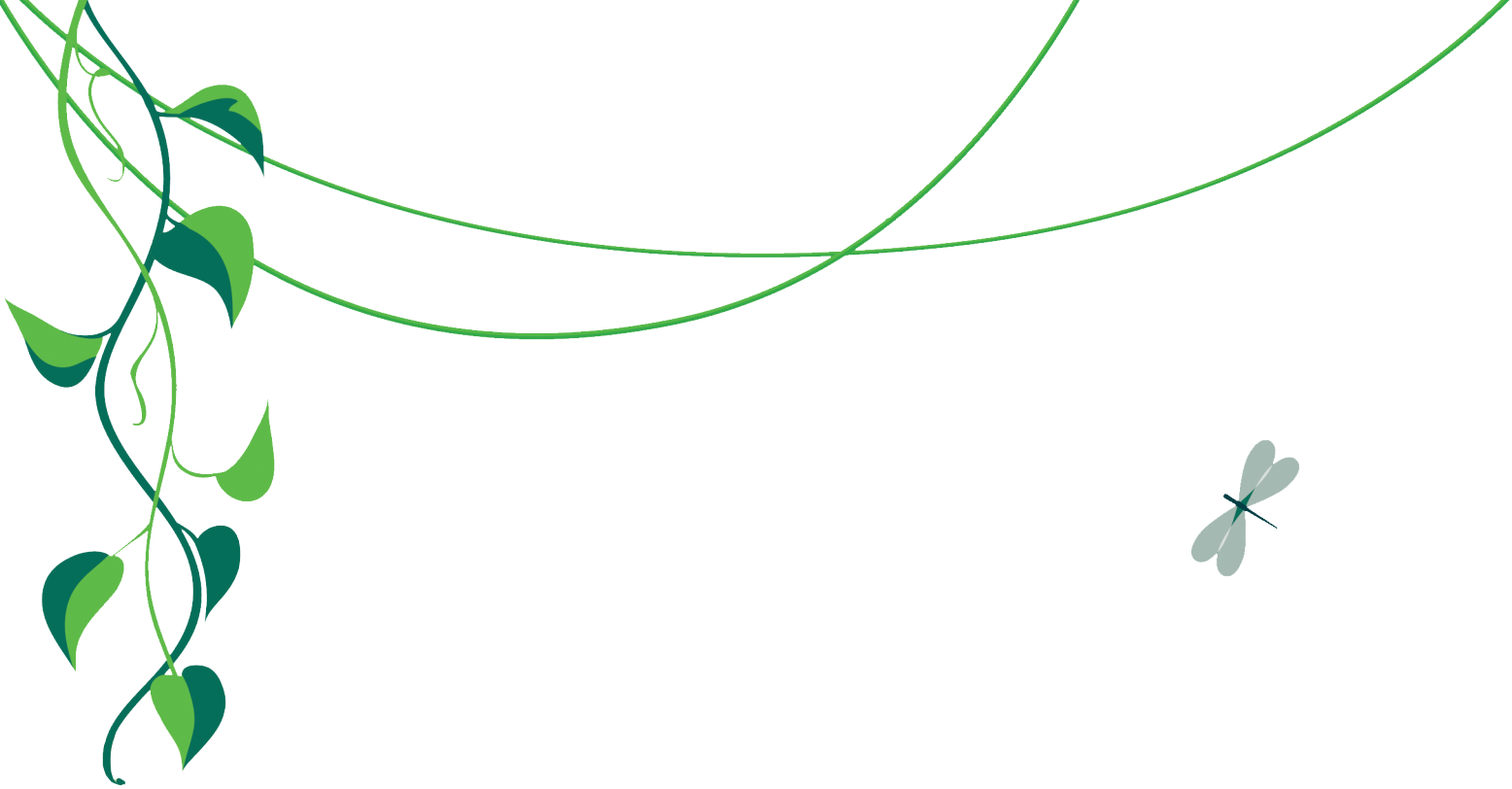


Biodiversity Management System | Energy Management System | Water Efficiency Management System | Waste Management System | Occupational Health & Safety | Carbon Foot print

TIES 2024

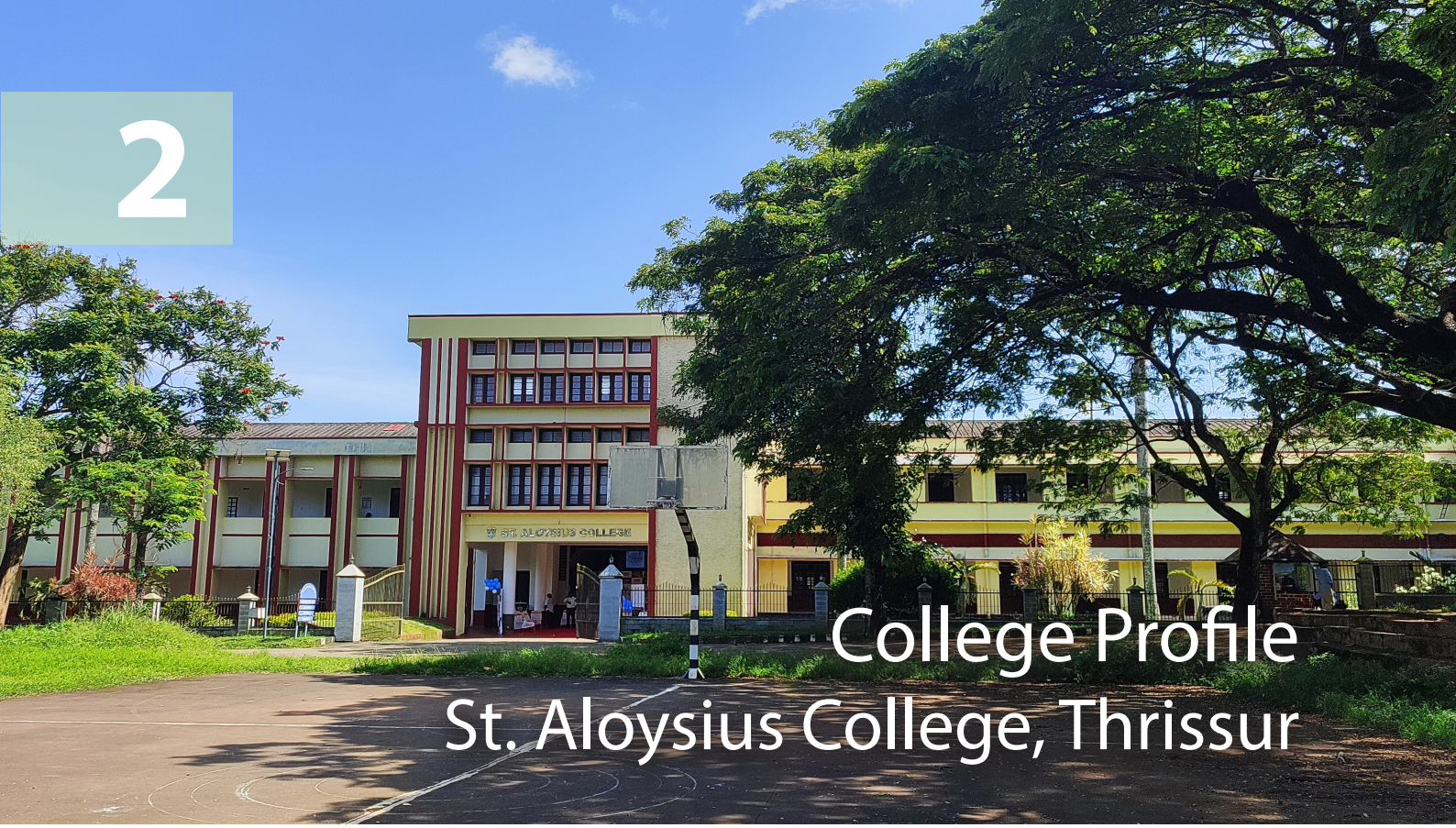
Chapter II

COLLEGE PROFILE
St. ALOYSIUS COLLEGE
ELTHURUTH, THRISSUR



Sustainable development begins
with Education

- UNESCO -



2

College Profile
St. Aloysius College, Thrissur

2.1. HISTORY OF THE COLLEGE

St. Aloysius College, Elthuruth, is a first grade college affiliated to the University of Calicut. It is run by Fathers who belong to the congregation of Carmelites of Mary Immaculate (CMI) founded by St. Kuriakose Ellas Chavara. The CMI community of Fathers and Brothers work in various educational institutions and social centers throughout the country and abroad.

St. Aloysius College, Elthuruth, is administered by St. Mary's Monastery, a House under the Devamatha Province, Thrissur of the CMI congregation. The other institutions in the same campus and under the administration of the Monastery are St. Aloysius L.P., U.P., High School, Higher Secondary School, St. Aloysius Boarding House, St. Berchman's Minor Seminary and St. Mary's Parish Church.

The College was sanctioned by the Government of Kerala as per order G.O. Ms 40/69/Edn. Dt.21.1.69 and was given provisional affiliation to the Kerala University on 27 June 1968. Permanent affiliation was accorded to the College by the University of Calicut on 15 March 1971. In July 1978 the College was upgraded with B.A. Economics. The college obtained U.G.C. affiliation [GO No. F.8-10/84 (CP)] in April 1984. To cater to the increasing academic demand, joining hands with government initiatives, the college started self-financing programs from 2004. The College completed fifty years of its service to the academic fraternity in 2018.

Today St. Aloysius College is an Institution of higher education under the University of Calicut with seventeen undergraduate courses (Chemistry Commerce-Banking, Commerce-Co-operation, Commerce-Computer, Commerce-Finance, BBA HRM, BA Multimedia, Economics, English, Mathematics, Physics, Psychology, Zoology, Botany and Computational Biology, B Voc Gemology and B Voc. Jewelry Designing B. Voc Nursery & Ornamental Fish Farming) and eight postgraduate courses (Chemistry, Commerce, Economics, English, eight postgraduate course statistics and Zoology).

2.2. AIM AND OBJECTIVES

- To accept and cherish students as they are and instil in them commitment to values, enabling them to grow in the diversity of our cultural, social and religious traditions.

- To stimulate academic competency for the promotion of qualitative teaching-learning and research

experience in the College.

- To encourage self-evaluation and accountability in all matters concerning the objectives of higher education.
- To promote holistic development of individuals through co-curricular activities in the campus and collaborative programs with other institutions.
- To provide all possible student support to make easy progression to higher studies and useful employment.

2.3.VISION

St. Aloysius College, Elthuruth is guided by the vision and mission of St. Kuriakose Elias Chavara. We emphasise value based, life-oriented education and nurture authentic individuals in a culture of solidarity. Here the educators and the learners join hands in molding intellectually competent, ethically motivated, socially committed and spiritually inspired individuals capable of building a more humane social order within the context of religious pluralism and cultural diversity.

2.4.MISSION

To accept the students as they are instill in them commitment to values, enabling them to grow in the diversity of our cultural, social and religious traditions.

2.5.Value Framework

To promote the following core values among the faculty and students.

- Global Competencies
- Sound Ethical Aptitude
- Incessant Quest for Excellence
- Regional/National Progress
- Holistic Development

2.6.COLLEGE ADMINISTRATION

2.6.1. Administrative heads

Manager : Rev. Fr. Thomas Chakramakkil CMI
Principal : Dr. Chacko Jose P.
Office Superintendent : Mr. M.T. Joy
Bursar : Rev. Fr. Arun Jose K CMI
Director (Self-financing Program) : Dr. Pius T.K

2.6.2. College Governing Body

1. Chairman : Rev. Fr. Dr. Jose Nandhikkara CMI Provincial, Devamatha Province
2. Manager : Rev. Fr. Thomas Chakramakkil CMI
3. Principal : Dr. Chacko Jose P.

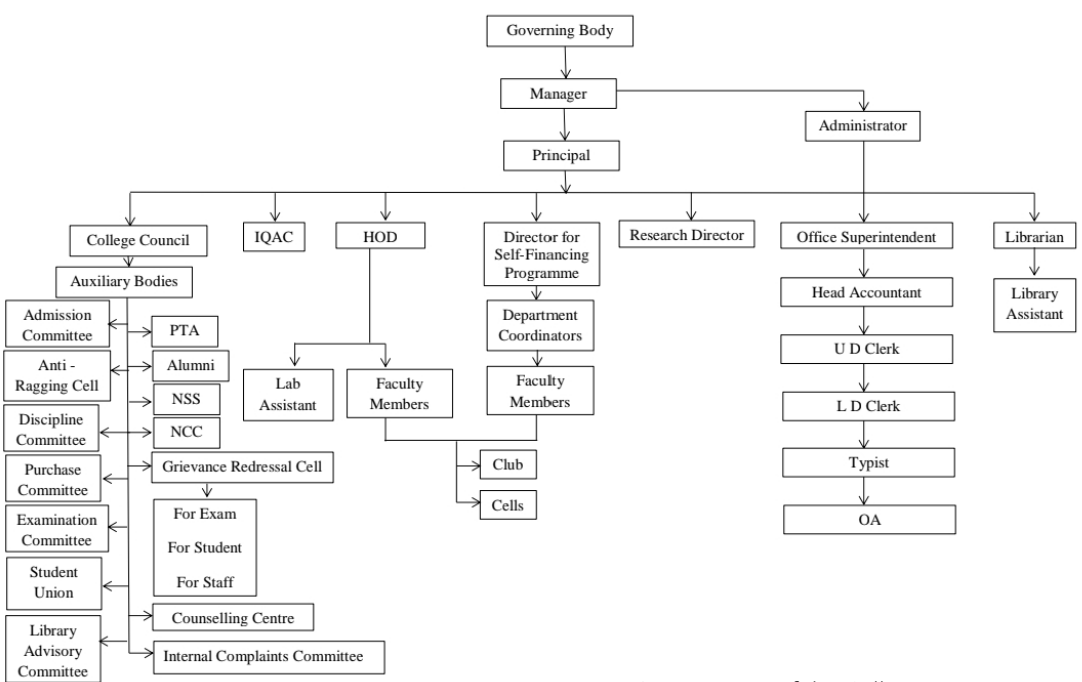


Fig. 2.1. Organogram of the College

4. Bursar	: Rev. Fr. Arun Jose K. CMI
5. Minority Community Representative	: Dr. T. K. Pius (Rtd., Associate Professor) Director, Self-Financing Program, St. Aloysius College
6. Management Nominees	: Dr. P. R. Varghese (Scientist F & Research Co-ordinator, Jubilee Centre for Medical Research, Jubilee Mission Medical College & Research Institute)
7. Management Representatives College (Alumni)	: Rev. Fr. Dr. Jolly Maliekkal CMI Principal, Christ College, Irinjalakkuada. : Rev. Fr. Santhosh Mundanmani CMI (Secretary, CMI Education Department) : Rev. Fr. Lijoy E.J. CMI
8. Teaching Faculty Representative	: Dr. Sinto Jacob
9. Non-Teaching Staff Representative	: Mr. M. T. Joy
10. Student Representative	: College Union Chairman

2.6.3. College Council

1. Dr. Chacko Jose P	: Principal
2. Mr. Jaison Jose P	: HOD, Research and P.G. Dept. of English
3. Dr. Bolie Therattil	: HOD, Department of Chemistry
4. Ms. Rajitha A.G	: HOD, Department of Commerce
5. Ms. Fiji Raphael	: HOD, Department of Economics
6. Mr. Jason Jacob	: HOD, Department of Mathematics
7. Dr. Dias E.D	: HOD, Department of Physics
8. Dr. Jeeja Tharakan	: HOD, Department of Zoology
9. Mr. Melvin Luke George	: Elected member
10. Dr. Libison K.B	: Elected member
11. Ms. Vineetha Davies	: Librarian
12. Mr. M.T. Joy	: Office Superintendent

2.6.4. IQAC Members

Co-ordinator	: Dr. Libison K B:
Joint- Coordinators /Members	: Dr. Sinto Jacob, Dr. Atheetha K. Unni Dr. Jijo Abraham, Dr. Sandhya Jayachandran, Mr. Jain J Threrattil, Dr. Jasmine Mathew, Ms. Nanette Joy
IQAC Advisory Group	: Mr. Melvin Luke George, Ms. Vineetha Davies V Mr. Raveesh R. Varrier

2.7. STRENGTH OF THE COLLEGE

2.7.1. Students

Sl.No.	Department	Program	Boys	Girls	Total
1	Physics	B. Sc. Physics	30	21	51
		MSc Physics	5	12	17
2	Mathematics	BSc Mathematics	35	24	59
		MSc Mathematics	3	15	18
3	Chemistry	B.Sc. Chemistry	25	25	50
		M.Sc. Chemistry	3	17	20
4	Economics	B A Economics	80	73	153
		M A Economics	4	23	27
5	Commerce	B.Com Cooperation	60	56	116
		B.Com Banking and Insurance	71	49	120
		B.Com Finance	63	114	177
		M com Finance	15	13	28
6	English	BA English	22	23	45
		MA English language and literature	2	20	22
		Ph.D	19	2	21
7	Zoology	B.Sc. Zoology	18	53	71
		M.Sc. Zoology	6	12	18
8	Botany	B.Sc. Botany & Computational Biology (Double Main)	21	34	55
9	Management Studies	BBA Finance	76	41	117
		BBA HRM	49	39	88
		B.com Computer Applications	73	33	106
10	Statistics	M.Sc. Statistics	1	6	7
11	Multimedia	B A multimedia	53	10	63
12	B.Voc. Studies	B.Sc. Psychology	8	66	74
		B. Voc. Jewellery designing	6	3	9
		B. Voc. Nursery and ornamental fish farming	10	7	17
		B.Voc Gemmology (Updated)	53	27	80
		Total	**811**	**818**	**1629**

Table 2.1. Number of students studying in the college during the academic year 2023-24.

2.7.2. Faculty members

Sl.No.	Department	Program	Boys	Girls	Total
1	Physics	B. Sc. Physics	3	2	5
		MSc Physics	0	4	4
2	Mathematics	BSc Mathematics	6	1	7
		MSc Mathematics			
3	Chemistry	B.Sc. Chemistry	4	1	5
		M.Sc. Chemistry	0	3	3
4	Economics	B A Economics	4	2	6
		M A Economics			
		Political Science	1	0	1
5	Commerce	B.Com Cooperation			
		B.Com Banking and Insurance	0	13	13
		M.Com Finance			
		B.Com Finance	3	1	4
6	English	BA English	0	6	6
		MA English language and literature			
		Ph.D			
		Malayalam	1	0	1
		HIndi	1	0	1
7	Zoology	B.Sc. Zoology	2	1	3
		M.Sc. Zoology	0	5	5
8	Botany	B.Sc. Botany & Computational Biology (Double Main)	0	6	6
9	Management Studies	BBA Finance	0	8	8
		BBA HRM			
		B.com Computer Applications			
10	Statistics	M.Sc. Statistics	0	5	5
11	Physical Education	Physical Education	1	0	1
12	Multimedia	B A multimedia	0	4	4
13	B.Voc. Studies	B.Sc. Psychology	0	4	4
		B. Voc. Jewellery designing	0	6	6
		B. Voc. Nursery and ornamental fish farming			
		B.Voc Gemmology			
		Total	**32**	**77**	**109**

Table 2.2. Strength of the faculty of the college during the academic year 2023-24.

2.7.3. Non-teaching Staff

Sl.No.	Category	Permanent	Management/Contract	Total
1	Library staff	3	2	5
2	LAB Assistants	5	2	7
3	College Office	8	1	9
4	Office Attendants	3	2	5
5	Maintenance staff	2	7	9
6	Security Staff	0	5	5
7	Canteen & Cafeteria	0	4	4
8	DTP Centre	0	1	1
Total		**21**	**24**	**45**

Table 2.3. Strength of the non-teaching staff of the college during the academic year 2023-24.

2.7.4. Total strength of college community (2023-24)

Sl.No.	Inmate category	Total no.
1	Students	1629
2	Teaching staff	109
3	Non-teaching staff	45
	Total	**1783**

Table 2.4. Total strength of the college during the academic year 2023-24.

2.7.5. Details of Programs of the college

2.7.5.1. Aided Programs

Aided stream			
Sl.No.	Department	No	Program
1	Economics	1	B A Economics
		2	MA Economics
2	Commerce	3	B.Com Finance
3	Mathematics	4	BSc Mathematics
		5	MSc Mathematics
4	Physics	6	B. Sc. Physics
5	Chemistry	7	B.Sc. Chemistry
6	Zoology	8	B.Sc. Zoology
7	Botany	9	B.Sc. Botany & Computational Biology (Double Main)
8	English	10	MA English language and literature

Table 2.5. Aided programs of the college

2.7.5.2. Self-financing programs

Self-financing program			
Sl.No.	Department	No	Program
1	Multimedia	1	B A Multimedia
	B vocational studies	2	B.Sc Psychology
		3	B. Voc. jewellery designing
		4	B. Voc. Gemmology
		5	B. Voc. Nursery and ornamental fish farming
3	Management studies	6	B.Com Banking and Insurance
		7	B.Com Cooperation
		8	B.com Computer Applications
		9	BBA Finance
		10	BBA HRM
4	English	11	BA English & Literature
5	Commerce	12	M.com Finance Management
6	Zoology	13	M.Sc. Zoology
7	Chemistry	14	M.Sc. Chemistry
8	Physics	15	M.Sc. Physics
9	Statistics	16	M.Sc. Statistics

Table 2.6. Self financing programs of the college

2.7.5.3. Ph.D Program

Doctoral Program		
Sl. No.	Department	Program
1	English	PhD in English

Table 2.7. Doctoral programs of the college

2.8. COLLEGE CAMPUS AND LOCATION

The college is situated on the outskirts of Thrissur, near St. Mary's Church in Elthuruth. The college's backyard is surrounded by lush paddy fields College is known for its lush green campus and serene environment.

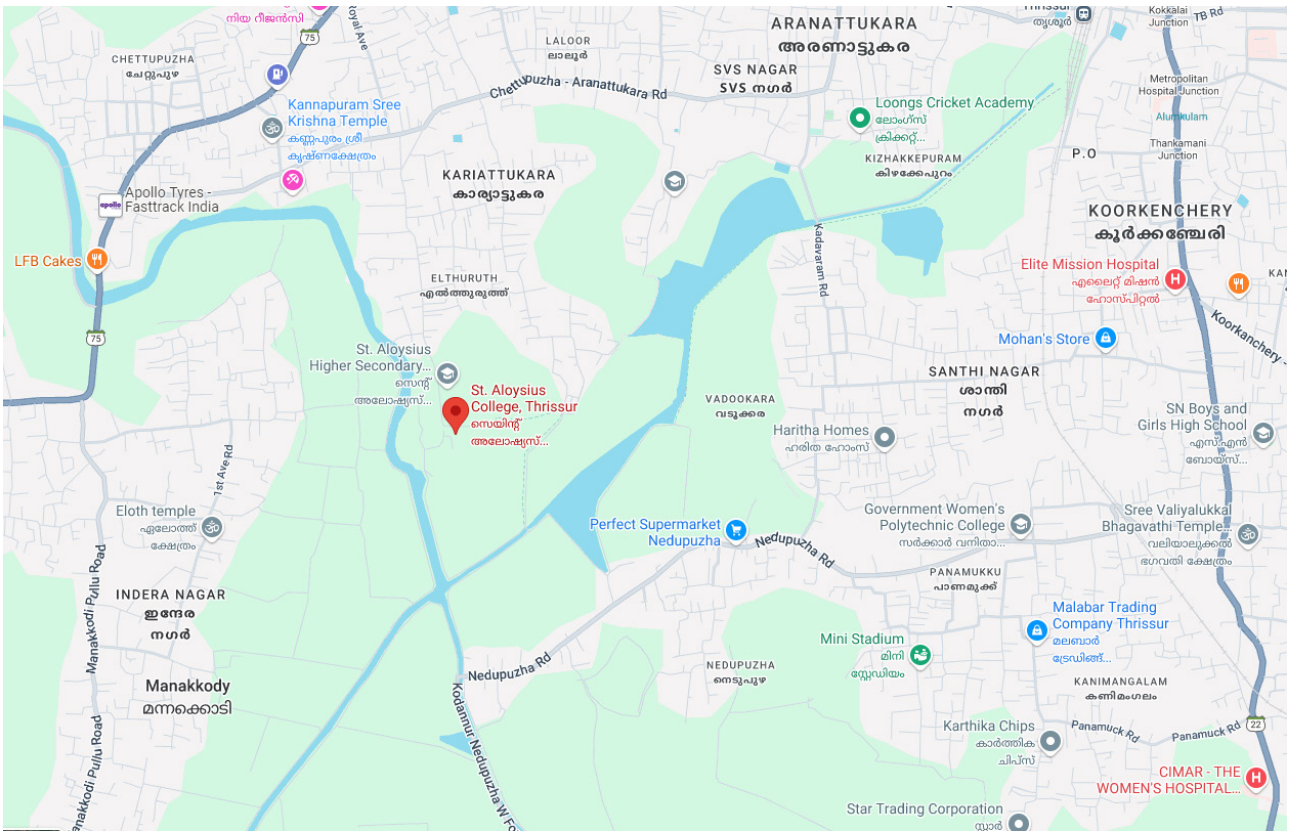


Fig.2.2. Location map of the College (10.496926572595262, 76.18096308296472)

2.9. CAMPUS LAYOUT

Main Buildings	Open spaces
Administrative block	Football ground
Chavara Block	Parking Ground
Jubilee Block	Opens stage /Ground
Bishops Clemens Block	Paddy field (25 acres)

Table 2.8. Landscape elements of the campus

Fig.2.3. Campus map of the College

2.9.2. Facilities of the college

Sl No	Facilities	Count
1	College Hostel	1
2	Auditorium	1
3	Conference hall	2
4	Exam Hall	24
5	Library	1
6	Lab	4
7	Computer lab	4
8	NSS Room	1
9	NCC Rom	2
10	Parking Lots	4
12	Fitness Centre	1
13	Health Centre	1
14	Green Spaces	4
15	Retail Outlets	1
16	Cafeteria and Dining Halls	1
17	Sports Complex	1

Table 2.9. Facilities of the college

Chapter III

ENVIRONMENT MANAGEMENT SYSTEM (EMS) OF St. ALOYSIUS COLLEGE

ENVIRONMENT MANAGEMENT COMMITTEE (EMS 2021-24)

Dr. Chacko Jose P
Principal
Fr. Arun Jose CMI
Administrator
Dr. Pius T K
Director
Mr. Jain J Therattil
Convenor
Dr. Libison K B
IQAC Cordinator
Mr. Sabu A L
Superintendent

3 Environment Management System

3.1. INTRODUCTION

An Environmental Management System (EMS) is a voluntary management tool that provides an organization with a framework to proactively manage potential and actual environmental risks and opportunities in a college campus. EMS identify, document, monitor, evaluate and communicate the level of environmental protection in the institution. EMS is part of the college and overall management system. EMS provides institution, processes and procedures, assigns responsibilities, allocates resources and evaluates ongoing planning activities, organizational structure and practices.

ISO 14001 is the best known and most successful international standard that formulates requirements for the environmental system. Its purpose is to provide an administrative framework to raise the level of corporate and environmental protection and to do so according to socio-economic requirements. An essential element of sustainable development is environmental management. Preserving the habitat for the current and upcoming generations has turned into an international endeavour. Many businesses have included this promise in their corporate policies. Thus, limiting environmental consequences and adhering to legal requirements are not the only aspects of environmental preservation. ISO 14001, on the other hand, is more concerned with a company's ongoing environmental performance improvement.

The objectives, needs, and importance of an Environmental Management System (EMS) in a college campus are as follows:

3.1.1. Objectives

- To systematically identify, evaluate, and manage environmental aspects and impacts associated with college operations and activities.
- To comply with relevant environmental regulations, laws, and standards.
- To continuously improve environmental performance through the establishment of objectives and targets.
- To raise awareness and promote environmental responsibility among students, faculty, staff, and other stakeholders.
- To integrate environmental considerations into decision-making processes across all levels of the institution.

3.1.2. Need

Increasing environmental concerns:
With growing awareness of environmental issues such as climate change, pollution, and resource depletion, there is a need for colleges to address their environmental impacts and contribute to sustainability efforts.

Legal and regulatory requirements: Compliance with environmental regulations is mandatory for colleges to avoid legal penalties and maintain their reputation as responsible institutions.

Stakeholder expectations: Students, parents, faculty, staff, and the broader community increasingly expect colleges to demonstrate a commitment to environmental stewardship and sustainability.

Resource efficiency and cost savings:
Implementing environmental management practices can lead to efficiencies in resource use, waste reduction, and cost savings for the college.

3.1.3. Importance

Environmental stewardship: An EMS helps colleges fulfil their role as environmental stewards by managing their operations in a manner that minimizes adverse environmental impacts.

Reputation and credibility: A well-implemented EMS demonstrates the college's commitment to environmental responsibility, enhancing its reputation and credibility among stakeholders.

Risk management: By proactively identifying and mitigating environmental risks, colleges can reduce the likelihood of incidents, fines, and reputational damage.

Educational opportunities: An EMS provides valuable learning opportunities for students, allowing them to engage with real-world environmental challenges and solutions.

Innovation and competitiveness: Colleges with strong environmental management practices can attract environmentally-conscious students, faculty, and staff, enhancing their competitiveness in a socially responsible marketplace.

EMS management plan regularise the practice of environment management through introducing sustainable practice. By integrating the principle of sustainability into their own operations and campus management, serving as living laboratories for students to observe, learn and participate in sustainable practice which gradually disseminate in regular lifestyle.

3.2. ENVIRONMENT MANAGEMENT SYSTEM POLICY

3.2.1. Introduction

Guided by the vision and mission of St. Kuriakose Elias Chavara, St. Aloysius College, Elthuruth, is dedicated to imparting value-based, life-oriented education. The institution nurture authentic individuals within a culture of responsibility and sustainability. The institution has woven a comprehensive policy thread that integrates key components such as energy, water, biodiversity, occupational health and safety, carbon footprint reduction, and responsible waste management. Through green initiatives, aim to cultivate a conscious mind-set among future generations. By transforming learning principles into action. Inspire and empower the youth to become catalysts for change within their families and society at large. The college is committed to incorporating sustainable development goals, striking a balance between renewable and finite resources, and sowing the seeds for a brighter, greener future. Through teachings and actions, seek to illuminate the path toward harmonious coexistence, where humanity and nature thrive hand in hand.

3.2.2. Goal

The goal of the institution is to create a sustainable and responsible campus by reducing energy use, lowering greenhouse gas emissions, and promoting energy-saving behaviors. The institution is committed to water recycling, ensuring all sources are sustainably managed. Biodiversity conservation is a priority, with assessments to document species and map habitats, guiding conservation efforts. Educate the campus community on the importance of environmental stewardship and engage local stakeholders in conservation initiatives. Additionally, focus on health and safety, waste reduction, recycling, and responsible disposal to foster an environmentally and socially responsible campus.

3.2.3. Objectives

- **3.2.3.1.** To encompass a wide range of sustainability and conservation initiatives aimed at creating a more environmentally responsible campus. These include the implementation of strategies to decrease energy use across all campus facilities and the adoption of practices that lower greenhouse gas emissions.
- **3.2.3.2.** The institution is committed to promoting energy-saving behaviors among students, faculty, and staff, alongside establishing comprehensive water recycling and conservation programs. Ensuring all water sources are sustainably managed and contamination-free is also a key focus.
- **3.2.3.3.** To conducting a biodiversity assessment, which involves surveying and documenting the diverse range of species found on the campus, including plants, animals, fungi, and microorganisms. This endeavor enhances the understanding of biodiversity and the overall health of the campus ecosystem. The institution aims to identify and document both native and non-native species on campus, compiling species lists to discern which species may be invasive or endangered. Additionally, mapping various habitats across the campus, such as woodlands, grasslands, and wetlands, is essential for evaluating their quality and biodiversity significance, thereby aiding in conservation planning.
- **3.2.3.4.** Education and awareness are integral to these efforts, with a commitment to educating students, faculty, and staff about local biodiversity and the importance of conservation. By actively participating in these assessments, the campus community can develop a deeper commitment to environmental stewardship. The institution also seeks to offer suggestions for conservation initiatives and management approaches aimed at improving campus biodiversity, such as restoring habitats, planting native species, and minimizing environmental impacts.
- **3.2.3.5.** Engaging the wider campus community, local stakeholders, and potentially the public in biodiversity conservation efforts is another objective, promoting partnerships and collective responsibility for environmental stewardship. Biodiversity considerations will be incorporated into campus planning and development processes to ensure that future projects prioritize the preservation and enhancement of biodiversity.
- **3.2.3.6.** Institution is dedicated to ensuring compliance with relevant health and safety legislation and regulations, providing a safe and healthy environment for all individuals on campus, and identifying and mitigating potential hazards and risks. A culture of safety and health awareness is promoted through adequate training and resources for health and safety management.
- **3.2.3.7.** To minimizing waste generation through responsible consumption and reuse strategies. The institution aims to implement a comprehensive system for waste segregation at the source, promote and facilitate recycling of all recyclable materials, and ensure the safe and responsible disposal of non-recyclable waste. Educating the campus community on waste management practices and their environmental impact is vital to achieving these goals.

3.2.4. Resource management

Effective resource management in educational institutions is crucial for fostering sustainability and reducing operational costs. By integrating efficient practices, the institution aims to lower its carbon footprint and promote an environmentally responsible culture among students and staff. This comprehensive approach includes the strategic use of energy, water, and waste management resources, focusing on advanced technologies, conservation measures, and renewable energy sources.

3.2.4.1. Energy Resource Management

The institution is dedicated to reducing energy consumption and operational costs through a variety of initiatives. It focuses on exploring alternative energy sources, encouraging energy conservation behaviors, and upgrading outdated technology with energy-efficient alternatives. Moreover, the institution aims to minimize energy use in transportation to reduce its carbon footprint.

3.2.4.2 Water Resource Management

Water resource management encompasses specific, targeted practices to ensure long-term sustainability. This

includes promoting effective conservation strategies and ensuring regular maintenance of water resources and related infrastructure. Additionally, exploring opportunities for water restoration and infrastructure upgrades to prevent excessive water use and encourage gray water recycling. It is equally important to foster behavior change among students, encouraging sustainable water practices and mindful consumption.

3.2.4.3 Biodiversity Management

The Biodiversity Resource Management Plan emphasizes sustainable strategies to enhance campus biodiversity while minimizing resource consumption and significantly increasing greenery. It supports local ecosystems and aligns with broader biodiversity goals. The plan fosters student interest and understanding of the importance of conservation, encouraging a sense of harmony with nature. Ultimately, it charts a clear path for preserving and protecting the campus's biodiversity.

3.2.4.4 Waste Management

Waste management at the institution is structured around the 5 R principles: reduce, reuse, recycle, rethink, and respect. These principles are actively promoted among students and extended to the wider community to foster awareness. This approach opens opportunities for developing a responsible waste management system. It aims to cultivate a culture that encourages proactive responses to the pressing issue of waste management and promotes behavior change through sustainable practices and to exploring innovative ideas that reduce the environmental impact of waste.

3.2.4.5.Health and Safety Management

The institution prioritizes the health and safety of its students and staff. Fire extinguishers are installed on each floor, and safety drills and first aid protocols are regularly practiced. Necessary resources, including training and equipment, are
provided to support health and safety initiatives, with specific provisions for disabled individuals. Compliance with relevant legislation and standards is ensured through regular reviews and updates of the health and safety policy. Employees, students, visitors, and contractors are all expected to adhere to these guidelines and report any hazards or unsafe conditions. This comprehensive resource management framework is designed to support the institution's commitment to sustainability, safety, and the well- being of the campus community.

3.2.4.6. Carbon foot print

The strategies aim to significantly reduce the campus's carbon footprint by implementing sustainable practices. Prioritizing water conservation with the use of efficient systems and techniques, and enhancing biodiversity by cultivating native plant species to support a balanced ecosystem. Additionally, a strong emphasis is placed on responsible waste management to ensure minimal environmental impact.

3.2.5. Curriculum Integration

Incorporating environmental sustainability into the curriculum of educational institutions is crucial for fostering a culture of sustainability and responsible stewardship of natural resources. This can be achieved by integrating energy management considerations into campus planning, operations, and decision-making processes. Ensuring that new constructions and renovations meet high energy efficiency standards is a key aspect of this integration.

Curriculum integration can take several forms. For instance, water sustainability topics can be embedded in courses related to environmental science, engineering, and other relevant fields. Students can be encouraged to undertake research projects focusing on local water management issues and solutions, thereby linking theoretical knowledge with practical, real-world applications. Similarly, environmental and sustainability topics can be incorporated into various disciplines, allowing students to engage in research projects that focus on local biodiversity and conservation efforts. Publishing books or book chapters on campus biodiversity, along with providing nameplates and barcodes on campus plants, can further enhance knowledge sharing among the student community.

In addition to these measures, waste management education should be integrated into relevant academic programs. Conducting awareness campaigns to educate the campus community on proper waste disposal practices will further support the institution's sustainability goals, ensuring that students and staff alike contribute to a greener, more sustainable campus environment.

3.2.6. Green Initiatives

- The educational institution has embarked on several green initiatives aimed at promoting sustainability and environmental stewardship on campus. Rainwater harvesting systems have been installed to capture and utilize rainwater, particularly for irrigation and other non-potable uses. To enhance campus greenery, gardens and green areas are being developed using drought-resistant plants and recycled water. Furthermore, the institution is committed to organic landscaping practices, such as composting, mulching, and natural pest control, which help reduce chemical usage and promote healthy plant growth.
- Awareness campaigns are being launched to educate the campus community about water-saving practices and the importance of local ecosystems like the Kole wetlands. In addition, the institution is restoring and creating wetlands on campus to support diverse aquatic and terrestrial species, contributing to biodiversity conservation.
- Green walls or vertical gardens are being incorporated into campus buildings to boost air quality and provide extra insulation. Regular planting events are conducted with the active involvement of students and faculty, fostering a sense of ownership and participation in the institution's green efforts. To further encourage sustainability, a student-led Green Committee has been established to oversee waste management initiatives and promote active participation in environmental activities.
- The institution is also promoting a culture of sharing and resource conservation by encouraging the creation of vegetable gardens using natural fertilizers from compost pits and establishing a sharing economy for books, uniforms, and other materials. Additionally, an annual campus clean drive is organized, mobilizing students and faculty to participate actively in maintaining a clean and green environment.

3.2.7. Research & Innovation

Prioritize research and innovation by allocating funds specifically for exploring advanced water conservation and energy management technologies and practices. By

fostering collaborations with local research institutions, innovative water management solutions tailored to regional needs can be developed, alongside exploring alternative energy sources and promoting behavior change and modification."Additionally, encouraging and supporting student research initiatives focused on the conservation of endangered plant and animal species in the locality can significantly contribute to biodiversity preservation. Institutions should also promote student-led research programs aimed at developing innovative methods for effective waste management practices, such as exploring waste-to-energy possibilities. To further advance knowledge and awareness in this field, organizing national and international conferences on sustainable waste management practices is essential, creating platforms for sharing insights and fostering collaboration among experts.

3.2.8. Community Engagement

The institution fosters community involvement through a range of green initiatives that aim to promote sustainability and environmental consciousness. By engaging with the local community, the college has been able to implement numerous programs that strengthen the relationship between the institution and its surroundings. One notable example of this is the regular cleaning drives organized by the National Service Scheme (NSS) & NCC of the college. These drives target the surrounding neighborhoods, improving cleanliness and hygiene while encouraging students to actively participate in creating a cleaner environment beyond the college campus.

3.2.9. Monitoring and Reporting

The stakeholders of the college including management, employees, students, and all those using the facilities, are expected to adhere to the institution's green policy and code. A Green initiative committee are responsible for organizing, executing, and overseeing the college's environmental efforts. Through these measures, the college demonstrates its strong commitment to environmental sustainability and its responsibility to minimize its environmental impact.

3.2.10. Compliance and Review

To ensure that its green policy remains effective and relevant, College conducts periodic reviews and updates. This process allows the institution to adapt to evolving environmental challenges, embrace new technologi-

cal advancements, and seize emerging opportunities. The college's commitment to regular policy evaluation ensures that it stays informed about changes in the environmental landscape and can readily adopt innovative approaches as they arise. As part of its environmental policy, the college has implemented an Environmental Management System (EMS) on campus, with periodic internal and external audits to maintain high standards of environmental care.

3.2.11. Conclusion

St Aloysius is dedicated to cultivating a culture of sustainability and environmental responsibility within community. Through the implementation of this environmental management policy, strive to reduce ecological impact, raise environmental awareness, and encourage responsible behaviors among students, faculty, and staff. By working together and continually improving, we reaffirm commitment to environmental sustainability, emphasizing community engagement and education. The institution goal is to create a healthier, more sustainable future for generations to come and contribute to a global shift towards environmental consciousness and responsibility.

3.3. ENVIRONMENT MANAGEMENT SYSTEM PLAN

St Aloysius College's Environment Management Plan enumerates the key strategies and actions necessary to implement and sustain the institution's commitment to environmental sustainability, as articulated in its Environment Policy. This comprehensive plan is designed to guide the college community in achieving the outlined environmental goals, nurturing a culture of environmental stewardship, and driving continuous improvement towards a more sustainable and eco-friendly campus. A detailed plan with calendar of short term and long-term activities will be developed and published at the beginning of every academic year.

3.3.1. Implementation Plan

- Phase 1: Assessment and Planning:
- Phase 2: Infrastructure Upgrades
- Phase 3: Education and Engagement:
- Phase 4: Monitoring and Review

3.3.2. Establishment of an Environmental Management Team

- Form a dedicated team comprising representatives from different departments and stakeholders (faculty, students, and administration) to oversee the implementation of the plan to ensure transparency and accountability. The environment management committee of the college will formulate once in three years.

3.3.3. Assessing and auditing sustainability

- Conduct a comprehensive assessment of the institution's current environmental impact, including energy consumption, waste generation, water usage, transportation, and land use includes analyzing current energy usage across all campus facilities to identify inefficiencies, peak demand times, and energy wastage
- Conducting a detailed evaluation of water usage to pinpoint areas with high consumption and potential leaks or inefficiencies, and examining the types, sources, and quantities of waste generated to identify high waste areas and opportunities for reduction.
- Adopt perform a risk assessment to identify hazard areas and assess various plant and animal groups on campus. This audit will establish a baseline for measuring future progress.

3.3.4. Establish clear and achievable objectives

- Establish SMART (Specific, Measurable, Achievable, Relevant, and Time-bound) goals that align with the institution's mission and values. Fostering Curriculum Innovation and Educational Advancement.

3.3.5 Optimizing Resource Management

- Reduce energy consumption and costs by using LED lighting, installing solar panels, and upgrading to energy-efficient appliances. Maintain HVAC systems regularly, promote energy conservation through signage, and maximize natural lighting.

- Efficient water use is achieved through rainwater harvesting, wastewater recycling, and green infrastructure. Regular maintenance prevents over-extraction and contamination. Water conservation is supported with low-flow fixtures, motion-sensor

taps, dual-flush toilets, and grey water recycling systems. Drought-tolerant plants and drip irrigation further reduce water waste.

- Waste management follows the 5 R principles: reduce, reuse, recycle, rethink, and respect, with a color-coded bin system on campus: green for biodegradable, blue for recyclable, and black for non-recyclable waste. Clear signage and collection points support proper segregation. Reusable items, double-sided printing, and responsible purchasing are encouraged. Composting and recycling through authorized agencies are key elements of the strategy to foster sustainability and responsibility.

- Resources, including training and equipment, are provided to support health and safety, with specific provisions for disabled individuals.

- Promote eco-conscious transportation options, such as bike-sharing programs, carpooling incentives, and the installation of electric vehicle charging stations.

- Integrate sustainability principles into college policies, procurement processes, and decision-making frameworks.

3.3.6. Crafting the blueprint for progress

- Foster a culture of sustainability by encouraging students to actively preserve green spaces, promoting eco-conscious transportation alternatives like bike-sharing, carpooling incentives, and electric vehicle charging stations, and integrating sustainability principles into college policies, procurement, and decision-making.
- This will cultivate a deeper sense of responsibility and affinity with nature, inspiring behavioral change that extends beyond college life

3.3.7. Green Initiatives

- Constructing a botanical garden to conserve native species and enhance campus biodiversity.
- Collaborating with the startup company Asrotech to establish a collection point called 'Haritham,' where a machine is installed to convert all types of plastic waste into recyclable materials. Through this initiative, students will receive a small honorarium for their participation, and the recycled materials will be repurposed for various uses.
- Internships, project works and assignments of all subjects shall be on environmental related topics to an extent of at least 40%, within a span of five years.

3.3.8. Research Support

- Advance the frontiers of environmental sustainability by launching targeted research initiatives, fostering cross-disciplinary partnerships, and investing in ground-breaking projects.
- Promote collaboration with academic departments to seamlessly integrate environmental and sustainability themes into the curriculum, using case studies, practical projects, and interdisciplinary discussions.
- Promote experiential learning and create opportunities for collaboration to deepen the understanding and commitment of students and faculty members to environmental issues.
- Encourage students and staff to explore opportunities for thesis work and publications that focus on resource management and sustainable futures.

3.3.9 Community engagement

- Collaborate with local communities and environmental organizations to support and amplify nearby sustainability initiatives, sharing resources, expertise, and knowledge to extend the reach of environmental awareness and action beyond the campus, fostering a broader culture of sustainability and collective impact.
- Collaboration with international, national and local agencies for implementing conservation projects and empowering stakeholder communities.
- Conducting projects and programs for stakeholder communities.

3.3.10 Materials Management and Procurement

- Make sustainability a core consideration in procurement align with sustainability goals, prioritizing eco-friendly products, energy-efficient solutions, and water-conserving technologies, and eliminating single-use items to cultivate a culture of environmental responsibility.

- 40% of equipment to be purchased, are of energy saving and eco-friendly; non-degradable wastes will be processed in the campus itself.

3.3.11 Performance Tracking and Analysis

- Develop and implement Comprehensive monitoring protocols to track progress toward environmental objectives, conducting comprehensive audits at regular intervals to evaluate the institution's environmental performance and impact.
- Ensure timely, transparent, and accessible reporting of results to all stakeholders, fostering accountability, trust, and continuous improvement.

3.3.12 Regulatory Compliance and Monitoring

- Maintain unwavering compliance with environmental laws and regulations, while periodically reviewing
- Refining the Environment Management Plan to address emerging challenges, capitalize on new opportunities, and drive continuous improvement in sustainability performance.

3.3.13 Conclusion

The Environment Management Plan is a testament to St Aloysius College's commitment to environmental stewardship, aligning perfectly with the institution's policy. This plan enables the college to champion sustainability, reduce its ecological footprint, and inspire community involvement, thereby solidifying its position as a leader in environmentally responsible education

Chapter IV

ENERGY MANAGEMENT SYSTEM (En MS) AUDIT REPORT

ENERGY MANAGEMENT SYSTEM
(EnMS 2021-24)

Dr. Anju Elsa Tom
Ms. Vidya C Nair
Ms. Rasmi T.
Mr. Freddy Kurian
Mr. Santosh Cheenikkal
Mr. Abin Babu
(Assistant. Professors)

Ms. Abhiramy B
Ms. Arundhathi E
Ms. Avanthika C Biju
Ms. Rudrambika M V
Mr. Aaditya Deva
Mr. Shavin C L
Ms. Annmary Antu
Ms. Arya S
Mr. Adithyakumaran K R
Mr. Adithyan E A
Mr. Jishnu K
Ms. Bysha Ravichandran A R
Ms. Aleena Francis
Ms. Rasila A R
(Students)

4

Energy Management System Audit Report

4.1. INTRODUCTION

Energy is indispensable in our everyday existence as it fulfils a fundamental human necessity. We rely on energy for nearly every aspect of our daily routines. The Earth boasts a variety of energy resources, each with its own unique characteristics. However, all energy sources leave some imprint on our environment, with their ecological ramifications stemming from various origins. This article aims to explore energy resources and their ecological implications.

Energy and environmental issues are intricately intertwined, as the production, transportation, and consumption of energy inevitably result in significant environmental consequences. Direct environmental ramifications stemming from energy production and usage encompass air pollution, climate change, water pollution, thermal pollution, and solid waste disposal. Notably, the combustion of fossil fuels stands out as the primary source of urban air pollution due to the emission of air pollutants. Moreover, the burning of fossil fuels serves as the primary driver of greenhouse gas emissions. Various water pollution challenges are also linked to energy utilization.

The electrical system, equipped with an extensive network of wiring, incorporates various safety devices. Connected to this system are variable loads, including heating, ventilation, and air conditioning (HVAC) units, fans, pumps, computers, lighting systems, blowers, compressors, and numerous other heavy machines. Unfortunately, the system's performance and efficiency are compromised by several factors such as device and wire aging, dust accumulation, humidity, outdated technology, among others. Consequently, electrical energy is lost and converted into heat, thereby reducing system efficiency and increasing power consumption. However, employing energy auditing methodologies can help mitigate these losses by evaluating the overall performance of the electrical system.

The energy audit involves investigating the energy usage within a specific area or building to determine its sources and optimal utilization. Based on this analysis, auditors devise various strategies to manage energy consumption effectively. This comprehensive process aims to reduce energy usage without compromising the functionality of devices or equipment and maintaining comfort levels. Factors such as consumer behavior, building age, and climate conditions play crucial roles in influencing energy consumption.

4.1.1. What is an energy Audit?

Energy auditing serves as a crucial means to pinpoint energy efficiency opportunities and strategies. It plays a pivotal role in uncovering potential efficiency measures

and evaluating their economic feasibility across various operational tiers. Beginning with a basic assessment involving site inspections and broad energy analysis, it uncovers low-cost savings avenues. As audits progress to more comprehensive levels, they delve deeper into energy costs, usage patterns, and system attributes, incorporating on-site measurements to pinpoint capital-intensive efficiency measures, aligning them with site-specific financial plans. The requirements that must be fulfilled for an energy audit are:

- Detailed inventory of energy infrastructure of the college/university
- A detailed review of the energy consumption profile (pattern of consumption of energy through each utility point- including ways of energy loss or wastage)
- Identification of energy saving opportunities (habitual modifications, change to energy saving infrastructure and equipment's, and use of alternate energy resources).

Energy audits conducted at such comprehensive levels can also serve as a vital foundation or initial stride in implementing and institutionalizing energy management systems (EnMS) within educational institutions. They facilitate the effective management of energy demand.

4.1.2. Need for energy audit

As the importance of sustainability continues to rise in our daily lives, there is a growing and sustained interest in professional energy management systems. This shift is driven by the recognition that saving energy and reducing CO_2 emissions has substantial benefits for our climate and environment. In recent years, a noticeable shift in energy consumption behaviour has been emerged. Beyond the motivation of reducing high electricity bills, a majority of institutions now rely on modern machinery and equipment designed for lower energy consumption. This demand for an efficient infrastructure has become increasingly evident.

The functions of the energy audit are:

- an energy audit can reduce energy consumption
- an energy audit can reduce the energy bill and save the money
- an energy audit can improve the comfort level
- an energy audit can reduce the carbon footprints
- an energy audit can reduce unnecessary waste and pollution

Tailoring energy audits to suit efficient energy management systems can further slash energy costs, thereby bolstering your financial liquidity. Consequently, you gain a clearer understanding of processes and consumption patterns, facilitating the swift and sustainable implementation of improvement measures.

4.1.3. Benefits of adopting energy management system

Energy management system, ISO 50001 can provide Organisations with a number of benefits. These include:

- Helping to achieve energy use reduction and carbon emissions in a systematic way;
- Creating a clear picture of current energy use status, based on which new goals and targets
- Evaluating and prioritizing the implementation of new energy-efficient technologies and measures
- Providing a framework to promote energy efficiency throughout supply chain;
- Providing guidance on how to benchmark, measure, document and report effective energy use
- Making better use of energy consuming assets, thus identifying potentials to reduce
- Maintenance costs or expand capacity

4.2. ENERGY MANAGEMENT SYSTEM POLICY (En MS)

4.2.1. Statement of Commitment

Energy utilization worldwide has significantly increased due to industrialization, urbanization, and technological advancements. This surge in energy consumption contributes to environmental degradation through greenhouse gas emissions, leading to climate change, air pollution, and resource depletion. These challenges are directly addressed by the United Nations Sustainable Development Goals (SDGs), including Goal 7 (Affordable and Clean Energy), Goal 13 (Climate Action), and Goal 15 (Life on Land). Educational institutions play a crucial role in addressing these issues by promoting awareness, conducting research on sustainable practices, and implementing green initiatives on their campuses. The institution are committed to adopting and implementing energy management practices that promote sustainability, efficiency, and environmental stewardship. Energy Management Policy is designed to reduce energy consumption, minimize carbon footprint, and cultivate a culture of conservation within the campus community.

By integrating sustainability into curriculum, operations and help to cultivate a generation committed to responsible energy use and environmental stewardship.

4.2.2. Goals

- **4.2.2.1.** Achieve a sustainable and energy-efficient campus by optimizing energy use, reducing reliance on non-renewable sources, and fostering a culture of energy conservation through continuous education, monitoring, and the adoption of renewable energy technologies.

4.2.3. Objectives

- Reduce Energy Consumption: Implement measures to minimize energy consumption across all facilities and operations of the institution.
- Promote Renewable Energy: Increase the utilization of renewable energy sources such as solar, wind, and biomass to reduce dependence on non-renewable energy.
- Energy Efficiency: Upgrade infrastructure and adopt energy-efficient technologies to optimize energy use and reduce wastage.
- Raise Awareness: Educate students, faculty, and staff about the importance of energy conservation and encourage their active participation in energy-sav ing initiatives.
- Monitor and Evaluate: Establish mechanisms to monitor energy usage regularly, set targets for reduc tion, and evaluate the effectiveness of energy man-age ment initiatives.

4.2.4. Resource Management

Introducing effective energy resource management in educational institutions is crucial for promoting sustainability and reducing operational costs. By implementing efficient energy practices, our institution strives to significantly lower its carbon footprint, fostering an environmentally responsible culture among students and staff. This involves the strategic use of energy resources through the adoption of advanced technologies, energy conservation measures, and renewable energy sources. Through this holistic approach reduce energy consumption and lower costs and also contributes to a more sustainable future.

4.2.5 .Policy Measures:

4.2.5.1 Energy Conservation:

- All members of the institution are responsible for
- Conserving energy by switching off lights, computers, and other electrical devices when not in use.
- HVAC systems will be operated efficiently, and temperature settings will be optimized to minimize energy consumption while ensuring occupant comfort.
- Regular maintenance and servicing of equipment will be conducted to ensure optimal performance and energy efficiency.

The strategic use of energy resources

4.2.5.2 Renewable Energy Integration

- Install solar panels on rooftops and open spaces to generate clean energy for powering lighting, water heating, and other electrical needs.
- Explore opportunities for harnessing wind energy through the installation of small-scale wind turbines on campus.
- Utilize biomass or biogas for cooking and heating purposes where feasible, utilizing organic waste generated on campus

4.2.5.3. Energy-Efficient infrastructure

- Retrofit existing buildings with energy-efficient lighting, insulation, and windows to reduce energy losses and enhance thermal comfort.
- Incorporate energy-efficient appliances and equipment in new construction projects and major renovations.
- Implement smart building technologies and energy management systems to monitor and control energy usage in real-time.

4.2.5.5.Reduce energy consumption in transportation services

- Promote the use of public transportation and introduce bike-sharing programs to reduce reliance on personal vehicles. Invest in electric vehicles for campus transport and install charging stations to support their use. Encourage carpooling by offering incentives such as preferred parking spots and reduced fees. These measures will help decrease fuel consumption and enhance pedestrian and cycling infrastructure, making walking

and biking safer and more convenient for students and staff.

4.2.5.5.Reduce energy consumption in transportation services

- Conduct awareness campaigns, workshops, and training sessions to educate the campus community about energy conservation practices and their role in achieving energy efficiency goals.
- Encourage students to undertake research projects related to energy management and sustainability, fostering innovation and knowledge dissemination

4.2.5.5.Reduce energy consumption in transportation services

- Introduce courses that cover the basics of energy systems, energy efficiency, renewable energy sources, and sustainability principles.
- Offer electives focused on areas such as renewable energy technologies, energy policy and regulation, sustainable building design, and smart grid technologies.
- Create certificate or minor programs in energy management for students across various disciplines, providing a structured pathway for in-depth study.

4.2.6. Research and Innovation

- Investigate the impact of educational programs on energy-saving behaviors among students and staff.
- Develop gamified platforms or apps that encourage and reward energy- saving actions, making energy conservation a part of the institution's culture.

4.2.7. Collaboration and community engagement

- Engage with students, faculty, staff, and the local community to foster a shared commitment to energy conservation.
- Partner with external organizations to enhance energy management initiatives.

4.2.8. Monitoring and Evaluation

- Establish a dedicated Energy Management Committee responsible for monitoring energy usage, analyzing trends, and identifying opportunities for improvement.
- Set annual targets for energy reduction and track progress towards achieving these targets through regular audits and performance assessments.
- Review and update the Energy Management Policy periodically to reflect advancements in technology and best practices in energy conservation.
- Ensure regular maintenance of HVAC systems and other equipment to maintain efficiency.

4.2.9. Conclusion

By adhering to this policy, St. Aloysius College, Elthuruth, strives to set an example in sustainable energy management, contributing positively to the environment and fostering a greener future for all.

4.3. METHODOLOGY

The energy audit was conducted by analysing various aspects of the institution's energy usage through a structured program schedule designed for systematic execution. The internal audit team consisted of 22 members 17 students and 5 faculty who were divided into five groups of four members each for data collection, supervised by faculty in charge.

4.3.1. Registers and documents

The team consolidated seven registers and five documents, including the energy audit training attendance sheet, auditor list, meeting records, and the institution's energy conservation plan and policy. Students were assigned the task of mapping the campus and marking electrical appliances and instruments. Various registers were maintained to track energy meter readings, monthly utility bills, solar system energy production, motor pump operations, and appliance logs. A maintenance register was also kept to monitor appliance performance, categorize them as effective or ineffective, and track operating hours on a daily and weekly basis. Special attention was given to weekend data and separate meter readings for each block.

4.3.2. Energy infrastructure documentation

Detailed documentation of the college's energy infrastructure, including lighting, audio-visual equipment, lab instruments, computers, and appliances, was prepared. The installed power usage was calculated using the power data of the gadgets and average time of usage per year (in KWH).

4.3.3. Usage pattern assessment through energy meter sampling data

The power consumption for each block was calculated by consolidating data collected over three weeks, with daily and weekly cross-checks to ensure accuracy. A centralized method of data collection was used. Energy meter readings were taken three times daily over a nine-day period, including weekends (Saturdays and Sundays) and a working day (Friday). Team members conducted observational visits to record details about equipment, lighting, and appliances, noting power capacity and usage patterns. Interviews with the system manager and relevant faculty provided additional insights.

4.3.4. Analysis of KSEB meter reading

Power consumption from the Kerala State Electricity Board (KSEB) was assessed through regular meter bills for the past two years (2021-2022, 2022-2023, and 2023-2024).

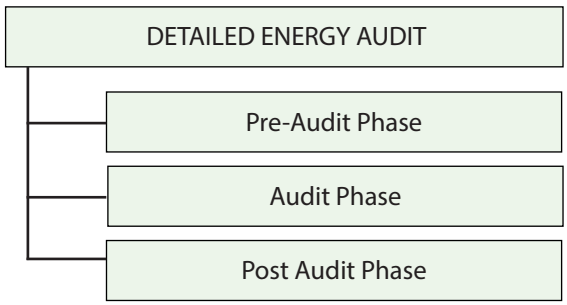
4.3.5. Identification of energy saving options and scope of alternate energy resources

The team also identified and documented potential alternative energy sources, along with a proposed action plan. The energy resources of the campus including KSEB supply, alternative energy sources, and their annual usage were analysed for various locations such as laboratories, offices, and kitchens to assess the college's carbon footprint.

4.3.6. Assumption

An effective Energy Management System (EnMS), aligned with an organization's business strategy, provides a clear view of energy usage and areas for performance improvement. It establishes structured policies, processes, procedures, and action plans to identify and implement energy-saving opportunities, promoting continuous improvement in energy management. Energy savings identified through an EnMS directly translate into measurable reductions in energy bills, which significantly lower overhead costs. Numerous organizations implementing ISO 50001 have reported first-year savings equal to or exceeding the costs of its implementation. Cost reduction and energy consumption reduction are closely linked. By setting up, maintaining, and continuously improving an EnMS, organizations can not only address immediate energy-saving opportunities but also better understand where, when, and how energy is consumed. This allows for identifying ongoing energy efficiency improvements. The use of Annex SL supports an integrated management system (IMS) that handles the requirements of ISO 9001, ISO 14001, and ISO 50001 simultaneously. Many processes such as document control, internal audits, non-conformity handling, and corrective actions can be managed jointly, avoiding duplication of efforts across standards. ISO 50001:2018, restructured using Annex SL, emphasizes a comprehensive energy review to understand an organization's energy use and requirements. This forms the basis for developing Significant Energy Uses (SEUs) and identifying efficiency opportunities. The success of energy efficiency initiatives and EnMS depends significantly on college management's involvement. The standard requires organizations to establish energy objectives, including measurable targets that take into account SEUs, opportunities for performance improvement, and applicable requirements. These must be monitored, communicated, and updated regularly. Prescriptive standards define the data to be collected, such as variables related to SEUs, energy consumption, operational criteria, static factors, and other details specified in action plans. ISO 50001 applies to the design of installations, equipment, systems, or processes that consume energy, promoting energy performance improvement throughout the life cycle. Organizations are required to integrate energy efficiency opportunities into the design, procurement, and operational controls of new or renovated SEUs. Improvements in energy efficiency can be demonstrated by comparing the Energy Performance Indicator (EnPI) values against the Energy Baseline (EnB). In cases where improvements are achieved outside of key SEUs, EnPI and EnB can still be used to demonstrate energy performance improvements. Significant deviations in energy performance must be investigated, as per the standard.

4.3.7. Stages of Energy audit



4.3.7.1. Pre-Audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with energy policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the usage pattern and habits related to energy consumption.
- Preparation of inventory of energy infrastructure- site diagrams, electrical diagrams, checklists etc.
- Analysis of consumption pattern; identification of energy loss or wastage

4.3.7.2 Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:

- Collect the information about the source of the energy supply
- Collect the energy bills to find out the tariff data and electrical energy cost (monthly bills of last 24 months)
- Collect the load sector data (power ratings of equipment's, instruments, utilities etc.)
- Review of present energy management procedure-losses, wastage, options for improvement for energy conservation.

The outcomes of the collected data are:

- Preparing process flow diagram and energy, and material balance.
- Identification of Energy Conservation (ENCON) opportunities.
- Energy conservation & saving options and recommendations.
- Technical and feasibility report.
- Implementation plan for energy-saving measures and projects for the third phase (post-audit phase).

4.3.7.3 Post audit phase

- The plan of action for the post-audit phase is implementation and follow-up. The result is to assist and implement ENCON recommendation measures ad monitor the performance.
- EMS committee will ensure that the Energy Management System is in place and the college is participating, by making the entire college/university community well informed through regular communications; monitoring through periodical evaluation programmes etc.

4.3.8. Steps of Energy Audit

4.3.8.1. Site assessment

Collection of contour map and campus diagram

- Preparing inventory of energy infrastructure of each building:
- Construction details of the building envelope (e.g. walls, roof, windows, doors and related insulation values)
- Manual, time clock or automated control and measuring methods (energy meters, main switches; MCB, ELCB etc.)- control section; capacity; location etc.
- Interior and exterior lighting systems and related controls
- Equipment, appliances, instruments etc. – watts, utility pattern, average consumption (monthly or yearly)
- Discussion with responsible persons of each infrastructure (on utility pattern, working condition, operation and maintenance procedures etc.)
- Date entry in prescribed forms (Energy spread sheets)

4.3.8.2 Data analysis

- Analysis of current and past performance (energy bill comparison, previous audit data etc.)
- Regression analysis involves the comparison of energy consumption on the Y axis versus the potential energy driver on the X axis (weather, working days/ holidays etc.).
- Preparation of checklists and verification

- Carbon credit calculation
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

4.3.8.3 Final audit by external audit team

- Checklists verification- identifying non conformities

4.3.8.3 Work plan & schedule

Activity	Frequency	Dates	Mode of data Collection
Energy Meter reading (for every meter in the college)	9 days; three times a day	Three Sundays; Three holidays as 15/7/2024 ,21/7/2024,28/7/2024 (Saturday)as 14/7/2024, 20/7/2024, 27/7/2024 Three working days12/7/2024,19/7/2024, 26/7/2024 (completed by three weeks)	Entry in the given format
Energy infrastructure assessment: Usage pattern of instruments, equipment, lights etc. Documentation of current ECM practices	Walk through audit and interviews with system managers (controlling or responsible staff or teachers)	One visit is enough in the assigned area. Collect data on power capacity and usage time of every light, fan, equipment, appliances, instruments etc.	Entry in the given formats
Alternate energy resources	Documents details of present alternate energy resources in the campus	Identify possible alternate energy sources	Entry in the given format Include in the action plan
List & details of energy resources in the campus	I. Electrical energy 1. KSEB supply per month 2. Alternate energy resources	Record the monthly/ annual usage quantity.	Keep registers. Data shall be entered in the given format
	II. Fossil fuels 1. LPG 2. Petrol/diesel 3. Kerosene etc.	Record annual usage with respective purpose uses and location (lab, office, kitchen etc.)	Enter in the given format

Table 4.1. Energy audit-activity wise work plan

Week	Week Days	Weekly Work Plan
First Week	2/7/24 to 9/7/24	• A meeting was held to discuss about the policies and to finalize the action plan • Every team member is asked to go through the manual and asked to prepare the checklists for carrying out the action plan • Collected the map of the college campus • Identification of meter locations to take the meter readings • The internal audit team is divided into 4 groups • The college campus is divided into 4 blocks and each group is assigned a block for the survey
Second week	10/7/24 to 17/7/24	• Each group is asked to identify the meter locations in their assigned area • A map is given to each group and assigned locations for meter reading data collection • Each group is asked to mark the electrical appliances/ instruments in the block. (line sketches and simple diagrams) • Handed over the data sheets and each group will start the data collection from the next Wednesday onwards
Third Week	18/7/24 to 25/7/24	• Each group is assigned to place registers on required areas for efficient data collection • Each team is asked to identify the working conditions of each appliances/ Instruments were inspected by the groups. • The efficient and non-efficient devices will be sorted. • A meeting will be held to analyze the progress of the energy audit and to analyze the results
Fourth week	26/7/24 to 01/08/24	• Preparing and uploading registers and documents, which includes documenting programs and activities as well as recording meeting minutes
Fifth Week	02/08/24 to 09/08/24	• Each group will be assigned to record the operational hours of each appliance separately for daily and weekly usage. Weekend data should also be collected. • The power meter readings for each block have to be recorded simultaneously.
Sixth Week	10/08/24 to 17/08/24	• This week is assigned for computation and documentation of the daily and weekly power consumption for each block, utilizing data from the fourth week.
Seventh Week	18/08/24 to 25/08/24	• Collection of power consumption data from all the 4 blocks and should cross-checked it with the power meter readings to verify for any discrepancies.
Eight Week	26/08/24 to 01/09/24	• • Ensuring all registers and documents are completed before finalizing the report

Table 4.2. Schedule of the energy audit

4.4. RESULT AND OBSERVATION

4.4.1. Electrical energy infrastructure of the college

The energy infrastructure (electrical) of the college was assessed by the internal audit team and the data is given in Table 4.3 to 4.10.

No.	Location	Bulb	LED (bulb)	(N) Tube light	LED tube light	Fan	Table fan	Speaker	Normal plug	Power plug	Scanner	Projector	PC	Printer	TV	Exhaust fan
1	3rd Bsc chemistry	0	0	2	0	2	0	3	3	0	0	1	0	0	0	0
2	Chemistry Department	0	0	3	0	2	0	1	21	0	0	0	1	1	0	0
3	Reasearch room	0	0	4	0	0	0	0	2	8	0	0	0	0	0	0
4	Bsc chemistry Lab	0	0	18	2	0	0	1	4	9	0	0	0	0	0	3
5	Washroom/Bsc che(lab)	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
6	Fume hood room	0	1	0	0	0	0	0	1	0	0	0	0	0	0	1
7	Directors (SF) office	0	0	2	0	2	0	1	1	0	0	0	1	1	0	0
8	Placement cell	0	0	2	0	2	0	1	1	0	0	0	0	0	0	0
9	Fitness centre	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0
10	PG department	0	0	0	1	1	0	1	1	0	0	0	1	0	0	0
11	I Msc chemisry	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0
12	I Dc chemistry	0	0	1	0	1	0	2	1	0	0	0	0	0	0	0
13	I DC physics	0	0	1	0	2	0	2	3	0	0	1	0	0	0	0
14	1DCMsc physics	0	0	1	0	1	0	0	3	0	0	0	0	0	1	0
15	Bsc Physics	0	0	4	0	3	0	1	12	0	0	0	0	0	0	0
16	II DC physics	0	0	0	2	2	0	3	3	0	0	1	0	0	0	0
17	Physics department	0	0	1	0	2	0	1	12	0	1	0	1	1	0	0
18	Washroom	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19	IIIDC physics	0	0	0	1	1	0	3	3	0	0	0	0	0	0	1
20	III DC physics	0	0	0	1	1	0	3	3	0	0	0	0	0	1	0
21	I Msc physics	0	0	3	0	2	0	0	3	4	0	0	0	0	1	0
22	I MA economics	0	0	1	0	2	0	1	1	0	0	0	0	0	0	0
23	Economics Department	0	0	0	1	4	2	1	16	2	0	0	1	1	0	0

Table 4.3. General electrical infrastructure of St. Aloysius college.

24	II MA Economics	0	0	0	1	2	0	1	3	0	0	0	0	0	1	0
25	I Dc Economics	0	0	1	0	2	0	1	1	0	0	0	0	0	1	0
26	II Dc Economics	0	0	1	0	2	0	1	1	0	0	0	0	0	1	0
27	IIIDC Economics	0	0	1	0	2	0	1	0	0	0	0	0	0	0	0
28	Examination Hall	0	0	1	0	2	0	1	4	0	0	0	0	0	1	0
29	Examroom	0	0	6	3	2	0	1	11	2	0	0	3	0	0	0
30	Main office	0	0	2	7	4	0	1	29	2	0	0	5	0	0	0
31	IQAC Room	0	0	0	14	0	0	2	4	1	0	1	2	1	0	1
32	Office 2	0	16	0	2	3	0	1	1	0	0	0	5	0	1	3
33	Store room	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
34	I DC commerce	0	0	1	0	2	0	3	1	0	0	0	0	0	0	0
35	II DC commerce	0	0	1	0	2	0	3	3	0	0	0	0	0	1	0
36	III DC commerce	0	0	1	0	2	0	3	3	0	0	0	0	0	1	0
37	Dept of commerce	0	0	0	2	2	1	1	10	1	0	0	0	1	0	0
38	II DC Chemistry	0	0	2	0	2	0	0	2	0	0	0	0	0	0	0
39	Principal room	0	0	0	5	4	1	0	10	0	0	0	1	1	0	0
40	Administrator	0	0	0	4	2	0	0	11	13	0	0	1	1	0	0
41	Computer lab	0	0	0	0	6	0	0	0	0	0	0	0	0	0	1
42	Auditorium hall	0	0	11	106	4	0	4	17	11	0	0	0	0	0	0
43	NCC room	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
44	NCC room 2	0	0	2	0	2	0	0	1	0	0	0	1	0	0	0
45	Bathroom	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
46	Store and photostat	0	0	1	0	1	0	0	1	1	0	0	1	1	0	0
47	Staff club	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
48	Bathroom 2	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0
49	Staff club 2	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0
50	Auditorium UPS room	0	0	0	4	0	0	0	6	1	0	0	0	0	0	0
51	Old file rom	0	0	0	4	0	0	0	2	0	0	0	0	0	0	0
52	I B voc jewellert Design	0	0	1	0	4	0	1	3	0	0	0	0	0	1	0
53	II Bvoc Jewellery	0	0	4	0	4	0	1	3	0	0	0	0	0	1	0

Table 4.3. General electrical infrastructure of St. Aloysius college.

54	IIIBvooc jewllery	0	0	3	0	4	0	1	3	0	0	0	0	0	1	0
55	B Voc jewellery design	0	0	2	0	2	0	1	2	0	0	0	0	0	1	0
56	Jewellery design department	0	0	2	0	3	0	1	21	0	0	0	0	0	0	0
57	B com CA	0	0	3	0	3	0	1	3	0	0	0	0	0	0	0
58	Bcom corporation	0	0	3	0	4	0	1	3	0	0	0	0	0	0	0
59	Bcom Banking	0	0	2	0	4	0	1	3	0	0	0	0	0	0	0
60	BBA finance I	0	0	2	0	4	0	1	3	0	0	0	0	0	1	0
61	BBA finance III	0	0	4	0	4	0	1	0	3	0	0	0	0	0	0
62	BBA finance III	0	0	4	0	4	0	1	2	0	0	0	0	0	0	0
63	BBA department	0	0	2	0	2	0	1	4	0	0	0	0	0	0	0
64	Wash room	0	0	3	0	0	0	1	0	0	0	0	0	0	0	0
65	BBA HRM I	0	0	3	0	4	0	1	2	0	0	0	0	0	1	0
66	BBA HRM II	0	0	3	0	4	0	1	3	0	0	0	0	0	1	0
67	Audio visual lounge	0	0	11	0	12	0	6	45	4	0	0	0	0	0	0
68	Seminar hall	0	0	4	0	4	0	3	2	2	0	0	0	0	1	0
69	Classroom	0	0	4	0	4	0	1	2	0	0	0	0	0	1	0
70	Classroom	0	0	4	0	4	0	1	2	1	0	0	0	0	1	0
71	Classroom	0	0	4	0	4	0	1	2	1	0	0	0	0	1	0
72	III Bsc he	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
73	3rd Msc Statistics	0	0	2	0	1	0	1	0	1	0	0	0	0	0	0
74	1st Msc Maths	0	0	0	3	1	0	1	1	0	0	0	0	0	0	0
75	2nd Msc Maths	0	0	1	0	1	0	1	0	1	0	0	0	0	1	0
76	Department of Maths	0	1	4	0	4	0	1	8	4	0	0	1	1	0	0
77	Healing hub	0	6	0	0	1	0	0	0	0	0	0	0	0	0	0
78	Psychology Lab	0	0	8	0	3	0	2	4	2	0	0	0	0	0	0
79	Department of Statistics	0	0	7	0	2	0	0	7	0	0	0	1	1	0	0
80	Store and Toilets	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0
81	I Msc Statitic	0	0	0	1	2	0	1	0	3	0	0	0	0	1	0
82	I BSC Maths	0	0	1	0	2	0	0	3	0	0	0	0	0	1	0

Table 4.3. General electrical infrastructure of St. Aloysius college.

83	II Bsc Maths	0	0	2	0	2	0	1	1	0	0	0	0	0	1	0
84	II Bsc Maths	0	0	2	0	2	0	1	1	0	0	0	0	0	0	0
85	Staff room	0	0	3	0	3	0	1	7	2	0	0	0	0	0	0
86	college union office	0	0	0	1	1	0	0		0	0	0	0	0	0	0
87	II Bvoc Gemology	0	0	1	0	2	0	3	3	0	0	0	0	1	0	0
88	NSS room	0	0	1	0	1	0	3	3	0	0	0	1	0	0	0
89	Classroom	0	0	1	3	2	0	1	1	1	0	0	0	0	0	0
90	Store room	0	0	1	0	1	0	0	3	0	0	0	0	0	0	0
91	Language E Lab	0	0	1	0	1	0	0	29	0	0	0	10	0	0	1
92	Dept Hind and malaylam	0	0	1	0	2	0	1	14	1	0	0	1	0	0	0
93	I year classroom	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
94	I Bsc Zoology	0	0	0	2	2	0	2	3	0	0	0	0	0	1	0
95	Store room	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
96	III Bsc Zoology	0	2	0	1	2	0	2	4	3	0	0	0	0	1	0
97	II Bsc Zoology	0	0	0	1	2	0	2	3	0	0	0	0	0	1	0
98	Faculty	0	0	2	0	2	0	0	5	4	0	0	1	1	0	0
99	Clinicl Lab	0	0	2	0	2	0	0	8	7	0	0	0	0	0	0
100	III BMMC	0	0	2	0	2	0	1	1	2	0	0	0	0	1	0
101	2nd BMMC	0	0	1	0	2	0	1	1	2	0	0	0	0	1	0
102	I BMMC	0	0	2	0	2	0	1	1	2	0	0	0	0	1	0
103	Staffroom	0	0	2	0	2	0	1	1	2	1	0	1	1	0	0
104	IM.Com	0	0	2	0	1	0	1	1	2	0	0	0	0	1	0
105	Classroom	0	0	4	0	3	0	1	1	2	0	0	0	0	1	0
106	I Bcom	0	0	4	0	2	0	1	1	2	0	0	0	0	0	0
107	III Bcom computer application	0	0	4	0	3	0	0	1	2	0	0	0	0	1	0
108	III Bcom Banking	0	0	4	0	3	0	1	1	2	0	0	0	0	1	0
109	II M.com	0	0	2	0	1	0	1	1	2	0	0	0	0	1	0
110	III Botany	0	0	4	0	2	0	1	1	2	0	0	0	0	1	0

Table 4.3. General electrical infrastructure of St. Aloysius college.

111	Canteen	0	0	1	3	7	0	0	1	3	0	0	0	0	0	0
112	Canteen Kitchen	0	0	0	6	0	0	0	2	5	0	0	0	0	0	0
113	Canteen Sitting area	0	0	0	2	3	0	0	0	0	0	0	0	0	0	0
114	Store and toilet	0	0	0	1	0	0	0	3	0	0	0	0	0	0	0
115	Library Block	0	2	19	18	1	0	1	1	0	0	0	1	0	0	0
116	Library area	0	0	4	0	16	0	0	138	0	0	0	6	0	0	0
117	Librarian's room	0	0	1	0	1	0	0	7	0	0	0	1	1	0	0
118	Archive & rare collection	0	0	1	0	2	0	0	34	1	0	0	2	1	0	0
119	Seminar hall	0	0	11	37	11	0	6	2	8	0	0	1	0	0	0
120	Classroom	0	0	1	3	2	0	1	1	1	0	0	0	0	0	0
121	Restroom for lady teacher	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
122	Director, Research centre in English	0	0	1	0	1	0	0	1	3	0	0	0	0	0	0
123	II MA English	0	0	1	0	1	0	0	5	0	0	0	0	0	1	0
125	IMA English	0	0	1	0	1	0	0	1	0	0	0	0	0	1	0
126	Research room	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
127	Reasearch &PG Dept Eng	0	0	2	0	2	0	0	17	0	0	0	1	1	0	0
128	Reaearch scholars room	0	0	1	0	1	0	0	7	1	0	0	0	0	0	0
129	Classroom	0	0	2	0	1	0	0	1	0	0	0	0	0	0	0
130	NCC Girls	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0
131	Common room for girls	0	6	5	0	4	0	0	4	0	0	0	0	0	0	0
132	Storeroom	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0
133	Staff room (Multimedia)	0	0	2	0	2	0	1	1	2	1	0	1	1	0	0
134	Staff room (Botany & compBio)	0	0	2	0	1	0	1	1	2	0	0	1	0	0	0
135	I Mcom	0	0	2	0	1	0	1	1	2	0	0	0	0	1	0
136	Classroom	0	0	4	0	3	0	1	1	2	0	0	0	0	1	0
137	II Bcom Cooperation	0	0	4	0	3	0	1	1	2	0	0	0	0	1	0

Table 4.3. General electrical infrastructure of St. Aloysius college.

138	Classroom	0	0	4	0	2	0	1	1	2	0	0	0	0	1	0
139	III Bcom Computer application	0	0	4	0	3	0	0	1	2	0	0	0	0	1	0
140	III Bcom Banking	0	0	4	0	3	0	1	1	2	0	0	0	0	1	0
141	II Mcom	0	0	2	0	1	0	1	1	2	0	0	0	0	1	0
142	III Botany	0	0	4	0	2	0	1	1	2	0	0	0	0	1	0
143	Women's Wing	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0
144	B Voc Gem	0	0	1	0	2	0	1	3	0	0	0	0	0	1	0
145	Media room	0	1	0	0	0	0	4	9	19	0	0	0	0	1	0
146	Conference hall	0	0	1	1	2	0	0	5	1	0	0	0	0	0	0
147	Office store	1	0	0	0	0	0	0	1	4	0	0	0	0	0	0
148	Research room(chemistry)	0	0	4	0	0	0	0	2	8	0	0	0	0	0	0
	TOTAL	**2**	**36**	**311**	**251**	**307**	**4**	**134**	**727**	**191**	**3**	**4**	**54**	**18**	**49**	**12**

Table 4.3. General electrical infrastructure of St. Aloysius college.

The college has a well planned electrical infrastructure including lightings, appliances like fan, refrigerator, photocopier etc., (Table 4.3) instruments and lab equipment.

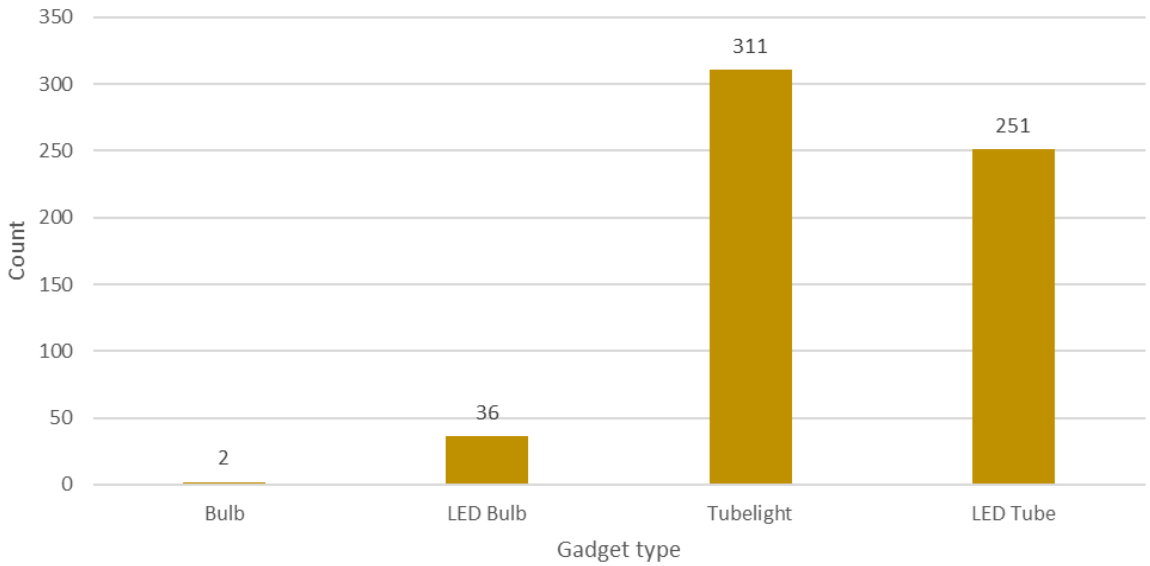


Fig. 4.1. Details of lighting infrastructure of the college

Regarding lighting infrastructure college has 311 fluorescent tube lights whereas only 251 LED tubes (44.67%). As per the Energy Management Plan, college has to replace all fluorescent tube lights with more efficient LED tube lights within a period of three years. However, it is a progressive step as the number of incandescent bulbs are very few (5.26%). This shall be replaced with more efficient electrical gadgets.

4.4.2. Analysis of installed energy capacity and average use

Location	No of points	Count	Hours / (Week)	Days	Watt	KWh	Total uage	KwH/week	Kwh year
Auditorium hall	Tubelight	11	3	3	40	120	9	360	14400
	Fan	4	3	3	65	195	9	585	38025
	Speaker	4	3	3	20	60	9	180	3600
	Tubelight LED	106	3	3	36	108	9	324	11664
	CCTV	4	3	3	12	360	9	108	1296
	MCB	4				0	0	0	0
	CFL	1	3	3	11	33	9	99	1089
	Spot ligt	10	3	3	2	6	9	18	36
NCC Room 1	Tubelight	1	3	3	40	120	9	360	14400
NCC Room 2	Tubelight	2	3	3	40	120	9	360	14400
	Fan	2	3	3	40	120	9	360	14400
	Computer	1	3	3	200	600	9	1800	360000
Bathroom 1	Tubelight LED	3	3	3	36	108	9	324	11664
Store room &Photostat	Tubelight LED	1	3	3	36	108	9	324	11664
	Fan	1	3	3	40	120	9	360	14400
	CCTV	1	3	3	200	600	9	1800	360000
	Printer	1	3	3	200	600	9	1800	360000
Staff club 1	Tubelight LED	1	3	3	36	108	9	324	11664
Bathroom 2	Tubelight LED	3	3	3	36	108	9	324	11664
Auditorium UPS room	Tubelight LED	4	3	3	36	108	9	324	11664
	Battery	5	3	3	50	150	9	450	22500
	UPS	1	3	3	500	1500	9	4500	2250000
	Wifie	1	3	3	6	18	9	54	324
Old file room	Tubelight LED	4	3	3	36	108	9	324	11664
Canteen	CCTV	1	24	7	360	8640	168	60480	21772800
	Tubelight	6	5	5	40	200	25	1000	40000
	Fan	6	5	5	40	200	25	1000	40000
	Water cooler	1	24	6	80	1920	144	11520	921600
Canteen kitchen	Tubelight LED	6	5	5	40	200	25	1000	40000
F	Freezer	1	24	7	100	2400	168	16800	1680000
	Mixie	1	1	5	500	500	5	2500	1250000
	coolor	1	5	5	80	400	25	2000	160000
	Fridge	1	24	7	300	7200	168	50400	15120000
Canteen	CCTV	1	24	7	360	8640	168	60480	21772800
Washroom	LED Light	1	5	5	36	180	25	900	32400
								TOTAL	66380118

Table 4.4 Installed capacity and average usage of electrical infrastructure based on sample survey in auditorium and canteen buildings (supplied through auditorium KSEB meter).

Location	No of points	Count	Hours / (Week)	Days	Watt	Kwh/count	Total uage	KwH/week	Kwh year
Classroom	Tubelight	1	5	5	40	40	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	4	5	5	40	160	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	3	5	5	40	120	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	2	5	5	40	80	25	1000	40000
	Fan	2	5	5	65	130	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	40	40	15	600	24000
Faculty	Tubelight	3	5	5	150	450	25	3750	562500
	Fan	3	5	5	65	195	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Classroom	Tubelight	4	5	5	40	160	25	1000	40000
	Speaker	1	1	5	20	20	5	100	2000
	Fan	3	5	5	65	195	25	1625	105625
Classroom	Tubelight	3	5	5	40	120	25	1000	40000
	Fan	3	5	5	65	195	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Classroom	Tubelight	2	5	5	40	80	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Classroom	Tubelight	2	5	5	40	80	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	4	5	5	40	160	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Classroom	Tubelight	4	5	5	40	160	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Faculty	Tubelight	2	5	5	40	80	25	1000	40000

	Fan	2	5	5	65	130	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
Ladies	Tubelight	3	5	5	40	120	25	1000	40000
	Speaker	1	1	5	20	20	5	100	2000
Classroom	Tubelight	1	5	5	40	40	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	3	5	5	40	120	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Research purpose	Tubelight	11	1	5	40	440	5	200	8000
	Fan	12	1	5	65	780	5	325	21125
	Speaker	6	1	5	20	120	5	100	2000
	CCTV	2	24	7	360	720	168	60480	21772800
Faculty meeting	Tubelight	4	3	5	40	160	15	600	24000
	Fan	4	3	5	65	260	15	975	63375
	Speaker	3	1	5	20	60	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	4	5	5	40	160	25	1000	40000
	Fan	4	5	5	65	260	25	1625	105625
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	4	3	5	40	160	15	600	24000
	Fan	4	3	5	65	260	15	975	63375
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	3	5	150	150	15	2250	337500
Classroom	Tubelight	4	3	5	40	160	15	600	24000
	Fan	4	3	5	65	260	15	975	63375
	Speaker	1	1	5	20	20	5	100	2000
	TV	1	1	5	150	150	5	750	112500
								TOTAL	28024925

Table 4.5. Installed capacity and average usage of electrical infrastructure based on sample survey in J block (supplied through chemistry KSEB meter).

Location	No of points	Count	Hours / (Week)	Days	Watt	Kwh	Kwh of total point	Total usage	KwH/week	Kwh year
3rd M.Sc. Statistics	Tube light	2	5	5	40	200	400	25	1000	40000
	Fan	1	5	5	65	325	325	25	1625	105625
	Speaker	1	1	5	20	20	20	5	100	2000
I MSc Maths	Tube light LED	3	5	5	36	180	540	25	900	32400
	Fan	1	5	5	65	325	325	25	1625	105625
2nd M.Sc.	Fan	1	5	5	65	325	325	25	1625	105625
	Speaker	1	5	5	20	100	100	25	500	10000
	TV	1	3	5	150	450	450	15	2250	337500
Department of Maths	Tubelight	4	5	5	40	200	800	25	1000	40000
	Fan	4	5	5	65	325	1300	25	1625	105625
	Speaker	1	1	5	20	20	20	5	100	2000
	Computer	1	3	5	200	600	600	15	3000	600000
	Printer	1	1	5	200	200	200	5	1000	200000
	Main Box					0	0	0	0	0
	LED	1	5	5	36	180	180	25	900	32400
	Bulb	1	5	5	60	300	300	25	1500	90000
Healing hub	LED	6	2	5	36	72	432	10	360	12960
	Fan	1	2	5	65	130	130	10	650	42250
	Wall Fan	1	2	5	50	100	100	10	500	25000
Psychology Lab	Tubelight	8	5	5	40	200	1600	25	1000	40000
	Fan	3	5	5	65	325	975	25	1625	105625
	Speaker	2	3	5	20	60	120	15	300	6000
Dept of Statis	Tube light LED	7	5	5	36	180	1260	25	900	32400
	Fan	2	5	5	65	325	650	25	1625	105625
	Computer	1	3	5	200	600	600	15	3000	600000
	Printer	1	1	5	200	200	200	5	1000	200000
Store	Tubelight LED	1	5	5	36	180	180	25	900	32400
I M.Sc. Staticstics	Tubelight LED	1	5	5	36	180	180	25	900	32400
	Fan	2	5	5	65	325	650	25	1625	105625
	TV	1	2	5	150	300	300	10	1500	225000
	Speaker	1	1	5	20	20	20	5	100	2000

I B.Sc. Maths	Tubelight	1	5	5	40	200	200	25	1000	40000
	Fan	2	5	5	65	325	650	25	1625	105625
	TV	1	3	5	150	450	450	15	2250	337500
2nd B.Sc. Maths	Tubelight	1	5	5	40	200	200	25	1000	40000
	Fan	2	5	5	65	325	650	25	1625	105625
	Speaker	1	1	5	20	20	20	5	100	2000
	TV	1	3	5	150	450	450	15	2250	337500
3rd B.Sc. Maths	Fan	2	5	5	65	325	650	25	1625	105625
	Tubelight	2	5	5	40	200	400	25	1000	40000
	Speaker	1	1	5	20	20	20	5	100	2000
Staff room	Tubelight	1	3	5	40	120	120	15	600	24000
	Fan	3	5	5	65	325	975	25	1625	105625
	Speaker	1	1	5	20	20	20	5	100	2000
										4623585

Table 4.6. Installed capacity and average usage of electrical infrastructure based on sample survey in B block building (supplied through Maths KSEB meter).

Location	No of points	Count	Hours / (Week)	Days	watt	Kwh	Kwh of total point	Total uage	KwH/ week	Kwh year
Classroom	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
Classroom	Tubelight	3	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
Classroom	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	3	5	150	450	23400	15	2250	337500
Staffroom	Tubelight	4	5	5	40	200	10400	25	1000	40000
	Fan	4	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	1	5	200	200	10400	5	1000	200000
Healing hub	LED Light	6	2	5	36	72	3744	10	360	12960
	Fan	1	2	5	65	130	6760	10	650	42250
	Wall fan	1	2	5	65	130	6760	10	650	42250
psychology lab	Tubelight	8	5	5	40	200	10400	25	1000	40000
	Fan	3	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
Dept Statistic	Tubelight	7	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	1	5	200	200	10400	5	1000	200000
Store &toilet	TB LED	1	5	5	36	180	9360	25	900	32400
I M.Sc. Statistics	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	TV	1	2	5	150	300	15600	10	1500	225000
	Speaker	1	1	5	20	20	1040	5	100	2000
I BSc Maths	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	TV	1	3	5	150	450	23400	15	2250	337500
II BSC Maths	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	3	5	150	450	23400	15	2250	337500
3rd BSC Maths	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625

	Speaker	1	1	5	20	20	1040	5	100	2000
Staffroom	Tubelight	3	5	5	40	200	10400	25	1000	40000
	Fan	3	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
B.voc Gem	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	TV	1	3	5	150	450	23400	15	2250	337500
	Speaker	1	1	5	20	20	1040	5	100	2000
Media room	CCTV	4	1	7	360	360	18720	7	2520	907200
	Speaker	4	1	7	20	20	1040	7	140	2800
	Amplifier	2	1	7	100	100	5200	7	700	70000
	TV	1	1	7	150	150	7800	7	1050	157500
	AC	3	1	7	720	720	37440	7	5040	3628800
	Heater	1	1	7	3800	3800		7	26600	101080000
	MCB	1	0	0		0		0	0	0
	LED Light	9	1	7	36	36	1872	7	252	9072
	LED Strip	3	1	7	24	24	1248	7	168	4032
Conference hall	Tubelight	1	3	5	40	120	6240	15	600	24000
	Tubelight LED	1	3	5	36	108	5616	15	540	19440
	Fan	2	3	5	65	195	10140	15	975	63375
	AC	1	3	5	720	2160	112320	15	10800	7776000
	Stabilizer	1	3	5	50	150	7800	15	750	37500
	Inverter	1	3	5	40	120	6240	15	600	24000
II BSC Chemistry	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
Chemistry dept	Tubelight	3	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	2	5	200	400	20800	10	2000	400000
Research room	Tubelight	4	3	5	40	120	6240	15	600	24000
BSc Chemistry Lab	Tubelight	15	3	3	40	120		9	360	14400
	Tubelight LED	2	3	5	36	108	540	15	540	19440
	Exhaust	3	4	5	20	80	400	20	400	8000
	Speaker	1	1	5	20	20	100	5	100	2000
Washroom/ BSc chemistry lab	LED bulb	1	1	5	40	40	200	5	200	8000
Fume hood room	Exhaust	1	1	5	40	40	200	5	200	8000
Physical chemistry lab	Tubelight	6	5	5	40	200	1000	25	1000	40000

	Tubelight LED	4	3	5	36	108	540	15	540	19440
	Spotlight	1	1	5	15	15	75	5	75	1125
	Hot air oven	4	10	14	220	2200	26400	140	30800	6776000
	Hot plate	1	0.5	7	220	110	1320	3.5	770	169400
	Centrifuge	1	1	5	220	220	2640	5	1100	242000
	Deironizer	1	1	5	220	220	2640	5	1100	242000
	Bensnburner	1	1	5		0	0	5	0	0
	Volta mini freezer	1	5	5	65	325	3900	25	1625	105625
	Rotary shaker	2	1	5	240	240	2880	5	1200	288000
M.Sc. Chemistry Lab	Tubelight	7	3	5	40	120	6240	15	600	24000
	Table fan	1	3	5	50	150	7800	15	750	37500
	Exhaust	1	1	5	40	40	2080	5	200	8000
	Spotlight	1	1	5	10	10	520	5	50	500
Washroom for girls	Tubelight LED	1	5	5	36	180	9360	25	900	32400
Directors office	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	4	5	200	800	41600	20	4000	800000
	Water cooler	1	1	5	80	80	4160	5	400	32000
Placement cell	Tubelight	2	4	5	40	160	8320	20	800	32000
	Fan	2	4	5	65	260	13520	20	1300	84500
	Speaker	1	1	5	20	20	1040	5	100	2000
Fitness centre	Tubelight	1	1	5	40	40	2080	5	200	8000
	Fan	1	1	5	65	65	3380	5	325	21125
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
PG dept Chemistry	Tubelight LED	1	5	5	36	180	9360	25	900	32400
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	1	3	5	200	600	31200	15	3000	600000
I M.Sc. chemistry	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
IDC Chemistry	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
I DC Physics	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000

MSc Physics Lab	Tubelight	10	4	5	40	160	8320	20	800	32000
	Tubelight LED	1	4	5	36	144	7488	20	720	25920
	Speaker	3	1	5	20	20	1040	5	100	2000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Pedatrial fan	1	1	2	50	50	2600	2	100	5000
	Bulb	6	5	5	60	300	15600	25	1500	90000
	LED Bulb	2	5	5	40	200	10400	25	1000	40000
	Extension box	18	3	4	40	120	1440	12	480	19200
	Hot air oven	1	10	7	230	2300	27600	70	16100	3703000
	Muffle furnance	1	10	14	240	2400	28800	140	33600	8064000
	Induction coil	1	6	251	1400	8400	100800	1506	2E+06	2.952E+09
	Hot plate	1	0.5	7	1400	700	8400	3.5	4900	6860000
	Magnetic stirrer	2	2	14	1250	2500	30000	28	35000	43750000
	CRO	8	3	4	220	660	7920	12	2640	580800
I MSc Physics	Tubelight	1	3	5	40	120	6240	15	600	24000
	Fan	1	5	5	65	325	16900	25	1625	105625
	TV	1	2	5	150	300	15600	10	1500	225000
BSc Physics lab	Tubelight	4	4	5	40	160	8320	20	800	32000
	Fan	3	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
BSc Physics lab	Tubelight	1	4	5	40	160	8320	20	800	32000
	Tubelight LED	3	4	5	36	144	7488	20	720	25920
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	6	3	5	200	600	31200	15	3000	600000
II Dc Physic	Tubelight	2	4	5	40	160	8320	20	800	32000
	Fan	2	4	5	65	260	13520	20	1300	84500
	Speaker	2	1	5	20	20	1040	5	100	2000
Physics dept	Tubelight	1	4	5	40	160	8320	20	800	32000
	Fan	2	4	5	20	80	4160	20	400	8000
	Speaker	1	1	5	15	15	780	5	75	1125
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	2	5	200	400	20800	10	2000	400000
Washroom	LED bulb	1	1	5	40	40	2080	5	200	8000
	Exhaust	1	1	5	40	40	2080	5	200	8000
III DC Physic	Tubelight LED	2	4	5	36	144	7488	20	720	25920
	Fan	2	4	5	65	260	13520	20	1300	84500
	Speaker	2	1	5	20	20	1040	5	100	2000
I MSc Physics	Tubelight	3	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625

	TV	1	3	5	150	450	23400	15	2250	337500
IMA Economics	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
Economics dept	Tubelight LED	1	5	5	36	180	9360	25	900	32400
	Fan	4	45	5	65	2925	152100	225	14625	950625
	Pedastrial	2	2	5	50	100	5200	10	500	25000
	Speaker	1	1	5	20	20	1040	5	100	2000
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	2	5	200	400	20800	10	2000	400000
IIM Economics	Tubelight LED	1	5	5	36	180	9360	25	900	32400
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	5	5	150	750	39000	25	3750	562500
I DC Economics	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	4	5	150	600	31200	20	3000	450000
II DC Economic	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	4	5	150	600	31200	20	3000	450000
III DC Economics	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
Examination hall	Tubelight	1	5	5		0	0	25	0	0
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	TV	1	4	5	150	600	31200	20	3000	450000
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
Exam room	Tubelight LED	3	5	6	36	180	9360	30	1080	38880
	Tubelight	6	5	6	40	200	10400	30	1200	48000
	Fan	2	5	6	65	325	16900	30	1950	126750
	Computer	3	5	6	200	1000	52000	30	6000	1200000
	Speaker	1	1	5	20	20	1040	5	100	2000
	Coolor	1	3	5	80	240	12480	15	1200	96000
	Electric stove	1	1	5	1000	1000	52000	5	5000	5000000
	ID printer	1	3	5	100	300	15600	15	1500	150000
	SEROX	1	5	5	220	1100	57200	25	5500	1210000
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
Main office	Tubelight LED	7	5	6	36	180	9360	30	1080	38880
	Tubelight	2	5	6	40	200	10400	30	1200	48000

	Fan	4	5	6	65	325	16900	30	1950	126750
	Computer	5	5	6	200	1000	52000	30	6000	1200000
	Speaker	1	1	5	20	20	1040	5	100	2000
	XEROX	1	5	5	220	1100	57200	25	5500	1210000
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
IQAC ROOM	LED	14	5	6	36	180	9360	30	1080	38880
	Computer	2	5	6	200	1000	52000	30	6000	1200000
	Speaker	2	1	5	20	20	1040	5	100	2000
	Printer	1	3	5	200	600	31200	15	3000	600000
	Exhaust	1	4	5	40	160	8320	20	800	32000
	MCB	1	0	0		0	0	0	0	0
	Projector	1	1	5	6	6	312	5	30	180
	wifie	1	5	5	180	900	46800	25	4500	810000
	Amplifier	1	1	5	100	100	5200	5	500	50000
	AC	2	6	6	720	4320	224640	36	25920	18662400
	Wall fan	2	5	5	65	325	16900	25	1625	105625
Sore room	Tubelight	1	1	5	40	40	2080	5	200	8000
Office 2	LED Bulb	16	5	6	10	50	2600	30	300	3000
	Tubelight LED	2	5	6	36	180	9360	30	1080	38880
	Fan	3	5	6	65	325	16900	30	1950	126750
	Wall fan	4	5	6	65	325	16900	30	1950	126750
	XEROX	1	5	5	220	1100	57200	25	5500	1210000
	Speaker	1	1	5	15	15	780	5	75	1125
	Exhaust	3	4	5	40	160	8320	20	800	32000
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Computer	5	5	6	200	1000	52000	30	6000	1200000
I Dc commerce	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
	TV	1	5	5	150	750	39000	25	3750	562500
II DC Commerce	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Speaker	2	1	5	20	20	1040	5	100	2000
	TV	1	4	5	150	600	31200	20	3000	450000
Gemmology Lab	Tubelight	4	5	5	40	200	10400	25	1000	40000
	Tubelight LED	2	5	5	36	180	9360	25	900	32400
	Fan	3	5	5	65	325	16900	25	1625	105625
	Exhaust	1	3	5	40	120	6240	15	600	24000
	Computer	1	3	5	200	600	31200	15	3000	600000
	VC	1	1	2	1	1	52	2	2	2
	Micro (ELC)	3	4	5	500	2000	104000	20	10000	5000000
	WEI	2	4	5	6	24	1248	20	120	720

	Tubelight LED	8	4	5	36	144	7488	20	720	25920
	DIM(02) MICRO	3	4	5	2	8	416	20	40	80
	FTP49 MICRO	2	4	5	2.5	10	520	20	50	125
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Speaker	1	5		20	100	5200	0	0	0
Jewellery designing lab	Tubelight	3	5	5	40	200	10400	25	1000	40000
	AC	1	4	7	750	3000	156000	28	21000	15750000
	Fan	2	5	5	65	325	16900	25	1625	105625
	TV	1	5	5	150	750	39000	25	3750	562500
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Speaker	1	1	5	20	20	1040	5	100	2000
III Dc commerce	Tubelight	1	5	5	40	200	10400	25	1000	40000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	15	15	780	5	75	1125
	TV	1	4	4	150	600	31200	16	2400	360000
Dept commerce	Tubelight LED	1	5	5	36	180	9360	25	900	32400
	Fan	1	5	5	65	325	16900	25	1625	105625
	Speaker	1	1	5	20	20	1040	5	100	2000
	Printer	1	1	5	200	200	10400	5	1000	200000
	Pestrial fan	1	3	5	50	150	7800	15	750	37500
	Laptop	2	1	5	50	50	2600	5	250	12500
II DC Chemistry	Tubelight	2	5	5	40	200	10400	25	1000	40000
	Fan	2	5	5	65	325	16900	25	1625	105625
Principalroom	Tubelight LED	5	5	5	65	325	16900	25	1625	105625
	Fan	4	5	5	65	325	16900	25	1625	105625
	AC	2	5	5	750	3750	195000	25	18750	14062500
	Micro (ELC)	1	1	5	100	100	5200	5	500	50000
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	1	5	200	200	10400	5	1000	200000
	LAPTOP	1	1	5	50	50	2600	5	250	12500
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Table fan	1	5	5	50	250	13000	25	1250	62500
administrators office	Tubelight LED	4	5	5	36	180	9360	25	900	32400
	Fan	2	5	5	65	325	16900	25	1625	105625
	Stabilizer	1	24	7	50	1200	62400	168	8400	420000
	server	1	3	5		0	0	15	0	0
	Computer	1	3	5	200	600	31200	15	3000	600000
	Printer	1	1	5	200	200	10400	5	1000	200000
Computer lab	Exhaust fan	1	4	5	40	160	8320	20	800	32000

	Inverter Battery	8	5	5	144	720	37440	25	3600	518400
	UPS	3	4	5	6	24	1248	20	120	720
	Fan	4	4	5	65	260	13520	20	1300	84500
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	AC	2	2	5	750	1500	78000	10	7500	5625000
Library block	CCTV	2	24	7	360	8640	449280	168	60480	21772800
	Speaker	1	1	5	20	20	1040	5	100	2000
	ID scanner	1	4	5	5	20	1040	20	100	500
	Fan	1	5	5	65	325	16900	25	1625	105625
	Computer	1	3	5	200	600	31200	15	3000	600000
	LED	18	5	5	36	180	9360	25	900	32400
Library area	Tubelight	4	3	5	40	120	6240	15	600	24000
	Computer	6	5	5	200	1000	52000	25	5000	1000000
	Fan	16	3	5	65	195	10140	15	975	63375
	Printer	1	1	5	200	200	10400	5	1000	200000
	wifie	2	6	6	180	1080	56160	36	6480	1166400
Librarians room	Tubelight	1	3	5	40	120	6240	15	600	24000
	Computer	1	1	5	200	200	10400	5	1000	200000
	Fan	1	5	5	65	325	16900	25	1625	105625
	Printer	1	1	5	200	200	10400	5	1000	200000
	Wifie	1	6	6	180	1080	56160	36	6480	1166400
Achieve &rare collection	Tubelight	1	3	5	40	120	6240	15	600	24000
	Fan	2	5	5	65	325	16900	25	1625	105625
	Computer	2	4	5	200	800	41600	20	4000	800000
	Printer	1	1	5	200	200	10400	5	1000	200000
	Wifie	1	6	6	180	1080	56160	36	6480	1166400
Seminar hall	Tubelight	24	3	5	40	120	6240	15	600	24000
	LED light	39	3	5	36	108	5616	15	540	19440
	fan	11	3	5	65	195	10140	15	975	63375
	AC	4	2	5	65	130	6760	10	650	42250
	Computer	1	4	5	200	800	41600	20	4000	800000
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Speaker	6	1	5	20	20	1040	5	100	2000
Media	LED Light	48	5	5	36	180	9360	25	900	32400
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Wall fan	1	5	5	50	250	13000	25	1250	62500
Physics Corridor	CCTV	1	12	24	360	4320	224640	288	103680	37324800
	Wifie	1	24	7	180	4320	224640	168	30240	5443200

Chemistry Corridor	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Wifie	1	5	5	100	500	26000	25	2500	250000
	Lift	1	6	6	3.75	22.5	1170	36	135	506.25
Seminal Hall	Tubelight LED	1	5	5	36	180	9360	25	900	32400
	Tubelight	1	5	5	40	200	10400	25	1000	40000
Seminal Hall 2	LED	5	5	5	36	180	9360	25	900	32400
Washroom	LED Light	1	5	5	36	180	9360	25	900	32400
Portico	TV	1	5	5	3750	18750	975000	25	93750	351562500
	CCTV	1	24	7	360	8640	449280	168	60480	21772800
	Fan	1	5	5		0	0	25	0	0
							12354669			3922286432

Table 4.7. Installed capacity and average usage of electrical infrastructure based on sample survey in A block (supplied through Chemistry KSEB meter).

Location	No of points	Count	Hours / (Week)	Days	Watt	Kwh	Kwh of total point	Total uage	Kwh/ week	Kwh year
College union office	TB LD	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
II B.voc Gem	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	3	1	5	20	20	100	5	100	2000
	PRN	3	1	5	200	200	1000	5	1000	200000
NSS Room	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
	SPK	3	1	5	20	20	100	5	100	2000
Classroom	TB	1	5	5	40	200	1000	25	1000	40000
	TB LED	1	5	5	36	180	900	25	900	32400
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
Store room	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
Restroom ladies	TB	1	1	5	40	40	200	5	200	8000
	FAN	1	1	5	65	65	325	5	325	21125
Director/ Research English	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
II MA English	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
	TV	1	3	5	150	450	2250	15	2250	337500
I MA English	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
	TV	1	3	5	150	450	2250	15	2250	337500
Language lab	TB	1	3	5	40	120	600	15	600	24000
	Exhaust	1	3	5	40	120	600	15	600	24000
	FAN	1	3	5	65	195	975	15	975	63375
	PC	10	3	5	200	600	3000	15	3000	600000
	Main switch	1				0	0	0	0	0
Research room	TB	1	5	5	40	200	1000	25	1000	40000
Dept. Hindi/ Malayalam	TB	1	5	5	40	200	1000	25	1000	40000
	TB LED	1	5	5	36	180	900	25	900	32400
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
	PC	1	1	5	200	200	1000	5	1000	200000

Research PG Dept. English	TB	2	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	PC	13	1	5	200	200	1000	5	1000	200000
	Cooler	1	5	5	80	400	2000	25	2000	160000
	PRN	1	1	5	200	200	1000	5	1000	200000
	Kelltle	1	1	5	240	240	1200	5	1200	288000
Research scholars room	TB	1	1	5	40	40	200	5	200	8000
	FAN	1	1	5	65	65	325	5	325	21125
I year Classroom	TB	1	5	5	40	200	1000	25	1000	40000
	FAN	1	1	5	65	65	325	5	325	21125
NC C Girls	TB	1	1	5	40	40	200	5	200	8000
	FN	1	1	5	65	65	325	5	325	21125
Commom room for girls	TB	5	1	5	40	40	200	5	200	8000
	FAN	4	1	5	65	65	325	5	325	21125
	LED Bulb	6	1	5	40	40	200	5	200	8000
Genetic Lab	TB	6	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
	Deep freezer	1	24	7	100	2400	16800	168	16800	1680000
	wifie	2	5	5	12	60	300	25	300	3600
	Centrifuge	2	2	54	220	440	23760	108	23760	5227200
	5 TC HL Microscope	7	1	44		0	0	44	0	0
	PC	1	3	5	200	600	3000	15	3000	600000
	Slide warming tabel	1	1	88	220	220	19360	88	19360	4259200
	electrophoresis	1	1	1	100	100	100	1	100	10000
	Electrophoresis Power1	1	2	1	100	200	200	2	200	20000
	Electronic balancing	1	2	5		0	0	10	0	0
	Laminar air flow chamber	1	10	1	450	4500	4500	10	4500	2025000
II MSc Lab/ Classroom	TB	9	4	5	40	160	800	20	800	32000
	FAN	2	5	5	65	325	1625	25	1625	105625
	TV	1	3	5	150	450	2250	15	2250	337500
	Centrifugal	2	2	54	220	440	23760	108	23760	5227200
	Tissue flotation bath	1	2	52	450	900	46800	104	46800	21060000
	Hot air oven	1	3	52	220	660	34320	156	34320	7550400
	water bath	2	1	4	1500	1500	6000	4	6000	9000000

	Slide warming table	1	1	5	220	220	1100	5	1100	242000
M.Sc. Zoology lab/classroom	TB	9	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	TV	1	3	5	150	450	2250	15	2250	337500
	Incubator	1	2	110	220	440	48400	220	48400	10648000
	water bath	2	1	4	1500	1500	6000	4	6000	9000000
Dissection hall	TB	12	5	5	40	200	1000	25	1000	40000
	TB LED	6	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	TV	1	3	5	150	450	2250	15	2250	337500
Dept. Botany Zoology	FAN	1	5	5	65	325	1625	25	1625	105625
	LED	1	5	5	40	200	1000	25	1000	40000
	Tb	1	5	5	40	200	1000	25	1000	40000
	Wifie	1	5	5	12	60	300	25	300	3600
	PC	1	3	5	200	600	3000	15	3000	600000
	PRN	1	5	5	200	1000	5000	25	5000	1000000
I BSc Zoology	FAN	2	5	5	65	325	1625	25	1625	105625
	TB LED	2	5	5	36	180	900	25	900	32400
	TV	1	3	5	150	450	2250	15	2250	337500
	Amplifier	1	1	5	100	100	500	5	500	50000
	SPK	1	1	5	20	20	100	5	100	2000
Botany Lab	FAN	2	5	5	65	325	1625	25	1625	105625
	TB	3	5	5	40	200	1000	25	1000	40000
	TB LED	4	5	5	40	200	1000	25	1000	40000
III BSc Zoology	SPK	2	1	5	20	20	100	5	100	2000
	TV	1	3	5	150	450	2250	15	2250	337500
	Amplifier	1	1	5	100	100	500	5	500	50000
	FAN	1	5	5	65	325	1625	25	1625	105625
	TB LED	1	5	5	36	180	900	25	900	32400
	LED Bulb	2	5	5	40	200	1000	25	1000	40000
II BSC Zoology	FAN	2	5	5	65	325	1625	25	1625	105625
	TB LED	1	5	5	36	180	900	25	900	32400
	TV	1	1	5	150	150	750	5	750	112500
	SPK	2	1	5	20	20	100	5	100	2000
Faculty	TB	2	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	Wall fan	1	5	5	55	275	1375	25	1375	75625
	fuse	7				0	0	0	0	0
	pc	1	3	5	200	600	3000	15	3000	600000

	PRN	1	1	5	200	200	1000	5	1000	200000
Clinical Lab	FAN	2	5	5	65	325	1625	25	1625	105625
	TB	2	5	5	40	200	1000	25	1000	40000
	wifie camera box	1	5	5	180	900	4500	25	4500	810000
IIIBMMC	TB	2	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
	TV	1	3	5	150	450	2250	15	2250	337500
II BMMC	TB	1	5		40	200	0	0	0	0
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
	TV	1	3	5	150	450	2250	15	2250	337500
I BMMC	SPK	1	1	5	20	20	100	5	100	2000
	TV	1	3	5	150	450	2250	15	2250	337500
	TB	2	5	5	40	200	1000	25	1000	40000
Staff room multimedia	FAN	2	5	5	65	325	1625	25	1625	105625
	TB	2	5	5	40	200	1000	25	1000	40000
	PC	1	3	5	200	600	3000	15	3000	600000
	PRN	1	3	3	200	600	1800	9	1800	360000
	Scanner	1	1	5	240	240	1200	5	1200	288000
	SPK	1	1	5	20	20	100	5	100	2000
Staffroom botany computational biology	TB	2	5	5	40	200	1000	25	1000	40000
	FAN	1	5	5	65	325	1625	25	1625	105625
	PC	1	3	5	200	600	3000	15	3000	600000
	Kettle	1	1	2	1500	1500	3000	2	3000	4500000
	SPK	1	1	5	20	20	100	5	100	2000
I M.com	FAN	1	5	5	65	325	1625	25	1625	105625
	TV	1	1	5	150	150	750	5	750	112500
	TB	2	5	5	40	200	1000	25	1000	40000
	SPK	1	1	5	20	20	100	5	100	2000
Classroom	TB	4	5	5	40	200	1000	25	1000	40000
	FAN	3	5	5	65	325	1625	25	1625	105625
	TV	1	1	5	150	150	750	5	750	112500
	SPK	1	1	5	20	20	100	5	100	2000
II B.com Cooperation	TV	1	1	5	10	10	50	5	50	500
	TB	4	1	5	40	40	200	5	200	8000
	FAN	3	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000

Classroom	TB	4	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	TV	1	1	5	150	150	750	5	750	112500
	SPK	1	1	5	20	20	100	5	100	2000
I B.com	TB	4	5	5	40	200	1000	25	1000	40000
	FAN	2	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
III B.com computer app	TB	4	5	5	40	200	1000	25	1000	40000
	FAN	3	5	5	65	325	1625	25	1625	105625
	SPK	1	1	5	20	20	100	5	100	2000
III B.com BANKING	TB	4	5	5	40	200	1000	25	1000	40000
	FAN	3	5	5	65	325	1625	25	1625	105625
	Speaker	1	1	5	20	20	100	5	100	2000
II M.com	Tubelight	1	5	5	40	200	1000	25	1000	40000
	Fan	2	5	5	65	325	1625	25	1625	105625
	Speaker	1	1	5	20	20	100	5	100	2000
III Botany	Tubelight	4	5	5	40	200	1000	25	1000	40000
	Fan	2	2	5	65	130	650	10	650	42250
	Speaker	1	1	5	20	20	100	5	100	2000
	TV	1	1	5	150	150	750	5	750	112500
Women's wing	Tubelight	1	1	5	40	40	200	5	200	8000
	Main switch motor	1	0	0		0	0	0	0	0
	Fan	3	5	5	40	200	1000	25	1000	40000
	Tubelight LED	2	5	5	36	180	900	25	900	32400
Store &toilet	Tubelight LED	1	5	5	36	180	900	25	900	32400
Language	Tubelight LED	3	5	5	36	180	900	25	900	32400
	Speaker	1	5	5	20	100	500	25	500	10000
	LED Bulb	1	5	5	40	200	1000	25	1000	40000
										97699900

Table 4.8. Installed capacity and average usage of electrical infrastructure based on sample survey in C block (supplied through Zoology KSEB meter).

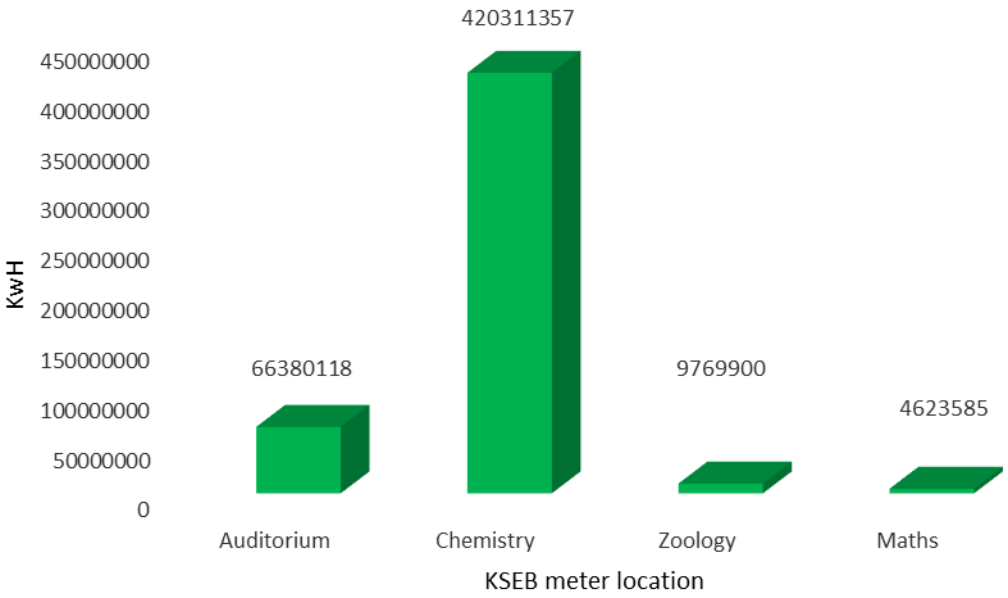


Fig. 4. 2. Meter wise comparison on the average electricity use based on installation capacity

The analysis of consumption pattern of electrical energy in various buildings showed that the highest usage is in meter located at the chemistry block. This is due to the higher number of electrical installations especially lab equipment and instruments in this block.

4.4.3. Analysis of KSEB bill data of past years (2021-22 to 2023-24)

Sl No	Meter/ Consumer number	Location	Area covered	Periodicity of billing
1	1156780019861	Maths	B-Block	Bimonthly
2	1156785013206	Zoology	C- Block	Monthly
3	1156788013343	Chemistry	J-Block and A- Block	Monthly
4	1156789014578	Auditorium	Auditorium and canteen	Bimonthly
5	115688017307	Motor and pump	Pump house	Bimonthly

Table 4.9. KSEB energy meters and covered area

Solar power generation is recorded in this meter. Usage is recorded as import and solar power supplied to the grid as export in this meter.

St. Aloysius College has five KSEB connections and the area covered under each meter is given Table 4.9. The energy bills issued by KSEB for a period of three years were analyzed in order to find out the monthly and yearly usage pattern. The section wise (building or block) analysis also performed.

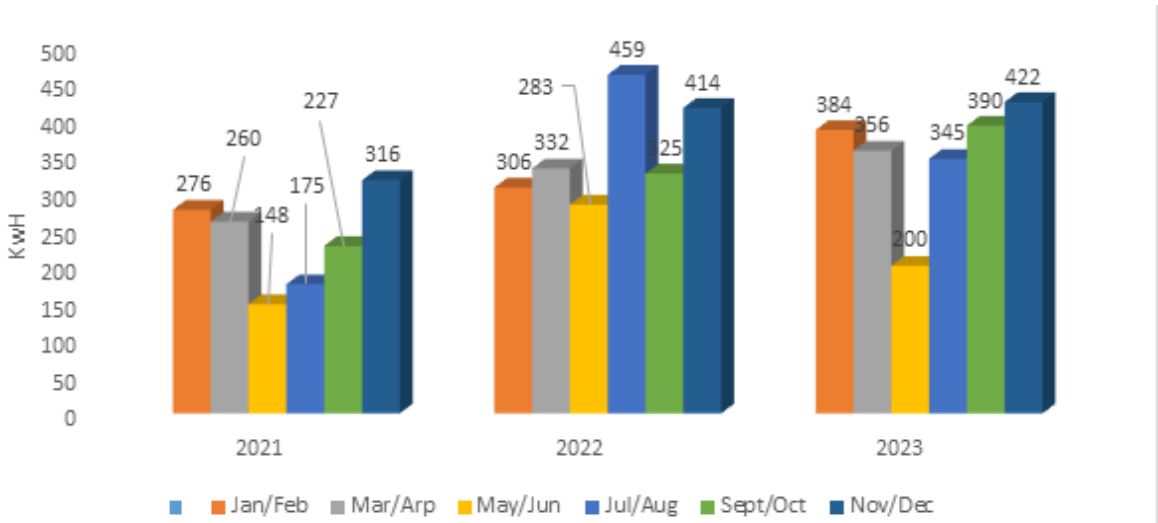


Fig.4.3. Total average energy consumption (Meter 1; 1156780019861- Maths) during in the year 2021, 2022 and 2023

The average consumption was lowest during summer vacation period every year owing to the lowest activity in the college.

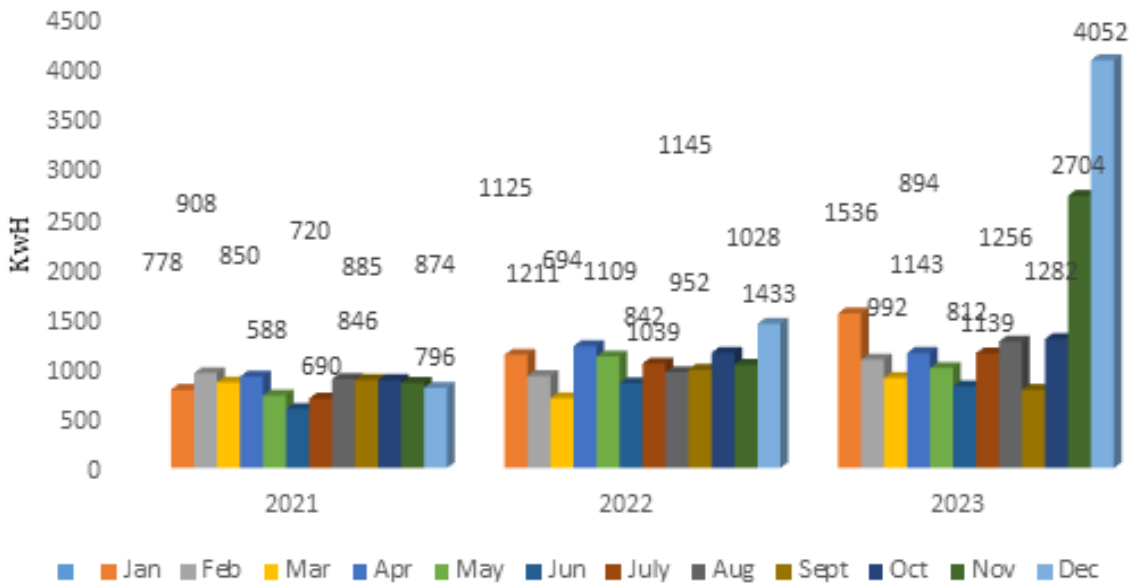


Fig.4.4. Total average energy consumption (Meter 3; 1156788013343-chemistry) during in the year 2021, 2022 and 2023

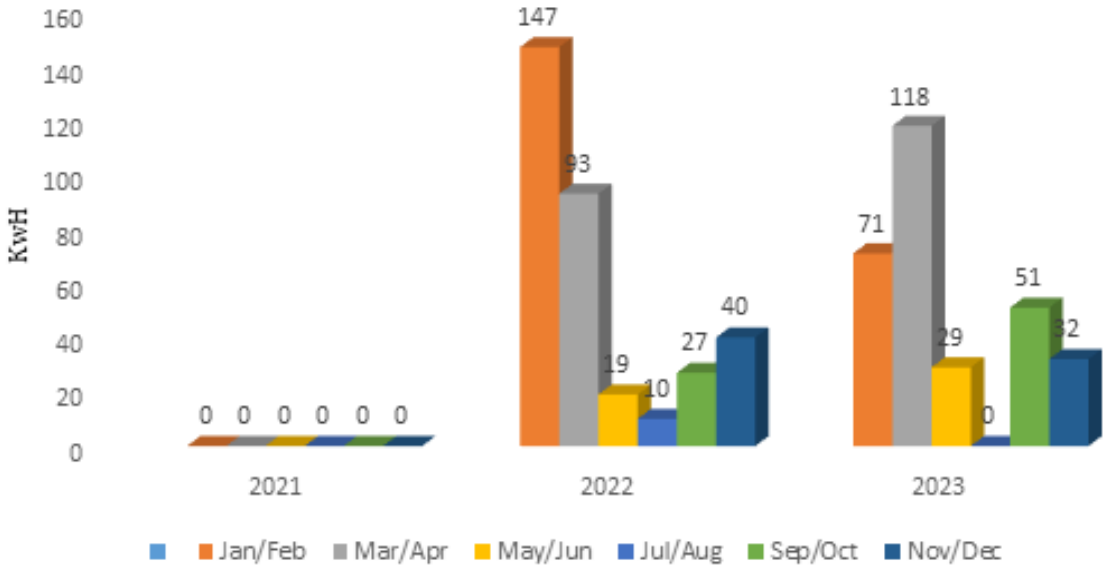


Fig. 4.5. Total average energy consumption (Meter 5. 1156788017307-Motor) during in the year 2021, 2022 and 2023

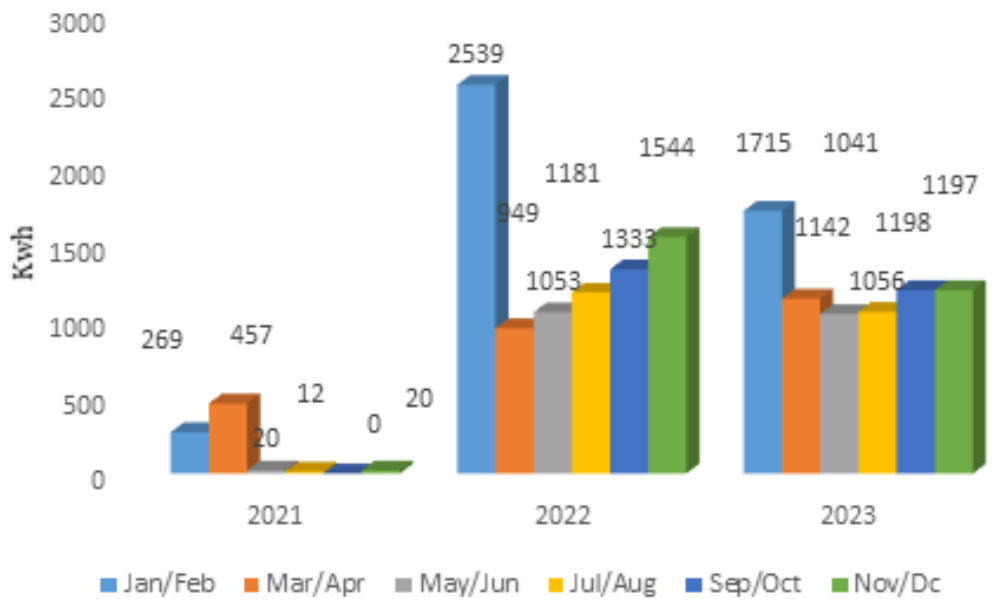


Fig.4.6. Total average energy consumption (Meter 4. 1156789014578- Auditorium) during in the year 2021, 2022 and 2023.

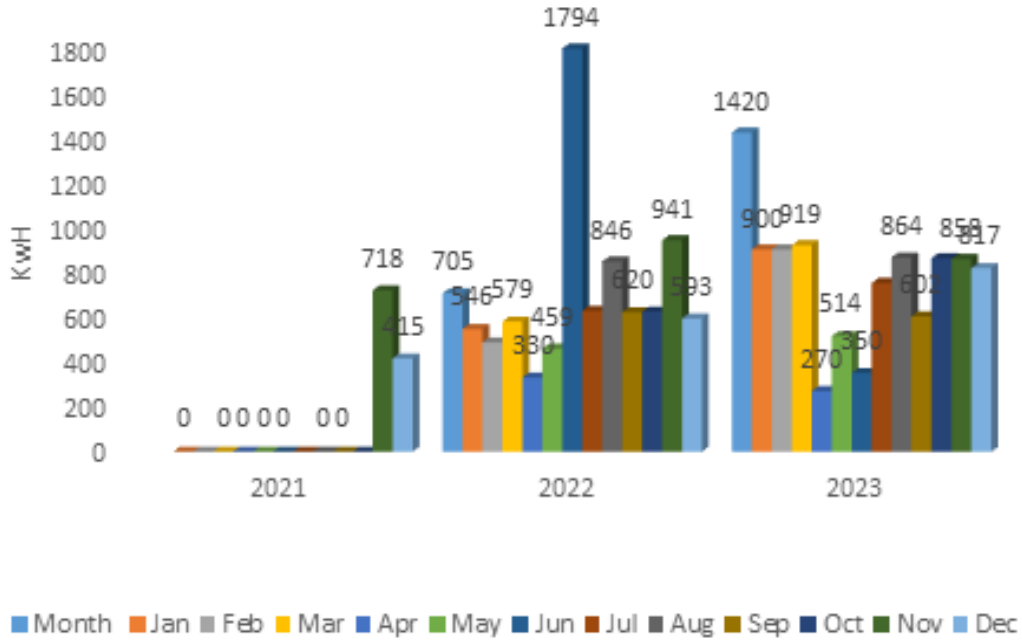


Fig.4.7. Total average energy consumption (Meter.2. 1156785013206, Zoology) during in the year 2021, 2022 and 2023.

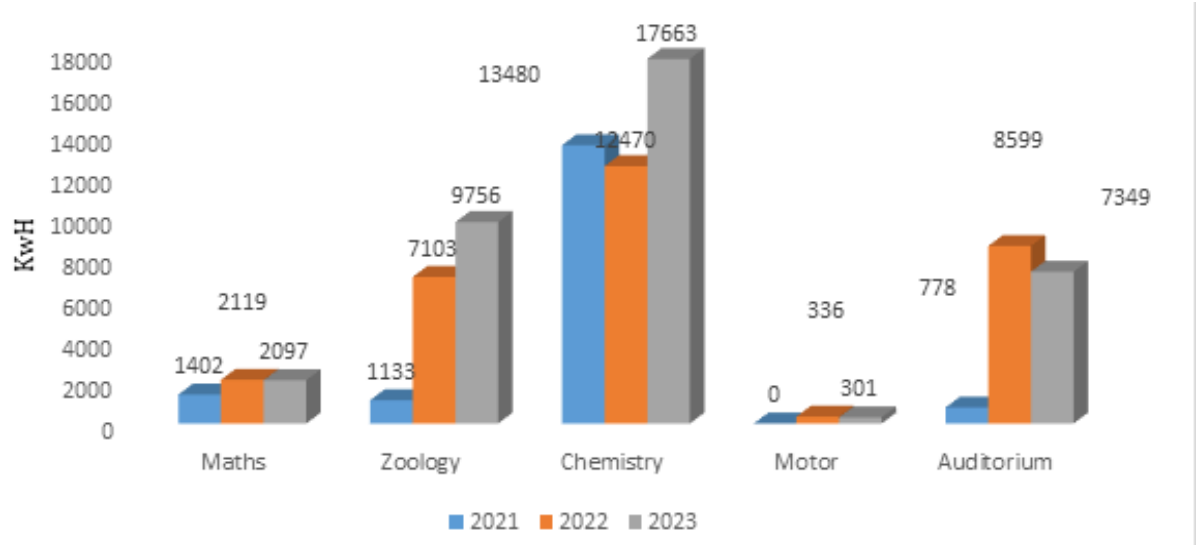


Fig. 4.8. Comparison of energy consumption through various meters in the college (as per the reading in energy bills of KSEB).

During 2021 the average consumption was lowest in all meters due to the partial working of the college due to the Covid restrictions. Even for weeks colleges were remined fully closed. During 2022 colleges were open and the consumption significantly hiked and during the last year came to a normal level (pre covid status). The highest average use is with the meter installed at chemistry block, where the maximum installations are found. All the electrical supply towards A-block and J block are from this meter.

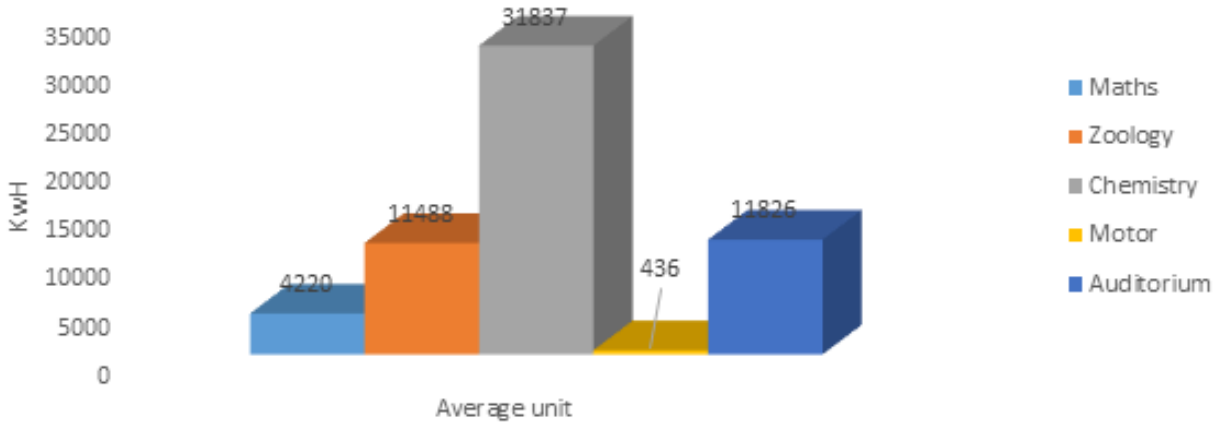


Fig. 4.9. Comparison of average energy consumption through various meters in the college during three years (as per the reading in energy bills of KSEB).

As per the bill data the highest usage was reported for energy meter installed at Chemistry block form which the supply goes to A and J blocks. In the case of motor pump, being the lone connection n is the pump lowest usage has been reported (Fig. 4.9).

4.4.4. Analysis of KSEB meter reading sampling study

Internal audit team cross checked the average consumption of energy through various meters during working days, holidays and semi holidays using a structured sample study. The data is interpreted to find any wastage in the energy either through habitual reasons or due to the lapses in the energy infrastructure.

Week	Days	Mean consumption	Total holiday	Average per day consumption
1	Holiday	2.34	70	163.34
2	Semi holiday	2.34	95	221.67
3	Working day	3.5	200	700
Total per year consumption				1085.01

Table 4.10. Energy meter reading of Meter no. 1 (Maths) (n=9)

Week	Days	Mean consumption	Total holiday	Average per day consumption
1	Holiday	0.67	70	46.69
2	Semi holiday	0.00	95	0.00
3	Working day	0.00	200	0.00
Total per year consumption				46.69

Table 4.11. Energy meter reading of Meter no. 5 (Motor) (n=9)

Week	Days	Mean consumption	Total holiday	Average per day consumption
1	Holiday	39.14	70	2739.34
2	Semi holiday	50.9	95	4835.5
3	Working day	76.54	200	15306.67
Total per year consumption				22881.5

Table 4.12. Energy meter reading of Meter no. 3 (Chemistry) (n=9)

Week	Days	Mean consumption	Total holiday	Average per day consumption
1	Holiday	4	70	280
2	semi holiday	4.67	95	443.34
3	Working day	16.5	200	3300
Total per year consumption				4023.34

Table 4.13. Energy meter reading of Meter no. 2 (Zoology) (n=9)

Week	Days	Mean consumption	Total holiday	Average per day consumption
1	Holiday	2	70	140
2	semi holiday	6.34	95	601.67
3	Working day	18.75	200	3750
Total per year consumption				4491.67

Table 4.14. Energy meter reading of Meter no. 4 (Auditorium) (n=9)

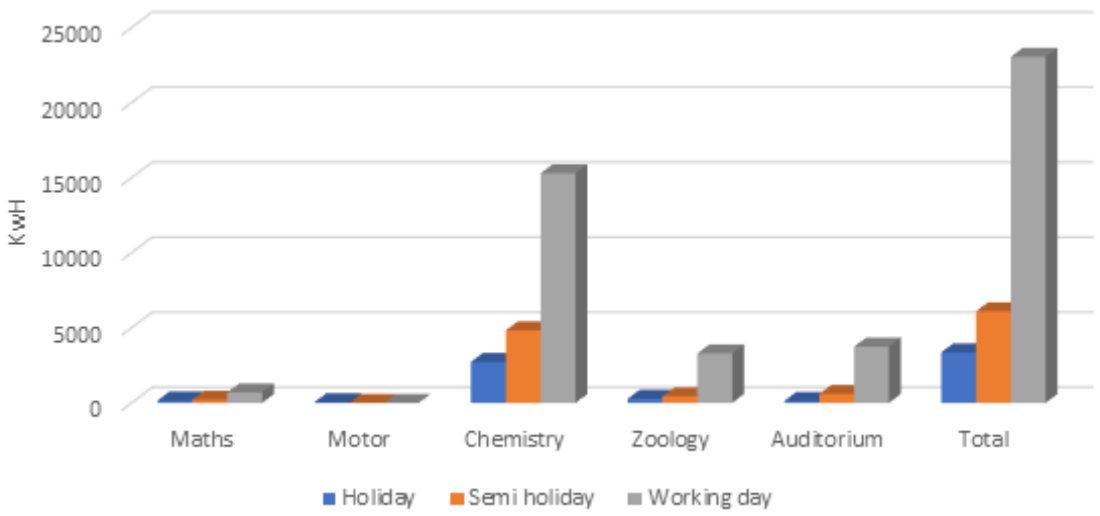


Fig. 4.10. Comparison of energy consumption on various types of functional days in the college (based on the sampling meter reading study. N=9).

It is well evident that on working days the highest usage of electricity occurs followed by semi working days like Saturdays and least in holidays like Sundays.

The usage of energy is directly proportional to the rate of activities in the college (Fig.4.10).

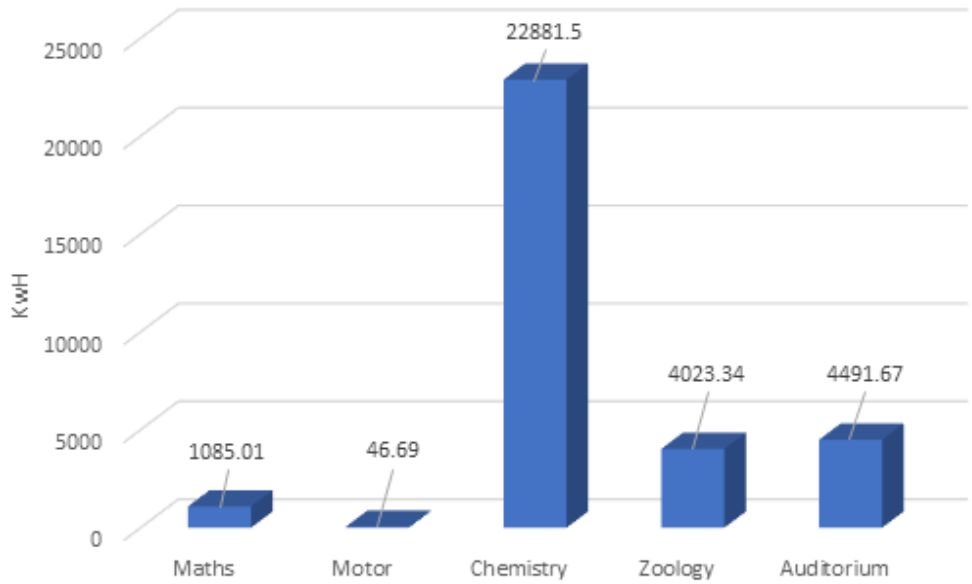


Fig. 4.11. Comparison of energy consumption through various meters in the college (based on the sampling meter reading study. N=9).

The sample survey on energy meter reading showed that the highest usage is from the meter installed at chemistry block which supplying electricity to A and J blocks.

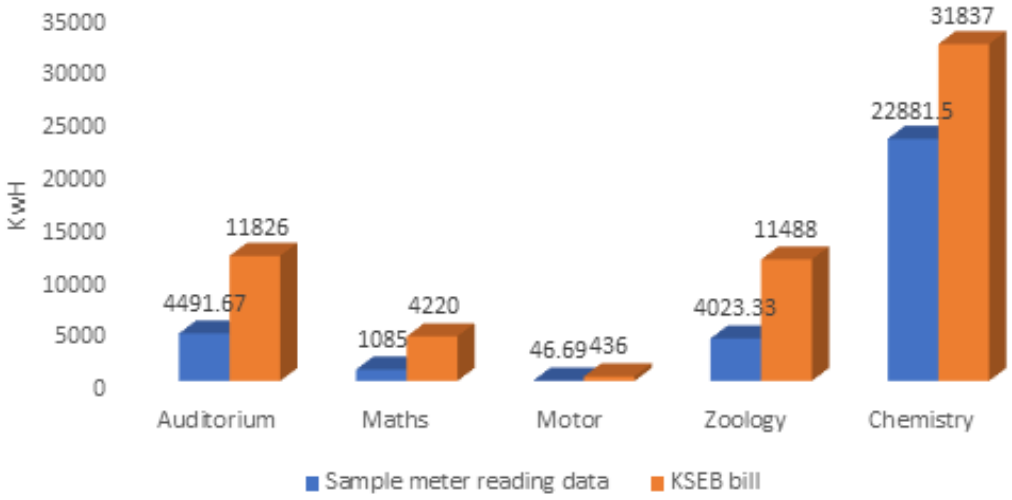


Fig. 4.12. Comparison of energy consumption data collected through sample survey and KSEB bills.

The comparison of sample survey data on average consumption of energy and the average consumption as per KSEB bill showed that a normal correlation exists between the two sets of the data. However, in the case of auditorium there is a sharp difference and it may due to the sampling error. It is reported that during selected holidays auditorium has been used for public or private programs. During the sampling period such programs were not reported and this may be the reason for varied correlation between the two sets of the data (Fig.4.12).

4.4.5. Solar energy production in the college

The college has a solar energy production unit with an installed capacity of 10KVA and it is connected to the power grid of KSEB. The solar energy generated during the last three years are shown in Fig. 4.13 to 4.15. It is well evident that during summer months the average production is at its peak and by raining season it is diminishing. This because of the natural phenomena that during summer season more solar light is available.

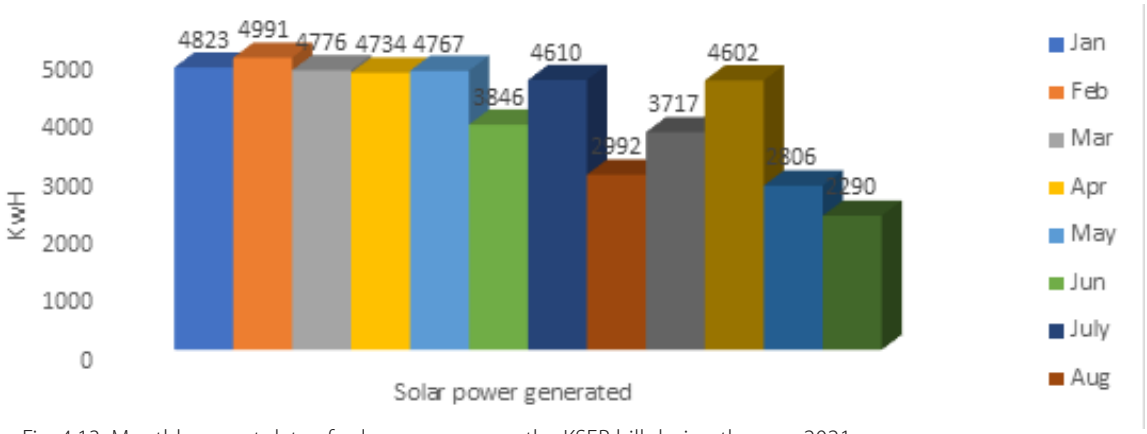


Fig. 4.13. Monthly export data of solar energy as per the KSEB bill during the year 2021

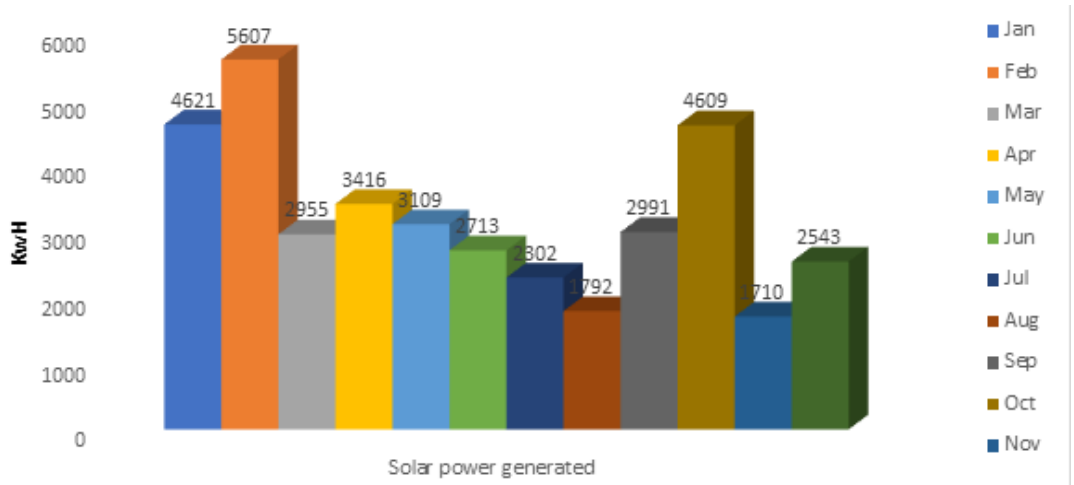


Fig. 4.14. Monthly export data of solar energy as per the KSEB bill during the year 2022

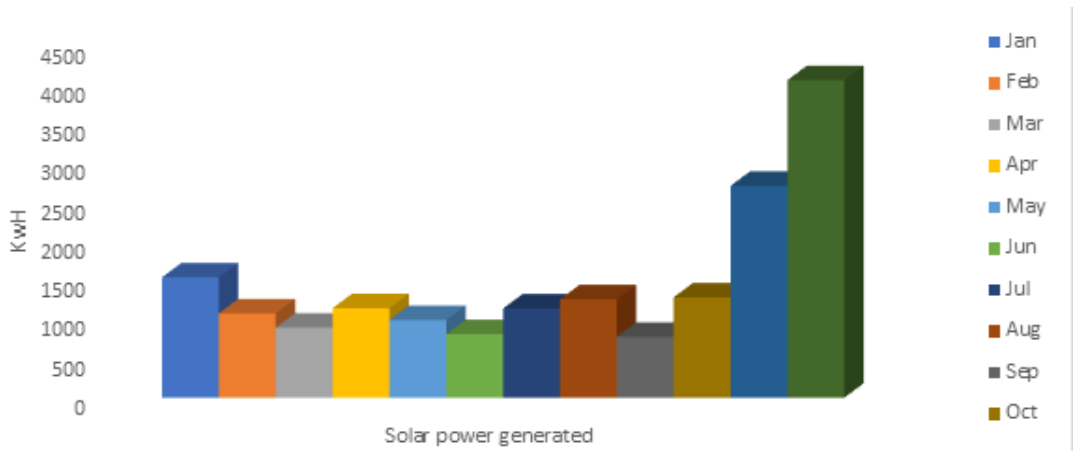


Fig. 4.15. Monthly export data of solar energy as per the KSEB bill during the year 2023

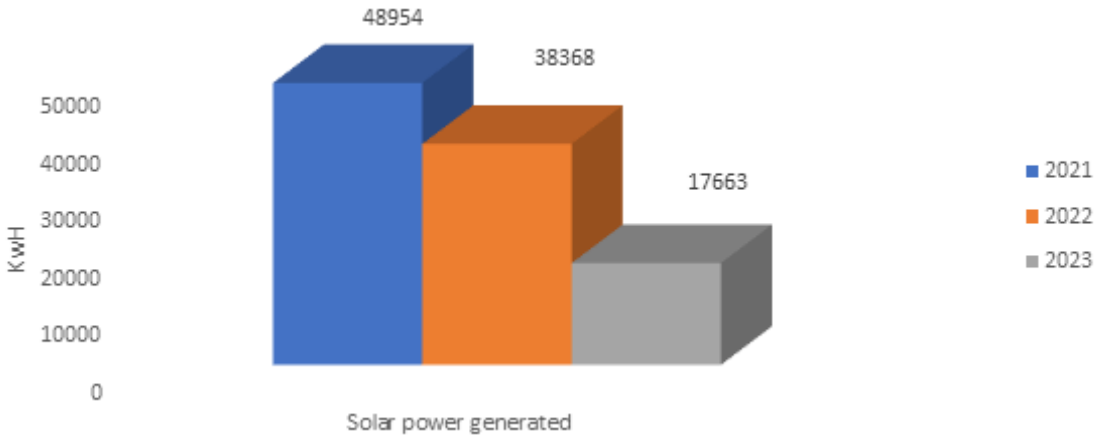


Fig. 4.16. Comparison of yearly generation of solar power in the college.

The comparison of average production of solar energy over a period of three years showed that the highest export has been reported in 2021 and the lowest in the year 2023. During 2021 the production was at its peak but the usage was relatively low due to the closure of the college for long periods due to covid restrictions. During 2023, the solar system got malfunctional but it remains unnoticed till the internal audit team explored the system as part of their surveillance audit in 2024. Currently the system is rectified and normal production of energy is expected.

4.4.5.Usage of LPG in the college as energy resource

Commercially available cylinders of LPG have been used in laboratories, canteen and kitchens. LPG cylinders are purchase through the office and distributed to the respective departments. There are 18 allotted cylinders in the college.

Sl.No:	Department	Number of LPG alotted	Usage period	Capacity	Total in Kg
1	Chemistry lab	9	4 month	14.2kg-3 ,19kg-6	469.8
2	Physics lab	3	2 years	19kg -3	28.5
3	Zoology lab	3	1 year	19kg-3	57
4	College Canteen	3	1 year	19kg x 120	2280
Total		18			2835.3

A biogas plan t is found in a dilapidated condition earlier which provided gas to the canteen.

High LPG Usage in Canteen The canteen is the largest consumer of LPG cylinders due to its daily operations. Moderate Usage in Chemistry Lab: Chemistry's use is moderately high, likely due to practical classes and lab experiments.

Low Usage in Physics and Zoology Labs: Both departments have relatively low usage, reflecting their specific experimental requirements that don't often need LPG. The total usage is estimated as 2835.3 of LPG per year. This has to be reduced by adopting biogas energy

4.4.7. Energy usage of vehicles of students and staff

Type of Vehicle	Vehicle count	No. of Vehicle shared	Total distance travelled (km)	Distance saved by sharing
Two wheeler	62	13	1931.5	1085
Three Wheeler	2	2	23	6
Four Wheeler	3	3	94	81

Table 4.16 Usage of vehicle of students and staffs

Sharing vehicles significantly reduces individual travel across all categories, especially in four-wheelers where almost 86% of travel was shared. Promoting vehicle sharing could further optimize transportation, reduce emissions, and promote sustainability. Two-wheelers, with a lower percentage of shared travel (56.18%), still present an opportunity for increased vehicle sharing initiatives.

The college purchased 131.33 litters of diesel, 5 litters of petrol, and 0.2 litters of oil, which were distributed as needed for the generator, laboratories, and other institutional purposes.

The college operates two generators, one with a capacity of 30 kW and the other with 32.5 kW.

4.5 CONCLUSION

- The college is maintaining required registers and relevant documents related to the assets, repairs, maintenance, and usage of all energy resources. The college has a modest electrical energy infrastructure with 727 plug points (6 amp), 36 LED bulbs, 251 LED tube lights, 307 ceiling fans, and 54 desktops. However, 56 percent of the tube lights are still fluorescent, which consume much more energy than LED tube lights. Strict implementation of the Energy Management Plan (EMP) to achieve 100% energy-saving light fittings is essential. Of the 307 ceiling fans, none are BLDC (brushless DC) fans, which are highly energy-efficient. A phased elimination of conventional ceiling fans is proposed in the plan.
- The college has two main power sources: supply from KSEB and solar power generation (10 KVA). KSEB has five connections in the college, with the highest energy usage occurring through the meter installed at the chemistry block, which supplies power to the main blocks—A and J blocks. The lowest usage is through the meter installed for a lone motor and pump.
- The college has both science and arts departments, in both the aided and self-financing streams, hence essential lab equipment, machines, and instruments are available at relevant sites. However, the available lab equipment, instruments, and appliances are restricted to the curriculum of undergraduate (UG) and postgraduate (PG) courses within the science departments, with the exception of the chemistry department.
- Approximately 95% of the equipment, instruments, and appliances currently in use are outdated models lacking an Energy Star rating. Consequently, these devices may contribute to substantial energy consumption. Therefore, it is strongly advised to mandate the procurement of only Energy Star-rated items in the future.
- The absence of usage registers for nearly all lab equipment constituted a significant non-conformity. This has been rectified, and it is now confirmed that usage registers are maintained for all equipment. However, calibration registers are not available, as only academic exercises are conducted in the laboratories. The research department of chemistry also lacks sophisticated modern instruments.
- The energy usage of the college remains moderate, with an annual per capita usage of 35 kWh of electrical energy. Habitual wastage is reported in several locations, but awareness campaigns have yielded positive results.
- Despite having the infrastructure for a biogas plant (but in dilapidated condition), it's evident that LPG consumption remains excessively high. However. It's imperative to implement more effective measures to reduce LPG consumption.
- 71.09 percentage of students and teachers who own vehicles are commute on a sharing basis. This has resulted in the savings of fossil fuels

4.6. RECOMMENDATIONS

- Phase wise implementation of EMP including energy conservation measures and promotion of energy saving equipment and gadgets recommended. Periodic surveillance audits (internal and external) should be conducted.
- Promotion alternate energy resources as proposed in the plan is highly significant in achieving sustainable energy management goals.
- IEC programs for all stakeholders including parents and local community will fetch improved results.
- Student can also take initiatives to bring innovative technologies and mechanism with low coast as

model and at the same to save energy. This may be as part of their internships or projects or standalone.

- Colleges can organize techno fests by collaborating with other institutions, providing students with opportunities to exchange ideas and engage with diverse knowledge. This collaborative effort represents a significant advancement for both students and faculty, fostering teamwork and the adoption of innovative plans.
- Students, with faculty guidance, have the opportunity to proactively undertake initiatives, introducing innovative technologies and mechanisms at a low cost as a model, all while concurrently striving to conserve energy.
- Establish a proficient power management team to regularly monitor the energy function's progress, engage in discussions, formulate plans, document findings, and assess the ongoing developments for implementing modifications in sustainable energy management.
- It would be preferable to devise an alternative plan aimed at reducing energy consumption through different methods, particularly focusing on reducing LPG usage. For example, implementing a biogas plant could be a viable solution strongly recommend to place efficient power management team members to systematically monitoring and documenting the energy management progress.

4.7 ENERGY MANAGEMENT SYSTEM PLAN

4.7.1 Establish an Energy Management Team

- **4.7.1.1 Composition:** Include faculty, administrative staff, students, and external energy consultants.
- **4.7.1.2 Responsibilities:** Oversee energy audits, implement energy-saving measures, monitor progress, and engage the campus community in energy initiatives.

4.7.2 Conduct an Energy Audit

- 4.7.2.1 Objective: Assess current energy usage across all campus facilities (classrooms, laboratories, dormitories, administrative buildings, etc.).
- 4.7.2.2 Methodology: Identify energy inefficiencies, peak demand times, and energy wastage.
- 4.7.2.3 Outcome: Develop a baseline energy consumption report to guide future actions.

4.7.3 Set Clear Energy Reduction Goals

- 4.7.3.1 Short-Term Goals: Reduce energy consumption by 10-15% within the first year.
- 4.7.3.2 Long-Term Goals: Achieve a 30-40% reduction in energy consumption over 5 years.
- 4.7.3.3 KPI Monitoring: Use key performance indicators (KPIs) to measure progress against goals.

4.7.4 Implement Energy Efficiency Measures

- **4.7.4.1 Lighting:**
  Replace incandescent bulbs with LED lighting.
  Install motion sensors and timers in common areas.
  Optimize natural lighting.
- **4.7.4.2 Heating, Ventilation, and Air Conditioning (HVAC):**
  Regular maintenance of HVAC systems.
  Install programmable thermostats.

Consider energy-efficient HVAC systems during upgrades.

- **4.7.5.3 Appliances and Equipment:**
  Encourage the use of energy-efficient appliances (Energy Star rated).
  Implement power management settings on computers and lab equipment.
  Replace old equipment with energy-efficient alternatives.
- **4.7.5.4 Building Insulation:**
  Improve insulation in older buildings.
  Install double-glazed windows to reduce heating and cooling demands.
- **4.7.5.5 Water Heating:**
  Install solar water heaters where feasible.
  Use timers to reduce water heating during non-peak hours.

4.7.5 Invest in Renewable Energy

- **4.7.5.1 Solar Panels:** Install photovoltaic panels on rooftops and open spaces.
- **4.7.5.2 Wind Energy:** Explore small-scale wind turbines if the location is suitable.
- **4.7.5.3 Geothermal Systems:** Consider geothermal heating and cooling systems for new buildings.

- **4.7.5.4 Energy Storage:** Implement battery storage systems to store excess renewable energy.

4.7.6 Promote Energy Conservation Awareness

- **4.7.6.1 Workshops and Training:** Organize sessions for students and staff on energy conservation practices.
- **4.7.6. 2 Awareness Campaigns:** Use posters, digital displays, and social media to encourage energy-saving behaviours.
- **4.7.6. 3 Competitions:** Introduce inter-departmental competitions to reduce energy consumption.
- **4.7.6. 4 Smart energy management system:** Research on the possibility of advanced energy storage options that can store excess energy produced during low- demand periods.

4.7.7 Sustainability and Environmental Impact

- **4.7.7.1 Interdisciplinary Approach:** Offer courses that combine energy management with environmental science, economics, and policy studies.
- **4.7.7.2 Case Studies:** Use the institution's own energy usage and management plan as a case study in sustainability courses.
- **4.7.7.3 Observation Visit:** Organize visits to renewable energy plants or sustainable buildings to see energy management in action.

4.7.8 Implement a Smart Energy Management System

- **4.7.8.1 Real-Time Monitoring:** Use smart meters and sensors to monitor energy usage in real-time.
- **4.7.8.2 Data Analytics:** Analyse energy data to identify trends and areas for improvement.
- **4.7.8.3 Automation:** Automate lighting, heating, and cooling systems based on occupancy and time of day.

4.7.9 Regular Maintenance and Upgrades

- **4.7.9.1 Routine Checks:** Perform regular maintenance on all energy-consuming systems and equipment.
- **4.7.9.2 Upgrading Infrastructure:** Plan for gradual upgrades of outdated energy systems and infrastructure.
- **4.7.9.3 Continuous Improvement:** Regularly review and update the energy management plan based on new technologies and practices.

4.8. ACTIVITIES CONDUCTED

Skill Enhancement programme INLIGHT '24

INLIHT'24 was a Hands on Training Workshop and Skill Enhancement programme in association with Entrepreneurship development Club and Institution's Innovation council in connection with National Energy Conservation Day on 24 th January 2024 at B Sc Physics lab organised by Department of physics, St Aloysius College ,Elthuruth. This report provides comprehensive overview of the programme ,highlighting the list of participants, certificate issued, feedback etc.

Event Overview

Purpose of the Programme

The objective of the Workshop aims at developing skill in Assembling and repairing LED BULB so that participants can access knowledge about the environment friendly, pollution free LED BULB as well as the skill acquired raise themselves to an Entrepreneurial level for earning income.

Intended Outcome

A Hands on Training Workshop and Skill enhancement programme in association with Entrepreneuship development Club and Institution's Innovation council in connection with National Energy Conservation Day was very much successful in developing skills among college students, faculties of Departments and also the ladies from nearby locality which includes 45 th division of Thrissur cooperation.

The Workshop enabled them to raise collective idea how LED BULB can be assembled with cost effective methods and how they can be reused after repaying so that electronic wastes get minimised.

Institution's benefit out of this Event

A Hands on Training Workshop and Skill enhancement programme in association with Entrepreneurship de-

velopment Club and Institution's Innovation council in connection with National Energy Conservation Day was indeed successful. The programme feedback showed the positive outcome of the Workshop. Women participated in the event was satisfied well enough that they acquired the skill in soldering and assembling LED BULB.

Since this was a programme to promote entrepreneurship development in nearby locality, we had provided the best innovative idea of LED BULB assembling and repairing. Even the faculties and students of our college can be generated the environment and eco friendly device development

St. Aloysius College
Elthuruth, Thrissur, Kerala - 680 611, India
Affiliated to the University of Calicut & Aided by the Govt. of Kerala
Reaccredited by NAAC in the Third Cycle with Grade B++
www.staloysiuselt.edu.in

INSTITUTION'S INNOVATION COUNCIL

DEPARTMENT OF PHYSICS

CERTIFICATE OF PARTICIPATION

Hands on Training Workshop

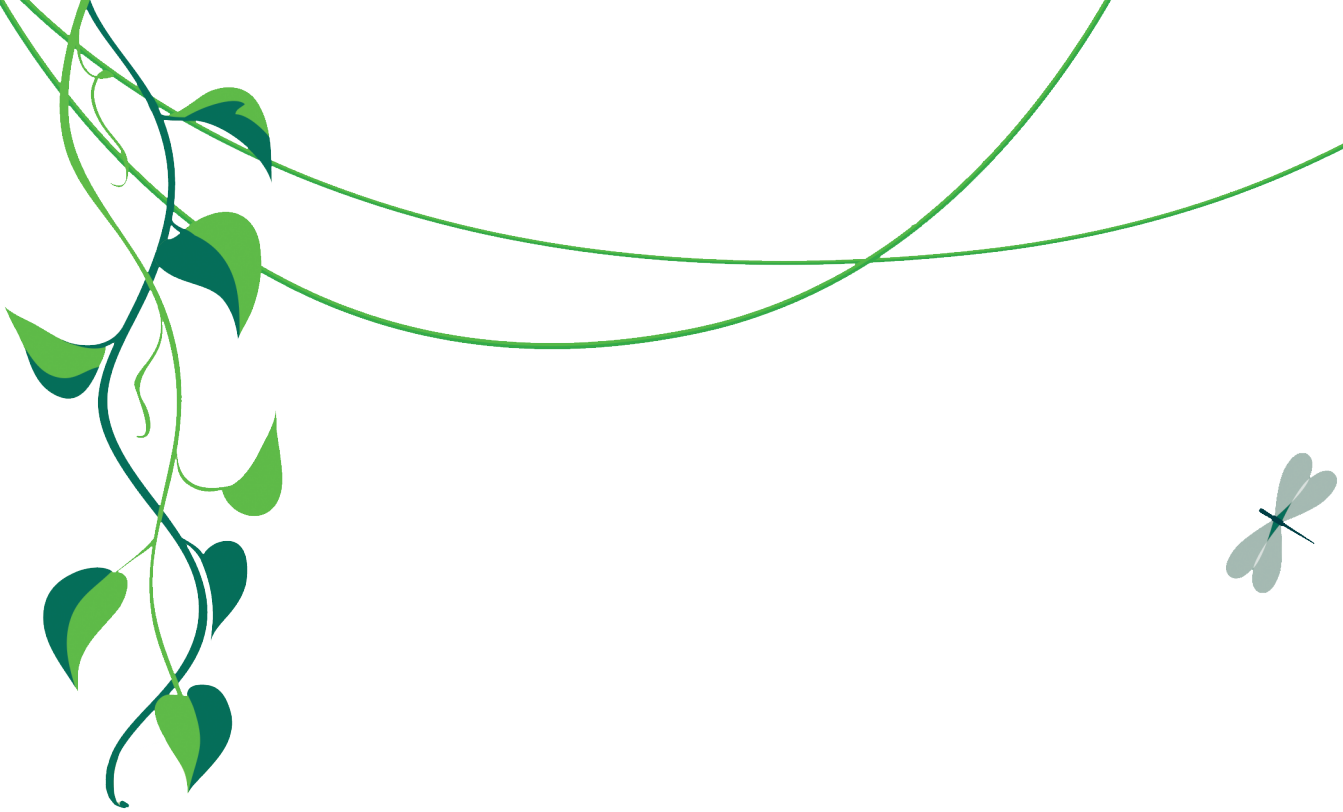
INLIGHT'24

This is to certify that Dr./~~Ms./Mr~~ Jijo Abraham
~~Assoc.Professor~~/Asst.Professor/~~student~~ Dept. of Physics has participated in one day Skill Enhancement Programme on LED bulb assembling organised by Department of Physics in association with Entrepreneurship Development Club, St Aloysius College,Elthuruth on 24th January 2024.

Dr. Dias E D
(Coordinator)

P.G. Dept of Physics
St. Aloysius College
Elthuruth, Thrissur

Ms Vidya C Nair
(Convenor)



The Environment is where we all meet;
where all have mutual interest;
it is the one thing all of us share.

- Lady Bird Johnson -

Chapter V

WATER EFFICIENCY MANAGEMENT SYSTEM (We MS) AUDIT REPORT

TIES

LIFT UP YOUR HEARTS

WATER EFFECIENCY MANAGEMENT SYSTEM (WEMS 2021-24)

Ms. Reshma K Jose
Ms. Vijitha K V
Ms. Abirami K
Dr. Nidhish G
(Assistant Professors)

Lima Shibu
P D Nivedh
Sreelakshmi
Adhip Krishna A R
Ananya Biju
Viveknathan
Alan Biju
Sandra Sunil
Malavika K J
Ancy M A
Devika Remesh
Marya K. P
Krishnapriya P. R
Sitta S. Puthur
Anjaly P. S.
Gopika K. Nandakumar
Angel Mariya Roy
(Students)

5

Water Efficiency Management System Audit Report

5.1. INTRODUCTION

Water, an invaluable natural asset, is indispensable for the survival of all living organisms. Life, whether animal or plant, is inconceivable without its presence, as it is crucial for fulfilling their daily metabolic functions. Moreover, plants rely on water to facilitate the synthesis of their sustenance through the process of photosynthesis.

Water resources encompass the entirety of natural water bodies found on Earth, irrespective of their form (whether vapour, liquid, or solid), and hold potential utility for humanity. Among these, the most accessible resources comprise oceans, rivers, and lakes, while additional sources encompass groundwater, deep subsurface waters, glaciers, and permanent snowfields. On average, an individual consumes between 60 to 70 litters of water per day. While we can endure days without food, the mere thought of surviving without water is unfathomable; even plants wither and shed their leaves in its absence

India gets an average precipitation of 4000 billion cubic meters (BCM) per annum. Precipitation is highly unevenly distributed with respect to time and space, over the country. As much as 75% of total average annual precipitation occurs in 4 months of monsoon period. Even during the monsoon months, about 50% of total annual rainfall takes place only in 15 days and in less than 100 hrs. Kerala is bestowed with 3000 mm. annual rains, of which 60% through two monsoons and 40% as summer showers. However, in recent years due to the changes in the weather pattern, the said cyclist has been disrupted. Currently, local rains and local floods are the major disaster in the state.

The steady increase in human utilization of natural waters, especially freshwater resources, has been an enduring trend over the centuries. Given the ongoing population growth and the expanding demand for water in agricultural, industrial, and recreational sectors, it seems improbable that this trajectory will shift. Consequently, there's a mounting apprehension regarding the sustainability of water supplies to meet future societal demands. Already, surface-water resources are reaching their peak utilization in numerous regions across the globe.

Water usage on a college campus typically involves a diverse range of activities and facilities, including residential halls (hostels), academic buildings, laboratories, dining services, and recreational areas. This multifaceted consumption includes drinking water, sanitation, landscaping,

cooling systems, and various experimental processes. Efficient water management is crucial in such settings to support sustainability goals, minimize waste, and reduce operational costs. Conducting a water audit provides a comprehensive assessment of current usage patterns, identifies areas for conservation, and helps in implementing strategies to optimize water resources across the campus.

5.1.1. What is Water Audit?

A water audit comprehensively assesses the water utilization of an entity, starting from the point of water intake to its discharge, meticulously scrutinizing every aspect of usage. This examination determines the quantity of water utilized, identifies any wastage or leakage, and pinpoints areas for consumption reduction. Furthermore, it evaluates existing treatment systems and practices, proposing enhancements to enhance efficiency and decrease usage. Drawing from these insights, the audit provides recommendations to minimize wastage and consumption, improve treatment methodologies, and conduct cost-benefit analyses. Additionally, it suggests implementing a system to monitor water intake, distribution, and utilization.

The requirements that must be fulfilled for a water audit are:

- A record of the amount of water supplied/consumed (total water supply) in the college/university
- Water loss and suggested measures to address water loss (through leakages, overflow and other unaccounted water losses through misuse etc.)
- Sustainable water conservation plan (habitual modifications, promotion of reuse of water; recycling waste water; harnessing alternate water sources etc.).

The water audit involves systematically obtaining a water balance by measuring the flow of water from the point of extraction or treatment, through the distribution network, to its various usage points, and eventual discharge. This process entails calculating the water balance, assessing water consumption, and pinpointing opportunities for water conservation.

5.1.2 Need for Water Audit

Water audits serve as a tool to pinpoint areas with higher specific water consumption, evaluate the burden of wastewater pollutants, and devise strategies for mitigation by employing the principles of 3R (Reduce, Reuse, and Recycle). Our water audit services have empowered industries to choose viable methods for reducing water consumption, curtailing wastewater production, and optimizing resource recovery. These audits offer comprehensive water efficiency solutions, leading to cost savings while aiding in internal policy adherence, legal compliance, and showcasing dedication to sustainability.

The functions of the water audit are:

- Reduced water losses
- Improved financial performance
- Improved reliability of supply system (quality water)
- Enhanced performance of the distribution system
- Better safeguard to public health and property
- An effective educational and public relations tool for the water
- System reduced legal liability, and reduced disruption, thereby improving level of service to the entire college/university community

Creating awareness among water users (students, staff, guests) the water audits employ a multi-staged approach aimed at delivering short-term and long-term sustainable water management solutions. Throughout this process, analytical, design, and engineering experts collaborate to scrutinize the audit findings and devise enhanced strategies for water management and sustainability.

5.1.3 Benefit of Water Management System

Effective implementation of a water efficiency management plan results in substantial savings in water and energy, therefore reducing the environmental impact of both water discharge and the need to pump water over long distances.

The adoption and proper implementation of a water efficiency management system are intended to result in improved water efficiency and can help to achieve the following outcomes:

- Identifying water as a resource can be considered part of organisational and budgetary planning.
- Assisting an organisation to manage water use better and optimise water demand.
- Recognising the impact on others that can occur with changing water use.
- Ensuring a greater level of accountability in water use.

- Providing a process for regular review for possible improvement and adoption of opportunities arising in water efficiency.
- Savings in operation by reducing water consumption through sustainable and efficient design, use of water conservation devices and proper monitoring.

5.2 WATER EFFICIENCY MANAGEMENT SYSTEM POLICY (WEMS)

5.2.1. Statement of Commitment

Water scarcity is a critical environmental issue impacting ecosystems, economies, and human health. It disrupts natural habitats, reduces biodiversity, and exacerbates the challenges of climate change, affecting everything from agriculture to energy production. This issue is directly linked to the Sustainable Development Goals (SDGs), particularly Goal 6, which aims to ensure availability and sustainable management of water and sanitation for all. The Water (Prevention and Control of Pollution) Act in India 1947 underscores the need for effective management and conservation practices to safeguard water resources. Our institutions initiate a significant role in addressing water scarcity by promoting awareness, integrating sustainability into their curricula, and fostering innovative solutions. Through research, community engagement, and educational programs, these institutions achieve to build an effective water conservation strategies and empower future generations to tackle this pressing global challenge.

5.2.2 Goals

The goal of the Water Efficiency Management Plan for the St. Aloysius College is to achieve a 25% reduction in overall water consumption within the next five years through the implementation of advanced water-saving technologies, rigorous conservation practices, and comprehensive education initiatives. This plan aims to enhance water use efficiency across all campus facilities, promote sustainable water management practices, and foster a culture of environmental stewardship among students, faculty, and staff.

5.2.3 Objectives

- To establish comprehensive water recycling and conservation programs.
- To achieve a 25% reduction in water usage within five years by implementing conservation practices
- To ensure all water sources are sustainably managed and contamination-free.

5.2.4 Assessment and Audit conduct

A comprehensive assessment of water usage periodically. This includes evaluating current consumption patterns, identifying areas of high usage, and assessing existing infrastructure for water management

5.2.5 Resource Management

Conservation Measure Implement measures to reduce water consumption. This could involve installing water-efficient fixtures, promoting water-saving practices such as rainwater harvesting, and encouraging the use of recycled water for non-potable purposes

5.2.6 Strategies for resource management

- **5.2.6.1 Wells:** Conduct bi-annual maintenance checks and water quality tests to prevent over- extraction and contamination.
- **5.2.6.2 Motor System**: Schedule quarterly inspections and efficiency assessments to reduce energy consumption and water waste.
- **5.2.6.3 Water Conservation:** Install low-flow fixtures, motion-sensor taps, and dual-flush toilets in toilets and other water outlets.
- **5.2.6.4 Waste water Treatment:** Implement grey water recycling systems in the canteen and laboratories to reuse water for landscaping and toilet flushing.
- **5.2.6.5 Rain water harvesting:** To conserve rainwater by collecting, storing, conveying and purifying of rainwater that runs off from rooftops, parks, roads, open grounds.
- **5.2.6.6. Recharging Open wells:** Techniques used to directly discharge water into deep water- bearing zones

5.2.7 Emergency Preparedness

Develop contingency plans for dealing with water shortages or other water-related emergencies. This may involve establishing emergency water storage facilities, implementing water rationing measures, and coordinating with local authorities

5.2.8 Education and awareness

Develop educational programs to raise awareness about water conservation among students, faculty, and staff. This could include workshops, seminars, and campaigns highlighting the importance of water conservation and practical tips for reducing water usage

5.2.9 Curriculum Integration

Integrate water management goals into the curriculum of relevant disciplines such as environmental science, engineering, and agriculture. Encourage research and innovation in water conservation technologies and practices Integrate water sustainability topics into environmental science, engineering, and other relevant courses. Encourage student research projects focusing on local water management issues and solutions.

5.2.10 Community Engagement

Collaborate with local environmental organizations to enhance regional water conservation efforts and organize community workshops and events to promote water sustainability and share knowledge.

5.2.11 Purchasing and Procurement

Infrastructure Updates Invest in infrastructure upgrades to improve water management systems in higher education institutions. This may include retrofitting existing buildings with water-saving technologies, upgrading plumbing systems, and implementing smart irrigation systems for landscaping

5.2.12 Monitoring and Reporting

Conduct monthly reviews of water usage data and publish annual reports detailing progress and areas for improvement.

5.2.13 Compliance and Review

Ensure all water management practices comply with local and national environmental regulations. Review and update the water management policy every two years to incorporate new technologies, practices, and regulatory changes.

5.2.14 Leadership and Accountability

Establish a committee responsible for overseeing the implementation of the water management policy. Assign specific tasks to staff members to ensure accountability and foster a culture of environmental responsibility throughout the institution.

5.2.15 Long-term Sustainability

Emphasize the long-term sustainability of water resources in higher education institutions. Encourage the adoption of holistic approaches to water management that take into account environmental, social, and economic factors.

5.2.16 Conclusion

By adopting a comprehensive water management policy, institutions can lead as a model for showcasing their commitment to sustainability and the well-being of future generations.

5.3 METHODOLOGY

The water efficiency audit, crucial for sustainable development, was conducted through a comprehensive analysis of water usage and maintenance practices.The audit team consisted of 19 members, 15 students and 4 faculty members. The process began with the preparation of a detailed water audit schedule. The team was divided into groups, with each group assigned specific tasks such as documenting meetings, checking taps and faucets, and conducting site inspections in each block of the college. The audit was structured around eight registers and five key documents.

5.3.1 Water infrastructure survey

The internal audit team conducted surveys to count the number and types of taps and faucets, assessing their condition (water infrastructure survey). Each block was mapped to identify water sources, including any located outside the campus. The audit also involved documenting water storage systems, noting their type, capacity, year of installation, and location. The leaking taps and respective quantity also were record specifically. This helped assess the functionality of the infrastructure, including taps, faucets, and pumping lines. Additionally, the team conducted water quality analysis, evaluated water risk management strategies, and reviewed maintenance practices for the water infrastructure.

5.3.2 Sampling data collection of five water meter

Water flow meters were provided at five locations where the main distribution line originates from each respective source or tank, and readings were taken over three weeks on sampling days. The pumping time and volume of water pumped were recorded at three replications over a period of nine days. These records included the date, time, quantity, and duration of water flow, allowing for the calculation of flow rates.

5.3.3 Register for the monitoring and analysing

The audit also covered water footprint registers, tracking usage patterns, grey water recycling, water losses, and overall resource management. Regular documentation of meetings and programs related to water conservation and sustainability was maintained throughout the audit, providing a clear inventory of the college's current water resources and practices.

5.3.4 Assumption

Water scarcity is one of the most critical global challenges today, and it is projected to intensify over the next decade. To tackle this urgent issue and promote water conservation in non-domestic sectors, organizations must adopt sustainable water management strategies. Freshwater scarcity remains a persistent problem worldwide, with only a small portion available for agriculture and distribution, leaving many regions vulnerable to drought. Contributing factors include human consumption patterns, intensive agricultural and industrial water use, and the effects of climate change. As demand for water continues to rise, its availability decreases. While we cannot create more water, we can manage our current resources more effectively through prudent water resource management. A well-designed framework, incorporating strategies to improve water efficiency, consumption assessment tools, and systematic water-saving measures, can lead to significant water and energy conservation, ultimately reducing environmental impacts. The successful implementation of a water management plan, aligned with ISO 46001 principles, delivers numerous benefits. It integrates water resource identification into organizational and financial planning, optimizes water demand, and enhances water usage management. It also highlights the potential social impacts of water consumption, ensuring greater accountability. The plan establishes protocols for regularly evaluating and identifying opportunities for water efficiency improvements, leading to operational savings through water conservation devices, sustainable design practices, and effective monitoring. Key strategic points such as raw water sources, conveyance systems, treatment plants, storage systems, distribution networks, and individual users can be assessed at regular intervals to identify water losses (WEMS). This audit will also support future system extensions, renovations, and modernizations. Monitoring water quality at strategic points in the distribution system is essential to identify contaminants and assess the purity of the supplied water. Based on the type of application and purity requirements, the appropriate treatment system can be designed and developed. Leakage assessments and evaluations of the water distribution system will also be integral components of this comprehensive study.

5.3.5 Water footprint verification

Water use is a central focus of many nations' sustainability strategies, requiring reliable and comparable data for effective regulation. ISO 14046 provides guidelines for calculating water footprints and reporting results, ensuring accuracy through independent verification. An organization's water footprint—representing both direct and indirect water usage and its impacts—is increasingly important to stakeholders, consumers, and international organizations. The ISO 14046 standard was developed to address these concerns. Organizations can showcase their commitment to sustainable water management through ISO 14046 Water Footprint and Verification Training, such as the program offered by SGS. In the 21st century, managing water resources will be a major challenge, particularly due to climate change, which is reducing water availability. This adds pressure on businesses to adopt more efficient water resource management practices. The ISO 14046 standard, now available, provides an internationally recognized framework for accurately determining the water footprint of organizations, processes, and products. The water footprint analysis evaluates not only water usage but also the potential environmental impacts associated with water. ISO 14046 can be used as a stand-alone assessment—focusing solely on water-related environmental impacts or as part of a broader life cycle assessment, which considers all relevant environmental impacts, not just those related to water.

5.3.6 Stages of water audit

Water audit has the following three phases:

5.3.6.1 . Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with water conservation policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the usage pattern and habits related to water consumption.

This phase includes following specific activities:

System audit (inventory of infrastructure)

- The current water usages and systems for water use under various sectors such as canteen, toilets, departments, common facilities, wash areas, and others need to be studied to check their operational efficiency and level of maintenance.
- The scope for any modification or up-gradation will depend on the status of existing systems.

Water Supply and Usage audit (Usage pattern of the campus)

- Water audit comprises of preparation of layout of water sources, distribution network, and service/delivery points to water users (lab, mess, canteen, toilets, office, public etc.) and return flow of waste or excess water.
- The layout should include locations and capacities of flow measurement devices installed at key points, dimensions of pipes and fittings in the water supply system, locations and particulars of flow control devices and history sheets of all measuring and control devices including pipes and fittings.

5.3.6.2 Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information regarding process has been collected during the audit phase:

- Flow measurement devices may be installed at all strategic points so that water losses from various components such as raw water source, conveyance system from raw water source to treatment plant, from treatment plant to treated water storage system, treated water storage system to distribution networks, individual users, etc. could be assessed at regular intervals (WEMS).
- Such audit will also prove useful for future extension, renovation and modernization of the system.
- Water quality of the distribution system needs to be monitored regularly at strategic points to find out the level and nature of contaminants present in the supplied water. Depending on the types of application and degree of purity needed, the treatment system can be designed and developed.
- The water distribution system, leakage assessment etc. will form an integral part of this study.

5.3.6.3 Post audit phase

- The plan of action for the post-audit phase is implementation and follow-up. The result is to assist and implement or enhance existing WEMS with sustainability solutions and monitor the performance.
- WEMS committee will ensure that the WEMS is in

place and the college is participating, by making the entire college/university community well informed through regular communications; monitoring through periodical evaluation programmes etc.

Two major activities are included in this phase:

Source sustainability audit

- A study of the availability of water from the current sources and past consumption patterns for various sectors of the college/university is necessary to understand the present water utilization and projecting future requirement.
- Data on development of sustainable source of water through rainwater harvesting and waste water (grey water) recycling should also be taken into consideration.
- Water conservation measures shall be identified and included in the action plan.

Discharge audit

- The quantity of grey water from all points of water usage shall be calculated. Based on such statistics recycling or waste water treatment options shall be implemented.

5.3.7 Steps of water Audit

The standard water balance or methodology is the framework for categorizing and quantifying all water uses in the water audit. It is called a 'balance' because when it is completed, all uses of water in the system equal the amount of water input by the sources.

5.3.7.1 Site assessment

Collection of contour map and campus diagram

- Preparing inventory of water infrastructure of each building:
- Water meter data (from various points of use)
- Data on quantity of water pumped every day (pump wise/location wise)
- Data on leaking infrastructure and quantity of lost water
- List of water conservation measures (WCM) and sustainability measures (SM) implemented
- Discussion with responsible persons of each infrastructure (on utility method, working condition, operation and maintenance procedures etc.)
- Date entry in prescribed forms (water spread sheets)

5.3.7.2. Data analysis

Analysis of current and past performance (water usage data and water loss data, before and after the implementation of WCM, SM etc.)

- Regression analysis involves the comparison of water consumption on the Y axis versus the potential water driver on the X axis (weather, working days/holidays etc.).
- Preparation of checklists and verification
- Water footprint calculation

5.3.7.3 Final audit by external audit team

- Checklists verification- identifying non conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards

5.3.7.4. Work plan and schedule of water audit

Week	Week Days	Weekly Work Plan	Activity
First week	02.07.2024 to 08.07.2024	Developing policies and action plan. Forming subgroups of water audit members and preparing registers and documents.	1. Members of the water audit were grouped. 2. Maintain regular minutes, program/activity logs, and the uploading of finished files and documents.
Second week	09.07.2024 to 15.07.2024	Divide the campus into distinct sections and carry out a survey to determine the number and types of tapes, faucets, tanks, and water sources located in each area.	Each group was given a specific region to inspect, including tapes, faucets, tanks, and water sources.
Third week	16.07.2024 to 22.07.2024	Construct a water map of the whole campus by combining and analysing the survey data.	The internal water audit team plot map based on the survey
Fourth week	23.07.2024 to 29.07.2024	Inspect the equipment's and the water sources' present states. (Include in a good, poor, or moderate category)	Every team documents the information in accordance with the guidelines, using sketches or diagrams to show where the taps, faucets, and other fixtures are located.
Fifth Week	30.07.2024 to 05.08.2024	Identify the water loss and problems by conducting a walk-through audit and filing a request to address the situation.	Enter the information in the desired format
Sixth week	06.08.2024 to 12.08.2024	Install water metres and gauge each user point	Record the data in the prescribed format.
Seventh week	13.08.2024 to 19.08.2024	Implementation of water conservation and sustainability strategies	Drafting of the final report
Eight week	20.08.2024 to 19.08.2024	Completing all necessary documents and registers prior to the final report	Check all registers and documents are completed.

Table 5.1. Schedule of the water audit at St. Aloysius College

Activities	Frequency	Dates of study	Mode of data collection
Water meter reading (for every meter in the college) OR manual one time evaluation	9 days; three times a day	Three holidays as 26/8/2024, 28/8/2024,1/8/2024 Three semi holidays as 24/8/2024, 31/8/2024,7/9/2024 Three working days as27/8/2024,3/9/2024. 4/9/2024 (complete by three weeks)	Entry in the given format
Usage pattern and quantity of water. Documentation of current WEMS practices. Grey water quantity from each section	Walk through audit and interviews with system managers (controlling or responsible staff or teachers)	Collect data on water usage from each section of every divisions of the college (for eg., in canteen, how much water is used for hand wash, cooking and its preparation, cleaning utensils, floor, table etc.	Entry in the given formats
Details of present water sources Water tank details	Type (open well, pond, tube well etc.), external sources (water supply)	Prepare a detailed inventory on each and every current water resource (capacity, sustainability etc.)	Entry in the given format
Alternate water resources (eg., Rain water harvesting systems)	Documents details of present alternate water resources in the campus	Identify possible alternate water sources	Entry in the given format Include in the action plan

Table 5.2. Water audit - Data collection process

5.4 RESULTS & OBSERVATION

5.4.1. Water Infrastructure of the college- Fixtures & gadgets

Language block - First floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Quantity of water leaking (litre per hour)	Leaking count
Store room	8	8	5	0	0	0	0
Botany Lab	2	0	0	0	0	0	0
Botany & Zoology dept.	2	1	1	0	0	0	0
Dissection hall	3	0	0	0	0	12	0
Clinical lab	2	0	0	0	0	0	0
Faculty	1	0	0	0	0	0	0
Language block - Second floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Classroom corridor	2	2	0	0	0	0	0
First Floor /Library block							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Conference room	2	1	1	0	0	0	0
Principal room	2	1	1	0	0	0	0
Washroom	3	2	2	0	0	0	0
Purifier	2	0	0	0	0	0.6	0
Office	2	1	1	0	0	0	0
Commerce dept	2	1	1	0	0	0	0
Msc Lab	12	0	0	0	0	0	0
Distillation Unit	2	0	0	0	0	0	0
Bsc Lab	24	1	1	1	0	0	0
Chemistry dept	1	0	0	0	0	0	0
Garden area	4	0	0	0	3	0	0
Chemistry dept	1	0	0	0	0	0	0
First block auditorium							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Ist Floor /Right side	3	1	1	0	0	2.4	0
Ist Floor	16	8	8	0	0	0	0
Ground floor auditorium	1	0	0	0	6	0	0
Canteen	13	0	0	0	0	0	0
Kitchen	3	0	0	0	0	0	0
Canteen outside	1	0	0	0	0	0	0
Girls Bathroom	4	2	0	0	0	0	0
Statistics block	2	1	1	0	0	0.6	4
Water purifier	2	0	0	0	0	0	0
Boys bathroom	1	6	0	0	0	0	0

Maths block	2	1	0	0	0	0	0
Language block ground floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Girls Toilet	21	12	0	0	0	36	0
Women's wing classroom 7	2	1	0	0	0	0	0
Women's wing classroom 12	2	1	1	0	0	0	0
English dept	2	0	0	0	0	0	0
First floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Physics dept	3	1	1	0	0	0	0
Bsc Lab	1	0	0	0	0	0	0
Msc Lab	1	0	0	0	0	0	0
Garden area	3	0	0	0	2	0	0
Economics dept	2	1	1	0	0	0	0
Office	2	1	1	0	0	0	0
Ladies toilet	5	1	1	0	0	0.48	1
Second floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Common wash area 1	7	0	0	0	0	2.88	4
Purifier	1	0	0	0	0	0	0
Common wash area 2	10	2	2	0	0	0	
Genetic Lab 1	1	0	0	0	0	0	0
Genetic Lab 2	2	0	0	0	0	0	0
First Floor							
Location	Tap	Flush	Faucet	Shower	Sprinkler	Leak (lit/hr.)	Count
Girls washroom	5	0	0	0	0	0.6	4
Purifier	1	0	0	0	0	0	0
classroom 22	4	0	0	0	0	20.28	1
Classroom 21	4	0	0	0	0	0	0
Common room for girls	10	5	0	0	0	90	2
Garden area	2					0	0
Boy's common washroom	9	4	4	0	0	3.24	5
TOTAL	225	66	34	1	11	169.08	21

Table 5.3. Water infrastructure of the College- fittings and gadgets

The college has a modest water delivery infrastructure. A total of 225 taps are in the college. The highest number of taps are provided in the B.Sc lab (24) followed by Girls' toilet (21). Out of the 225 taps 21 are found in leaking condition. An amount of 169.08 Lit. of water is losing every hour through these leaking taps. Internal auditors reported the matter to the college authorities and made arrangements for rectifying the problem.

There are 66 flush units in the college and all of them are conventional floating ball type. Hence, for every flush at least 15 litre of water is almost going as mere wastage. As per the Water Management Plan of the college the conventional type flush units will be replaced with modern controlled flush systems, in a phase wise manner.

5.4.2. Water storage facilities of the college

Sl. No	Type	Capacity	Year of installation	Location
1	Tank 1 (Polyethylene tank)	2000 L	2015	Chavara block
2	Tank 2 (Polyethylene tank)	5000 L	2015	Chavara block (For drinking purpose alone)
3	Tank 3 (Polyethylene tank)	2000 L	2004	Administrative block (Above the Dept. of Chemistry)
4	Tank 4 (Concrete tank)	10,150 L	1989	Administrative block (Above the Dept. of Physics)
5	Tank 5 (Concrete tank)	21,840 L	1989	Above the Dept. of Zoology

Table 5.4. Water storage facilities of the college (Total capacity of tanks - 40990 L.)

Sl. No	Filter /cooler	Location
1	Water cooler 1	Auditorium Block
2	Water cooler 2	A Block
3	Sand & carbon filter	In between Tank 1 Tank 2

Table 5.5. Water cooler /filters in the college

5.4.3. Water source, motor and pumps

College has two wells for water intake- one in front of the college and the other inside the campus near to the Chavara square. There are two electric pumps are in the college which pump the water to the five tanks. Pump 1 is taking water from the well situated in front of the college and pump 2 from the well near to the Chavara square.

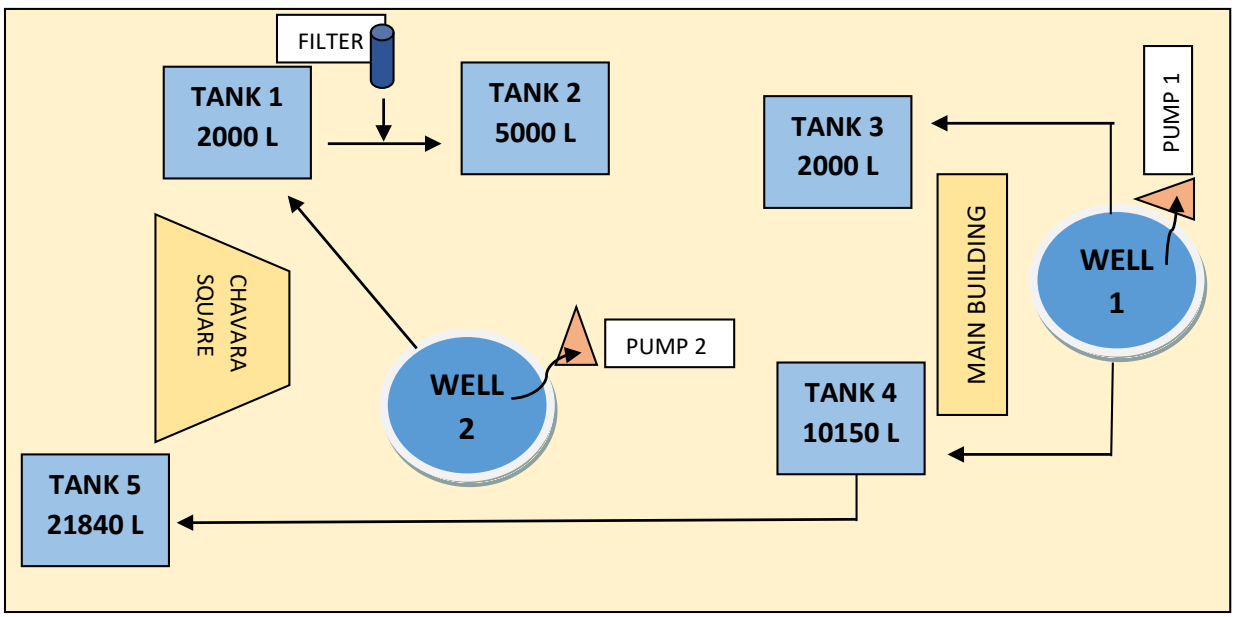


Fig. 5.1. Diagram showing the storage systems and water sources of the college (Not to the scale)

Date	Time-on	Time-off	Duration (minute)
12-07-2024	8:00 AM	9:00AM	60
15-07-2024	8:30AM	09:00	30
16-07-2024	8AM	8:30 AM	30
17-07-2024	08:30	9:30AM	60
18-07-2024	8AM	8:30AM	30
19-07-2024	8:30 AM	10:00AM	90
20-07-2024	8AM	8:45AM	45
22-07-2024	8:12 AM	9:10AM	58
23-07-2024	8:12 AM	9:10AM	58
24-07-2024	8:12AM	9:10AM	58
25-07-2024	9:40AM	11:15AM	95
Average time			55.82

Table 5.6. Duration of pumping for Pump-Motor No.1 (data from pumping register)

Date	Time-on	Time-off	Duration (minute)
12-07-2024	8:00AM	8:15AM	15
15-07-2024	8:30 AM	8:45 AM	15
17-07-2024	8:30 AM	8:45AM	15
18-07-2024	8AM	8:15AM	15
19-07-2024	8:30AM	8:45 AM	15
20-07-2024	8:AM	8:15AM	15
22-07-2023	8:15AM	8:35M	20
23-07-2024	8:20AM	8:35AM	15
24-07-2024	8:30AM	8:45AM	15
25-07-2024	8:37AM	8:50AM	13
Average time			15.3

Table 5.7. Duration of pumping for Pump-Motor No.2 (data from pumping register)

The pumping data shows that Pump 1 is working for 62% of the time required for filling the tank full daily. Pump 2 is working for 76.5% of the time required to fill the tank full, daily. In brief on an average by pumping for 70% of the time required for the tanks full is enough for daily usage of the campus. The full capacity of the tanks altogether is 40990 Litre, 28000 litre water is required for daily usage. Accordingly, the per capita daily usage of water is 16 Litre.

Fig. 5.2. Water meter fixed at the outlet of the tank

5.4.4. Sample study on water usage pattern in the college (Water meter reading)

Monitoring days	Average use of water per day	Total average per consumption per year
Holiday	0	0
Semi holiday	0	0
Working day	685	137000
	Total usage per year	137000

Table 5.8. Average water usage from Tank 1 (in litre/year)

A sample survey was conducted in order to assess the average use of water in the college campus. Five water meters are installed at the delivery line from five water tanks respectively. Internal auditors recorded the data on three sample types of functional days of the college such as working day, holiday and semi holiday. Data was tabulated, statistically analysed and interpreted.

Monitoring days	Average use of water per day	Total average per consumption per year
Holiday	415.33	29073.1
Semi holiday	1279.67	121568.7
Working day	2431.67	486334
	Total usage per year	636975.8

Table 5.9. Average water usage from Tank 2 (in litre/year)

Working days have the highest water consumption due to the presence of students, faculty, and activities, leading to increased demand for water in classrooms, restrooms, and other facilities. On semi-holidays, water usage is reduced compared to working days, possibly due to fewer academic activities or partial attendance of staff and students. However, certain administrative or facility-related operations might still be running, contributing to the relatively higher consumption than holidays. Holidays have the lowest water consumption. This may be due to minimal activities in the campus, with only essential services like security or maintenance teams operating, thus drastically reducing the water demand. Water usage scales significantly based on the type of day, with the most significant consumption on working days.

This suggests that any water-saving initiatives should primarily target working days to have the most impact on overall consumption. A notable reduction in water use during semi-holidays and holidays implies that implementing reduced operational schedules or staggered timings can effectively reduce water consumption.

Monitoring days	Average use of water per day	Total average per consumption per year
Holiday	85	5950
Semi holiday	19.67	1868.65
Working day	248	49600
	Total usage per year	57418.65

Table 5.10. Average water usage from Tank 3 (in litre/year)

Fig.5.3. Water filter well recharging system

Highest consumption on working days: Water usage on working days is significantly higher, likely due to the higher number of students, staff, and activities. This is a key area where water conservation strategies should be focused. Relatively low usage on holidays and semi-holidays: The College is already using significantly less water on non-working days, which suggests good practices in place for water conservation when the campus is less occupied.

Since the working day consumption is much higher, implementing more water-efficient systems, reducing wastage, and promoting awareness among campus users during working days could have a significant impact on overall water savings.

Monitoring days	Average use of water per day	Total average per consumption per year
Holiday	820.67	57446.9
Semi holiday	2160.33	205231.4
Working day	3370	674000
	Total usage per year	936678.3

Table 5.11. Average water usage from Tank 4 (in litre/year)

Working days have the highest water consumption due to full campus activity, with regular classes, administrative work, and increased student and staff presence. On semi-holidays, there is moderate water usage. These days may involve partial campus activity like exams or minimal staff presence, which reduces water usage compared to full working days. On holidays, the water usage is significantly lower, which is expected as the campus would have limited activity, likely just for maintenance or security purposes. Since working days consume the most water, water-saving measures can be introduced, such as installing water-efficient taps or promoting responsible water usage among students and staff. For holidays and semi-holidays, it would be beneficial to ensure that unnecessary water usage (e.g., leaky faucets, maintenance routines) is minimized to lower consumption.

Monitoring days	Average use of water per day	Total average per consumption per year
Holiday	463.33	32433.1
Semi holiday	3113	295735
Working day	3007.67	601534
	Total usage per year	929702.1

Table 5.12. Average water usage from Tank 5 (in litre/year)

Water usage during regular working days is the highest, which is expected due to the full operation of the campus, including students, staff, and facilities like labs, canteens, and washrooms. Water consumption significantly increases on semi-holidays, which may be because some staff or students are still present, along with ongoing maintenance work or other partial operations. During holidays, the water usage is relatively low, likely due to reduced occupancy and limited activities.

The data reflects a predictable pattern where water consumption is lowest during holidays, moderate during semi-holidays, and peaks on full working days. The annual water consumption for working days is notably higher than on semi-holidays and holidays, emphasizing the impact of regular activities on water usage. This insight could be useful for planning sustainable water management strategies.

Tank no.	Total average use per year (in litre)
Tank 1	137000.0
Tank 2	636975.8
Tank 3	57418.65
Tank 4	936678.3
Tank 5	929702.1
Grand Total	26,97,774.85

Table 5.13. Total water usage of the college (in litre/year)

Tank 4 and Tank 5 have the highest water pumping figures, with 936,678.3 litters and 929,702.1 litters per year, respectively. This suggests these motors are likely the primary contributors to the campus's water supply. Tank 3 has the lowest pumping figure at 57,418.65 litters per year. This could indicate it's either a backup motor or is used less frequently. The total amount of water pumped by Tank 2 is somewhat close to Tank 4 and Tank 5 but still significantly lower. This could imply varying usage patterns or operational priorities for each motor.

As per the meter daily usage survey the total quantity of water used per year is 26,97,774 litre. Hence it is estimated that 1540 litre of water is using per head per year in the campus. This data shows that the per capita daily usage of water is 7.7 litre only.

5.4.5. Area wise sample study on water usage pattern in the college (Manual measures)

Area 1 (n=9)	
Section	Rate of discharge (L)/day
Toilet & wash area	639
Drinking water	15
Toilet & wash area	551
Drinking water	11.5
Toilet & wash area	42
Drinking water	12.5
Toilet & wash area	25
Drinking water	0
Toilet & wash area	30
Drinking water	0
Toilet & wash area	15
Drinking water	0
Toilet & wash area	10
Drinking water	0
Toilet & wash area	10
Drinking water	0
Toilet & wash area	10
Drinking water	0
Total	1371

Table 5.14 Average measure of water usage in the Area I (Main block consisting of administrative office, physics and chemistry box)

Area 2 (n=9)	
Section	Rate of discharge (L)/day
Common Wash Area and Toilets	769
Common Wash Area and Toilets	686
Common Wash Area and Toilets	632
Common Wash Area and Toilets	84
Toilet and washroom	70
Common Wash Area and Toilets	176
Common Wash Area and Toilets	0
Common Wash Area and Toilets	0
Common Wash Area and Toilets	0
Total	2417

Table 5.15. Average measure of water usage in the Area II (Language block consisting of Zoology and botany laboratories)

Area 3 (n=9)	
Section	Rate of discharge (L)/day
Toilets and Wash areas	606
Drinking water	45
Toilets and Wash areas	607
Drinking water	43.5
Toilets and Wash areas	610.5
Drinking water	48.75
Toilets and Wash areas	0
Drinking water	0
Toilets and Wash areas	0
Drinking water	0
Toilets and Wash areas	0
Drinking water	0
Toilets and Wash areas	0
Drinking water	0
Toilets and Wash areas	0
Drinking water	0
Toilets and Wash areas	0
Drinking water	0
Total	1960.75

Table 5.16. Average measure of water usage in the Area III (Commerce department near chavara block)

Area 4 (n=9)	
Section	Rate of discharge (L)/day
Toilet & wash area	910
Drinking water	157.5
Toilet & wash area	870
Drinking water	142.5
Toilet & wash area	895
Drinking water	142.5
Toilet & wash area	895
Drinking water	123.75
Toilet & wash area	60
Drinking water	10
Toilet & wash area	110
Drinking water	10
Toilet & wash area	35
Drinking water	8.75
Toilet & wash area	0
Drinking water	0
Toilet & wash area	0
Drinking water	0
Toilet & wash area	0
Drinking water	0
Total	4370

Table 5.17. Average measure of water usage in the Area IV (Auditorium, canteen and Mathematics)

No.	Area code	Section of the campus	Average water usage (in L) per day
1	Area I	Main block consisting of administrative office, physics and chemistry box	1371
2	Area II	Language block consisting of Zoology and botany laboratories	2417
3	Area III	Commerce department near chavara block	1960.75
4	Area IV	Auditorium, canteen and Mathematics	4370
	TOTAL		10118.75

Table 5.18. Comparison of average water usage in different areas of the college campus

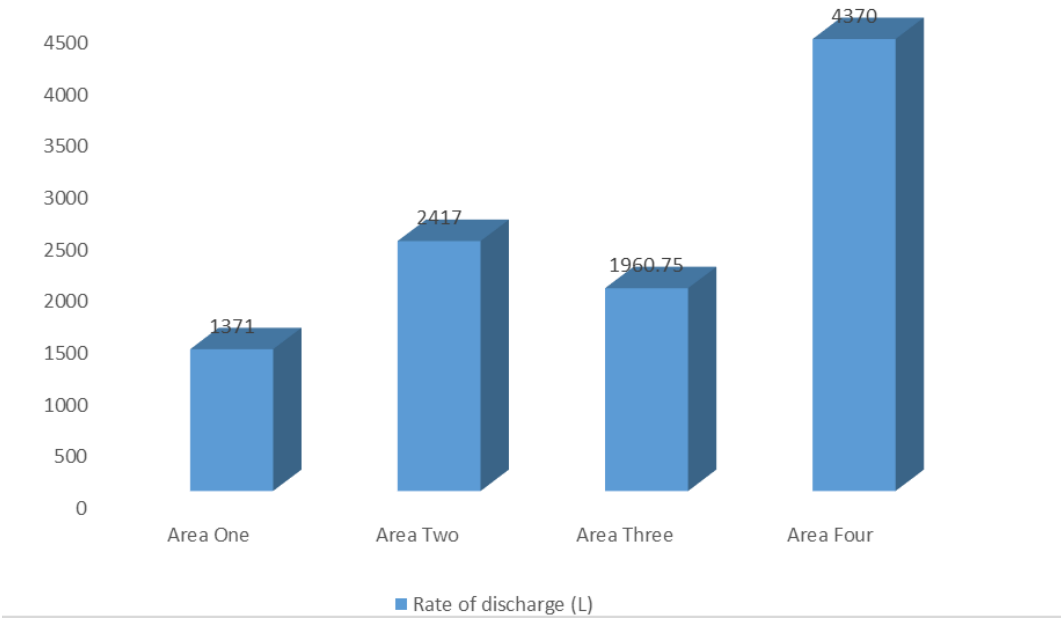


Fig.5.2. Comparison of water usages in different sections of the college campus (n=36)

The auditorium, canteen, and mathematics area have the highest discharge rate (4370 L), indicating a larger water source or greater water input compared to other areas. The canteen uses a significant amount of water for food preparation and has high wash area usage, while the auditorium requires substantial water for events and programs. In contrast, the main block, which includes the administrative office and physics and chemistry departments, has the lowest discharge rate (1371 L), suggesting limited water flow, likely due to minimal water usage.

No.	Sampling method	Average total water usage in the campus (litre/year)	Remarks
1	Using meter data of tank output	26,97,774.85	Periodic Water meter reading
2	Pumping data	57,38,600.00	Based on pumping time
3	Area-wise user point sampling	25,29,687.50	Measured sampling of water outlets
	Average	36,55,354.12	Rough estimate

Note: Data collected through participatory research mode. Sampling error may be relatively high.

Table 5.19. Total water usage in of the college campus – comparison of various estimations

5.4.6. Water quality analysis

College has been conducting water quality tests with approved laboratories and periodically assess the quality of water resources (two wells). Physical, chemical and bacteriological parameters are tested and quality is ensured.

Annual cleaning of water sources and storages are reported. Biannual cleaning and water quality analysis are recommended.

5.4.6. Water conservation measures

The college has a well recharge system that directs water from the roof of the main building to the well near Chavara Square. The location of the college is very close to an extensive wetland, so water shortages are not experienced even during the summer months. This situation has led to slight neglect and low maintenance of the well recharge system. The internal audit team has taken measures to revive the filtration system.

5. 5 CONCLUSION

- The college has a well-planned, but installed about 2-3 decades back, water collection, storage and pumping system. The main water resources are two open wells and five storage tanks are connected to these wells through two motor-pumps.
- The water delivery infrastructure is optimum. Conventional taps are the principal mode of water release at the user end. It shall be replaced with more water conserving taps at least in gent's toilets.
- The total water storage capacity of water-tanks in the college is 40990 Litre. But, 70% of its utilization is only reported as per the pumping data. Hence the per capita per day usage of water is estimated as 16 lit.
- The sampling study on water meter data (meters fitted on the tank outlets) the per day usage is 13488 litre only. This means that per capita per day usage is 7 litre only.
- The per capita usage as per the pumping data is almost double the per capita usage estimated through sampling study of meter reading. This may be because of the short period of the study. However, there may be wastage of water is routine in the campus and awareness campaigns shall be conducted.
- Water quality is good and it is periodically assessed through mandatory testing.
- Water resources are perennial and even during extreme summer water scarcity hasn't been reported.
- A well recharge system is installed with Well 2. There are no major water conservation measures or practices in the college due to the abundance of water.

5.6 RECOMMEDATION

- Being an academic institution, the students learn from the practices of the college in every aspect of life. Hence, more water conservation programmes shall be conducted in the campus.
- Periodic maintenance of water infrastructure is highly important.
- Biannual water quality testing of water sources recommended.
- Awareness programmes shall be conducted regularly for all stakeholders in order to empower and help them to habituate with water friendly lifestyle.
- Sustainable practices shall be implemented in the college in order to demonstrate and teach the students on such practices.

5.7 WATER EFFICIENCY MANAGEMENT SYSTEM PLAN

5.7.1Establish an Energy Management Team

- **5.7.1.1 Composition:** Include faculty, administrative staff, students, and external energy consultants.
- **5.7.1.2 Responsibilities:** Oversee water audits, implement water -saving measures, monitor progress, and engage the campus community in resource maintaining initiatives.

5.7.2. Assessment and Audit

- **5.7.2.1 Conduct a Water Audit:** Perform a detailed assessment of current water usage across the campus, including drinking water, restrooms, laboratories, landscaping, and other facilities.
- **5.7.2.2 Identify High-Consumption Areas:** Determine which areas consume the most water and identify any leaks or inefficiencies.

5.7.3 Water Conservation Strategies

- **5.7.3.1 Install Water-Efficient Fixtures:** Replace old faucets, showerheads, and toilets with low-flow or sensor-based models.
- **5.7.3.2 Promote Behavioural Change:** Educate students, faculty, and staff on water conservation

practices through workshops, signage, and campaigns.

- **5.7.3.3 Implement Water-Saving Technologies:** Use smart irrigation systems that adjust watering schedules based on weather conditions to reduce water waste in landscaping.

5.7.4 Rainwater Harvesting

- **5.7.4.1 Install Rainwater Harvesting Systems:** Collect and store rainwater from rooftops for non-potable uses such as irrigation, toilet flushing, and cooling systems.
- **5.7.4.2 Educate and Involve the Community:** Involve students in designing and maintaining the rainwater harvesting system as part of sustainability education.

5.7.5 Grey water recycling

- **5.7.5.1 Set up Grey water Recycling Systems:** Collect grey water from sinks, showers, and laundry facilities and treat it for reuse in landscaping or toilet flushing.
- **5.7.5.2 Integrate with Campus Infrastructure:** Ensure the grey water system is well- integrated with existing plumbing and landscaping needs.

5.7.6 Monitoring and Maintenance

- **5.7.6.1 Install Water Meters:** Place water meters in different campus zones to monitor and track water usage.
- **5.7.6.2 Regular Maintenance:** Develop a schedule for regular inspection and maintenance of water infrastructure to prevent leaks and inefficiencies.
- **5.7.6.3 Data-Driven Decision Making:** Use data collected from water meters and audits to continuously improve water management practices.

5.7.7 Incorporating Water Management in Curriculum

- **5.7.7.1 Interdisciplinary Courses:** Offer courses or modules on water management, sustainability, and environmental science that include practical projects related to campus water use.
- **5.7.7.2 Student-Led Initiatives:** Encourage student research and projects focused on improving water management on campus, fostering a culture of innovation and sustainability.

5.7.8 Emergency Preparedness

- **5.7.8.1Develop a Drought Management Plan:** Prepare for water scarcity situations by creating a drought management plan that includes water rationing, emergency supplies, and alternative water sources.
- **5.7.8.2 Establish Emergency Response Protocols:** Ensure the campus is equipped with protocols for addressing major leaks, contamination, or other water-related emergencies.

5.7.9 Engagement and Outreach

- **5.7.9.1 Collaborate with External Partners:** Work with government agencies, NGOs, and other educational institutions to share best practices and innovations in water management.
- **5.7.9.2 Community Involvement:** Engage the local community in water conservation efforts, including awareness programs and collaborative projects.

5.7.10 Continuous Improvement

- **5.7.10.1 Regular Reviews:** Periodically review the water management plan to incorporate new technologies, research findings, and policy changes.
- **5.7.10.2 Set Targets and Goals:** Establish measurable water conservation goals and report progress to the campus community to maintain accountability and transparency.

5.8 ACTIVITIES CONDUCTED

Report on the Conduct of International Conference on Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice and
Artificial Intelligence held at St. Aloysius College, Elthuruth, Thrissur

Introduction:

- The two-day International conference on Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice and Artificial Intelligence

was held on the 18th and 19th of October 2023. It was a joint effort of the Research and PG Department of English, St Aloysius College, Elthuruth, Thrissur, Journal of Dharma, and Globethics. The objective of the conference was to bring together scholars, researchers, and practitioners from diverse fields to discuss sustainability, species justice and artificial intelligence in literature and higher education.

Overview of Conference:

- The conference began with a programme introduction given by Ms. C.M. Meera, PhD Research Scholar, St. Aloysius College. This was followed by a welcome address delivered by Dr Betsy Paul C., Director, Research Centre in English, St. Aloysius College, Elthuruth. The Manager of St. Aloysius College Rev. Fr. Thomas Chakramakkil gave the inaugural address. It was followed by the Presidential Address given by Dr. Chacko Jose P, Principal, St. Aloysius College.The organizing secretary of Globethics Ms. Rajula V introduced the keynote speaker Rev Dr Fr Jose Nandhikkara CMI who is the national director of Globethics. The keynote speaker spoke on ethics and philosophy. This was succeeded by a talk on the organisation Globethics, its role and contributions given by Ms. Christine Housel, Donor Relations and Strategic Partnership, Geneva, Switzerland. Dr. Libison K.B, IQAC coordinator offered his felicitation and good wishes to the organizers and management for the organisation and conduct of this conference in his address. The head of the department Mr. Jaison Jose P proposed the vote of thanks.
- This was followed by the second keynote address given by Dr. Mohammad Shamsul Hoque, Professor in English, Daffodil International University, Bangladesh. The plenary afternoon session concluded with a panel discussion on "AI Ethics and Education: AI as the Student or Teacher?". Dr. Aleksandra Stevanovic, Dr. Brinda Sachidanandam and Dr. Nisha Francis Alapatt provided diverse and insightful comments and viewpoints on this topic. The proceedings of the first day concluded with a discussion and presentation of various papers
- related to the conference themes in six parallel offline sessions held in college and six parallel online paper presentation sessions held in the Zoom platform.
- The second day of the conference began with the presentation of various papers related to the conference in two offline and three online parallel sessions. The agenda and schedule for the second day of conference was laid out by Ms. Meera C M, PhD Research Scholar, St. Aloysius College, Thrissur. The first plenary session for the day commenced with a panel discussion on "Sustainability Matrix of HEI". Rev. Fr. Joseph Kusumalayam, Ms. Mary Pathrose, Mr Santhosh Thannikat, Dr. Vargheese K.J and Ms. Vineetha Davies V conducted the deliberations on this topic. The second plenary talk was delivered by Mr. J Anantha Krishnan, Senior Research Fellow, Department of English, Sreesankaracharya University, Kalady. The third session of the plenary talk was delivered by Dr. Nandini C Sen, Associate Professor, University of Delhi.
- This was followed by the valedictory function. Dr. Deepti Parangot, Programme Coordinator, Dept. of English, welcomed everyone to the valedictory function. The Valedictory Address was delivered by Dr. Chacko Jose P, Principal, St. Aloysius College. Participants were given an opportunity to share their feedback and response at the end of the valedictory function. The participants gave positive responses congratulating and appreciating the organisers and the college management for the successful execution of the conference. Thereafter the certificates of the participants were distributed by Rev. Fr. Arun Jose K. CMI bursar, St. Aloysius College. Dr. Atheetha K. Unni, organizing secretary gave the vote of thanks and the programme was concluded by 3.00 PM on 19 October 2023.

Conclusion:

- In conclusion, the International conference on Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice and Artificial Intelligence was a valuable and thought-provoking event. Since it was an International Conference it provided a platform for scholars, researchers, and practitioners from diverse fields and faraway places to come together and discuss the ethical questions and dilemmas in modern life. Interdisciplinary approach and the inclusion of marginalized voices were notable strengths of the conference. The discussions and presentations generated important insights and highlighted the need for a more inclusive and socially just society.

International Conference on *Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice, and Artificial Intelligence*

Jointly organized by Globethics, South Asia Centre,
Journal of Dharma and St Aloysius College, Elthuruth

18 & 19 October 2023

Globethics

Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice, and Artificial Intelligence

The 4th UN Sustainable Development Goal to "ensure inclusive and equitable quality education and promote lifelong learning opportunities for all" can find its rightful objective only from a strong ethical foundation. Since cosmic, global, inter- and intra-generational justice is at the very core of the concept of Sustainable Development, deliberations on higher education need to incorporate them. The "capability approach" advocated by Amartya Sen can initiate interesting and useful dialogues in this regard.

Higher Educational Institutions (HEI) need to consider seriously Markus Vogt and Christopher Weber's contention in "The Role of Universities in a Sustainable Society: Why Value-Free Research is Neither Possible nor Desirable," that "ineffective ethical knowledge relates to a ... shortened understanding of rationality, which subsequently leads to the marginalization of ethical questions."

NEP 2020 too envisages an education that will "build character, enable learners to be ethical, rational, compassionate, and caring," and asserts that education must develop "social, ethical, and emotional capacities and dispositions" along with cognitive capacities. Learners are, the policy states, to be given a "Global Citizenship Education (GCED)" that empowers them "to become aware of and understand global issues and to become active promoters of more peaceful, tolerant, inclusive, secure, and sustainable societies."

In the meantime, the onset of Artificial Intelligence into all spheres of human existence compels us to address ethical challenges from the very core of our epistemological conceptualisations and our stated objectives of higher education. Ethical interventions are needed to address dilemmas resulting from applications of AI in teaching, learning and evaluation.

NEP 2020 emphasizes holistic higher education by underscoring the fact that "research in the arts and humanities, along with innovations in the sciences and social sciences, are... extremely important for the progress and enlightened nature of a nation."

Studies in and on literature are capable of incorporating the aesthetic and the emotional with the rational and the ethical thus delineating cautionary principles and visionary conceptualisations. Literary studies can probe into the ethical parameters in institutional administration, governance, applied pedagogies, learning objectives and even epistemological frameworks.

The *International Conference on* "Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice, and Artificial Intelligence" intends to serve as a vital platform to explore the intricate relations between Higher Education and ethics primarily from the background of literary studies. At the same time since the topic necessitates a multi-disciplinary approach, scholarly research papers are invited from all domains of Humanities and Social Sciences to foster dialogue, critical thinking, and ethical awareness.

Thrust Areas

Papers are invited in areas related to (but not restricted to) the following:

Ethics and Policy Making in Higher Education and NEP 2020
Ethical Leadership in Academic Institutions
Ethical Challenges in Teaching and Learning
Ethics in Pedagogy/Curriculum
NEP 2020's vision of Holistic Higher Education
Ethical Implementation of NEP 2020
Ethical Higher Education in literary imagination
AI Ethics and AI-generated Literature: Creativity and Authorship
AI Ethics and Data Bias
Ethics, Culture, Race, Gender
Ethical Choices and Moral Dilemmas in Literature
Species justice and creative literature
Research Ethics and Academic Writing, Publishing
Inclusive Practices in Higher Education
Ethics and Educational Technology
Sustainability in Literary works
Sustainability in Higher Education

Submission Guidelines

- We solicit original, unpublished research papers that cater to the above thrust areas.
- Abstracts should be typed in Times New Roman font in MS Word format.
- The word limit for the abstract is 300.
- The word limit for the full paper is 2000-4000, following the MLA 9th edition guidelines
- Font size should be 12 for the text and 14 for titles with double spacing.
- Remember to include your full name, designation, institutional affiliation, phone number, and e-mail ID along with the abstract.
- The abstracts received will be reviewed by a panel of experts. Only selected abstracts will receive an acknowledgement via e-mail.
- A few selected papers, based on double-blind peer reviews, will find their place in the Journal of Dharma. The rest of the selected papers will be published as a book with an ISBN. **The selection of the abstract will not ensure the selection of the paper for publication.**

Please send your abstracts to
staloysiusethicsconference2023@gmail.com

IMPORTANT DATES
Abstract Submission: 05 September 2023
Intimation of Acceptance: 08 September 2023
Submission of Full Paper: 08 October 2023

Fee Structure

For paper presentation (both offline and online):
Faculty: **INR 1200/-**
Research Scholars/Students/Others: **INR 800/-**
For physical participation without presentation: **INR 300/-**
Online Participation: **Free**

ACCOUNT DETAILS
Name: **St Aloysius Educational Trust**
Name of the Bank: **Federal Bank**
Branch: **Olari**
Account Number: **12400100165271**
IFSC Code: **FDRL0001240**

*Fee includes lunch and refreshments for two days.
*If the presentation is done by more than one presenter, each presenter has to make a separate fee payment

Though we encourage physical participation, the conference is envisaged in a hybrid mode. Limited accomodation can be arranged on payment @ nearby hotels

Contact Us:
staloysiusethicsconference2023@gmail.com
Dr Atheetha K.Unni : 85900 35196

St Aloysius College, Elthuruth

St Aloysius College, Elthuruth, Thrissur, founded in 1968, is a first-grade college affiliated to the University of Calicut. It is administered by St Mary's Monastery under the CMI Congregation, guided by the principles of St Kuriakose Elias Chavara. The vision of the college is to mould intellectually inspired individuals capable of building a more humane social order within the context of religious pluralism and cultural diversity.

Research Centre & Department of English

The Department of English offers Undergraduate, Postgraduate, and Doctoral Programmes in English Language and Literature. Eminent faculty and updated technological assistance make the department a noted presence in academic and societal endeavours alike.

Globethics, South Asia Centre

Domiciled in Geneva, Switzerland, Globethics is an international organization committed to furthering its vision of Ethics in higher education. The organization reaches out to teachers, students and other stakeholders to support the integration of relevant and contextual standards and structures to promote a deeper understanding of ethics in their context. Through training programmes, research, collaborative projects and introduction to best practices, Globethics ensures qualitative differences in the approach to ethics and aims to achieve the United Nations Sustainable Development Goals through its endeavours.
To know more about Globethics and its resources visit:
www.globethics.net

Journal of Dharma

The Dharmaram Journal of Religions and Philosophies (ISSN 0253-7222), published by the Centre for the study of World Religions at Dharmaram Vidya Kshetram, Bengaluru since 1975, is a peer reviewed International Quarterly Journal that brings together scholars from all over the world and from across diverse cultures and traditions to seriously deliberate upon issues pertaining to religions and philosophies, encouraging research in inter-religious studies and dialogue. It is indexed in Arts and Humanities Citation Index (A&HCI) and Current Contents/ Arts & Humanities (CC/A&H) of the Institute Scientific Information, Scopus Index, Philosopher's Index: Religious Index One: Periodicals, Chicago and ATLA Religion Database.

Organising Committee

Rev. Fr Thomas Chakramakkil CMI (Manager, St Aloysius College)

Rev. Fr Dr Jose Nandikkara CMI (India National Director, Globethics, South Asia Centre, Bengaluru)

Rev. Fr Dr Mathew Aattumkal CMI (Editor, *Journal of Dharma*)

Dr Chacko Jose P. (Principal)
Rev. Fr. Arun Jose K. (Bursar)
Dr Libison K. B. (Coordinator, IQAC)
Dr Betsy Paul C. (Director, Research Centre in English)
Mr Jaison Jose P. (HoD, Department of English)
Ms Reshma K. Jose
Dr Abin Sojan
Mr Sandeep E.S.
Dr Arathi Babu
Ms Shruthy Krishnadas
Ms Athulya Surendran
Ms Jitha Gopinath
Ms Nima A.M
Ms C.M.Meera

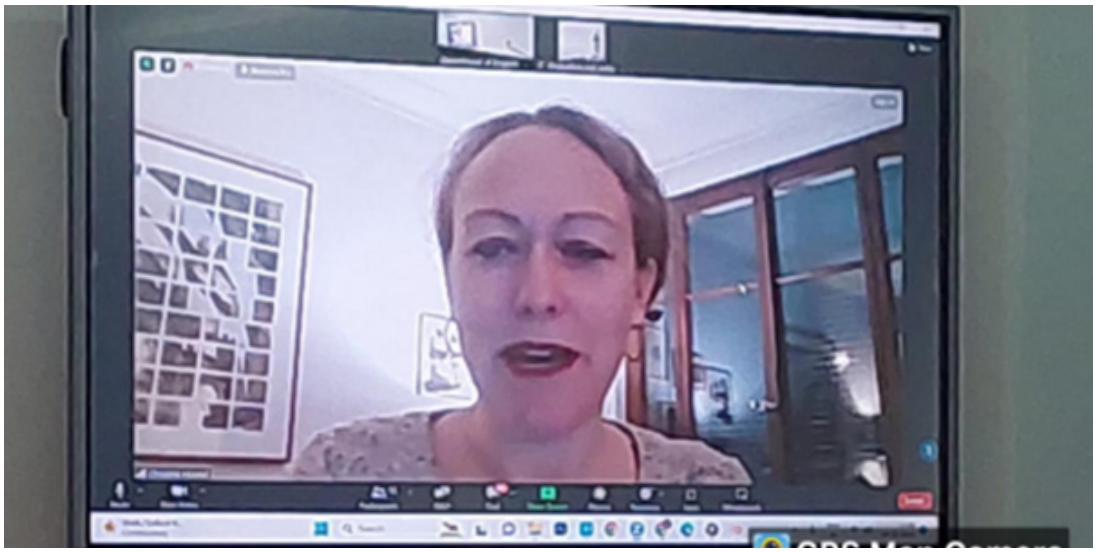
Organising Secretaries

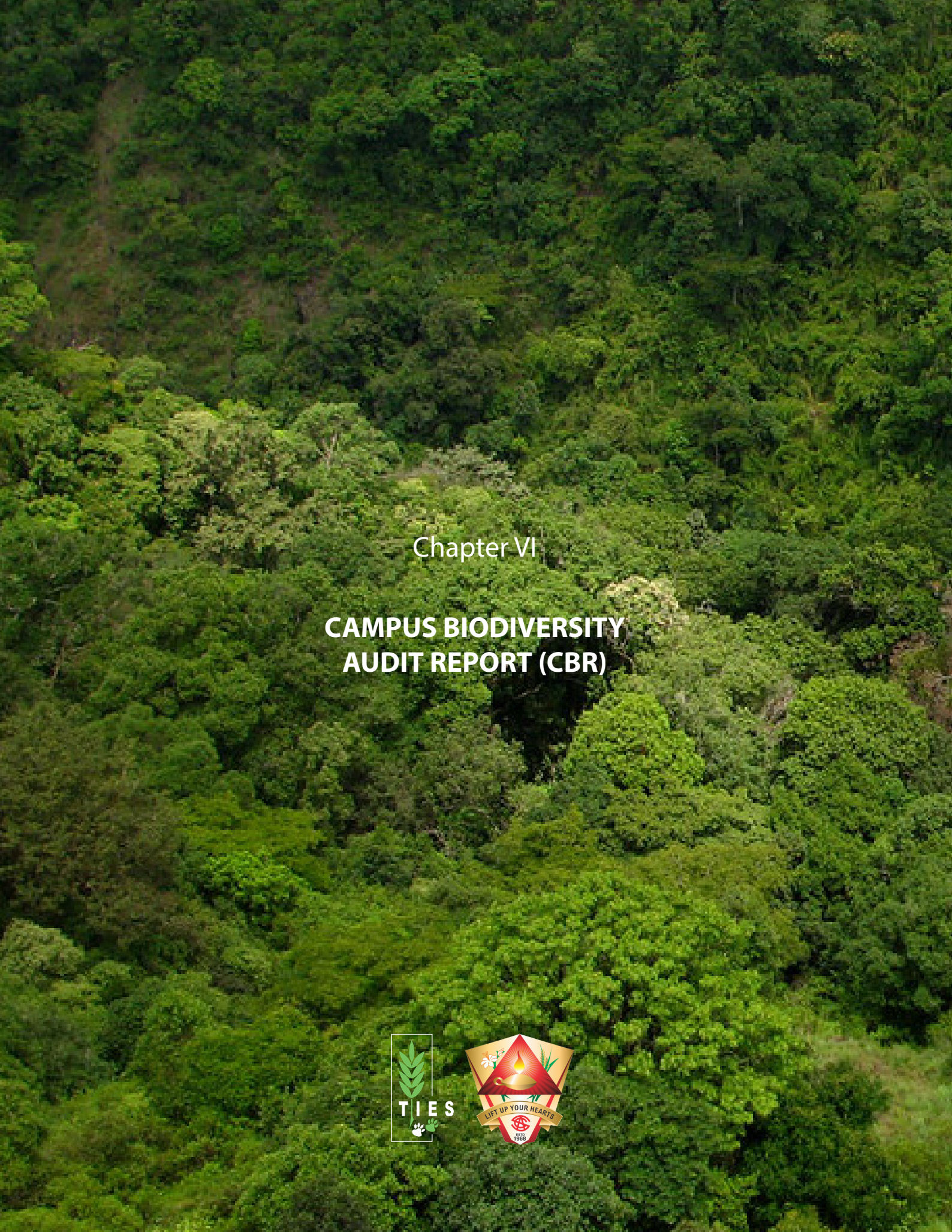
Ms Rajula V.
Regional Manager,
South Asia Centre,
Bengaluru

Dr Atheetha K.Unni
Assistant Professor
Research & PG
Department of English


International Conference on
Literary Studies and Ethical Higher Education: Exploring Sustainability, Species Justice, and Artificial Intelligence
18 &19 October 2023
Jointly organised by St. Aloysius College, Globethics & Journal of Dharma
Globethics
India National Director,Globethics
Manager
Principal
Bursar
Rev.Fr.Dr. Jose Nandikkara CMI
Rev.Fr.Thomas Chakramakkil CMI
Dr. Chacko Jose P.
Rev.Fr. Arun Jose K. CMI
RESOURCE PERSONS
Dr. Mohammed Shamsul Hoque
Dr. Nandini C. Sen
Christine Housel
J.S. Ananthakrishnan
PANNEL DISCUSSION
Santhosh Thannikat
Rev.Fr.Dr. Joseph Kusumalayam CMI
Dr Brindha T. Sachidanandam
Pallikatil Mary Pathrose
PANNEL DISCUSSION
Dr. Aleksandra Stevanovic
Vineetha Davies V.
Dr.K.J. Vargheese
Dr Nisha Francis Alapatt
Director of Research
Head of the Department
Organising Secretatires
Register here.
Dr Betsy Paul C.
Jaison Jose P.
Dr. Atheetha K.Unni
Rajula V.


GPS Map Camera





Chapter VI

CAMPUS BIODIVERSITY AUDIT REPORT (CBR)

TIES

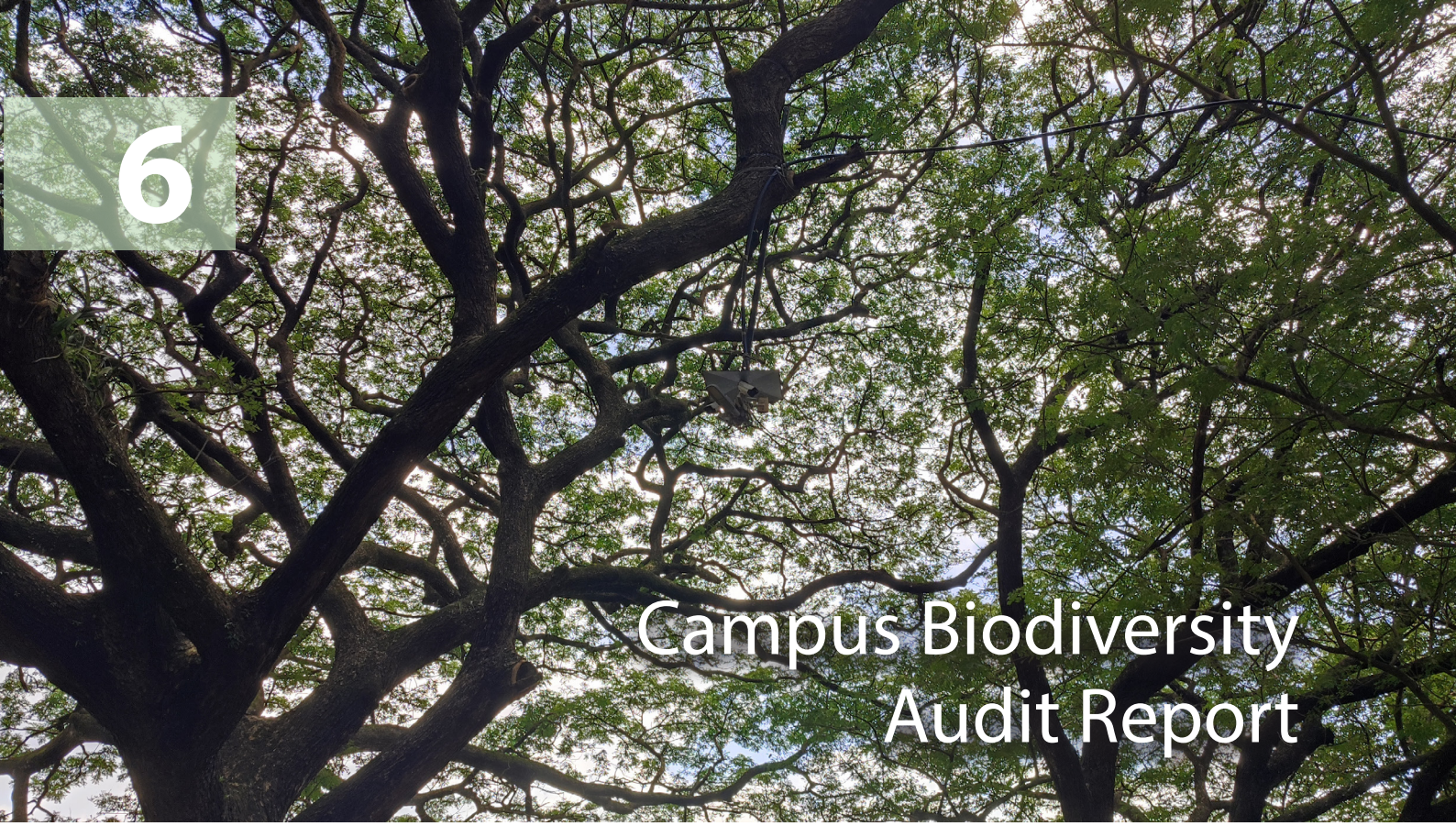
LIFT UP YOUR HEARTS

BIODIVERSITY MANAGEMENT COMMITTEE
(BMC 2021-24)

Mr. Jain J Therattil
Dr. Litty R.
(Assistant Professors)

Mr. Paul M. A.
(Lab assistant)

Ms. Mahalakshmi V.
Sarang Sanilan
Sana C. S.
Geethika P. G.
Gouri K. Uday
Albin Sunny
(Students)



6

Campus Biodiversity Audit Report

6.1 INTRODUCTION

Biodiversity plays a fundamental role in sustaining life by providing critical ecosystem services such as food provisioning, water purification, flood and drought control, nutrient cycling, and climate regulation. These services are indispensable for supporting human well-being and fostering economic growth. Despite the significant economic, social, and cultural values associated with biodiversity and ecosystem services, biodiversity loss is occurring worldwide, often at an accelerating pace. This loss stems from various factors including pollution, erosion, evolution, urbanization, industrialization, population growth, and habitat depletion. Habitat destruction, primarily driven by development activities, is a common cause, while the exploitation of particular species for economic gain or recreational purposes also contributes to biodiversity decline. Such loss has profound consequences for ecosystems, signalling either the disappearance or reduction of species within natural habitats, or both, at a global scale. The repercussions of biodiversity loss extend to the ecosystem's functionality and food chains, impacting agriculture and weakening resilience to natural disasters such as floods and droughts. Safeguarding biodiversity is imperative as its loss threatens:

- Reduction in genetic diversity
- Homogenization of flora and fauna
- Disruption of vital ecosystem functions essential for human needs such as pharmaceuticals, food, timber, and air and water purification.

Ecosystem services encompass a range of benefits that ecosystems offer. These span provisioning services like food, water, timber, fibre, and genetic resources; regulating services such as climate control, flood mitigation, disease regulation, and water purification; cultural services providing recreation, aesthetic appreciation, and spiritual enrichment; and supporting services like soil formation, pollination, and nutrient recycling. Human utilization of ecosystem services is swiftly expanding. As per the millennium ecosystem assessment, around 60% (15 out of 24) of the evaluated ecosystem services, encompassing 70% of regulating and cultural services, are undergoing degradation or unsustainable usage.

6.1.1 What is Biodiversity Audit?

The Biodiversity Audit entails an examination of biodiversity's significance across the campus. By implementing a Biodiversity Audit Strategy, aim to establish a foundational assessment of the campus' green areas' potential to support important and safeguarded habitats and species. Moreover, the audit offers tailored suggestions for bolstering and optimizing biodiversity. Through this assessment,

will delineate current site habitats, produce habitat maps for each area, and evaluate the condition of each habitat type. Additionally, we will scrutinize existing management practices and, where applicable, offer recommendations for enhancing current conditions. Our ultimate goal is to gauge measurable biodiversity advancements, thereby contributing to future biodiversity gains.

6.1.2 Why measuring biodiversity?

- Degradation of habitats at alarming rate- urgent to estimate the current status before extinction
- Measures of biodiversity regarded as indicators of the wellbeing of ecological systems
- Currently biodiversity is the central theme of ecology and development
- Varied tools and techniques are essential for measuring biodiversity in diverse habitats
- Mandatory- as a signatory of Convention on Biological Diversity (1992)
- Mandatory as per Biodiversity Act, 2002 & Biodiversity Rules, 2004.

6.1.3 Need for biodiversity audit

The biodiversity audit looks at how well the college/ university campus provide habitat for wildlife (any animal or plant which are not nurtured by man). It also helps to aware and sensitise the college community on the importance and services provided by the biodiversity. The functions of the biodiversity audit are:

- college community is aware and sensitised on the campus biodiversity
- improved greenery and liveliness
- improved aesthetic beauty of the campus
- enhanced informal and formal education provisions in the campus (name tag on a tree is an example)
- Better safeguard to public health and environment (good air, water, food etc.)
- an effective educational and public relations tool (e.g., exhibition of thematic gardens)
- community education and community feedback (e.g., traditional knowledge regarding plants or animals)

6.2 CAMPUS BIODIVERSITY MANAGEMENT POLICY

6.2.1 Statement of Commitment

Human socio-economic activities and quality of life depend on ecosystem services, including provisioning (food, water, timber), regulating (climate control, disease regulation, flood protection), and supporting (soil formation, nutrient cycling) services. Biodiversity loss is a critical global threat, with over a third of species facing extinction and 60% of ecosystems degraded in the last 50 years. Role of education institution is essential for the sustainable and equitable use of biodiversity and its conservation, as well as for mainstreaming biodiversity. A lack of awareness about biodiversity and its importance often leads to its exploitation through activities like unsustainable logging or poaching. The future of biodiversity depends on the global collective action of an educated society, including efforts to promote local and indigenous knowledge of biodiversity to address this need, the institution aims to promote biodiversity conservation by conducting biodiversity audits to monitor and enhance campus biodiversity and species abundance. This policy establishes guidelines for these audits to ensure sustainability and biodiversity conservation.

6.2.2 Goals

- To create a sustainable, biodiverse, and ecologically resilient campus environment that supports native species, promotes environmental stewardship, and serves as a living laboratory for the conservation of sustainable practices.

6.2.3 Objectives

- To conducting a biodiversity assessment involves surveying and documenting the diverse range of species found on the campus, specifically on major groups of plants and animals and for possible fungi, and microorganisms. This endeavor contributes to a comprehensive understanding of biodiversity and the health of the ecosystem.
- To identify and document species present on the campus, encompassing both native and non-native varieties. This effort aims to compile species lists and discern which species might be invasive or endangered.

- To map various habitats across the campus, such as woodlands, grasslands, wetlands, and human activity area to evaluate their quality and biodiversity significance. This understanding of habitat distribution aids in planning for conservation efforts.
- To educate students, faculty, and staff about the biodiversity in local environment and the critical importance of conservation. Active participation in the assessment can enhance awareness and cultivate a commitment to environmental stewardship.
- To offer suggestions for conservation initiatives and management approaches aimed at improving biodiversity on campus. These recommendations may involve restoring habitats, planting native species, and minimizing environmental impacts.
- To engage the wider campus community, local stakeholders, and potentially the public in efforts to conserve biodiversity. This promotes partnerships and encourages collective responsibility for environmental stewardship.
- To incorporate biodiversity considerations into campus planning and development processes. This ensures that future projects on campus prioritize the preservation and enhancement of biodiversity.

6.2.4 Biodiversity Audit Process

- **6.2.4.1.** Conduct regular biodiversity audits to assess the abundance and distribution of flora and fauna across campus.
- **6.2.4.2.** Document species diversity and population trends using standardized methods.
- **6.2.4.3.** Identify and prioritize areas for conservation and habitat restoration based on audit findings.

6.2.5 Responsibilities

- **6.2.5.1** Oversees the implementation of biodiversity audits, develops conservation strategies, and coordinates educational initiatives.
- **6.2.5.2** Ensures adherence to biodiversity conservation measures during campus construction and maintenance activities.
- **6.2.5.3** Integrate biodiversity conservation into relevant curricula and research activities.
- **6.2.5.4** Actively participate in biodiversity conservation efforts and support related educational initiatives.

6.2.6. Curriculum Integration

- **6.2.6.1 I**ncorporating environmental and sustainability topics into the curriculum across various disciplines. Encourage students to engage in research projects that focus on local biodiversity and conservation efforts.
- **6.2.6.3.** Publishing books or book chapters on campus biodiversity, and providing nameplates and barcodes on each plant to share knowledge about campus flora with the student community.

6.2.7 Education and Outreach

- **6.2.7.1** Organize workshops, seminars, and educational campaigns to promote awareness about the importance of biodiversity conservation among students, staff, and the community.
- **6.2.7.2** Encourage active participation from students and staff in citizen science projects, such as species monitoring, biodiversity surveys, and habitat restoration efforts.
- **6.2.7.3** Build partnerships with local communities, government bodies, and conservation organizations to extend conservation initiatives beyond the campus and contribute to broader environmental preservation efforts.

6.2.8 Research and conservation

- **6.2.8.1** Conducting both minor and major research projects focused on the biodiversity within the campus, including monitoring changes in patterns, identifying emerging threats, and addressing challenges to conservation.
- **6.2.8.2** Assisting local communities and governing bodies in the preparation of People's Biodiversity Registers (PBRs) to document and conserve biodiversity at the local level.
- **6.2.8.3** Carrying out field surveys in local and neighboring areas to compile a comprehensive checklist of flora and fauna, aiding in the understanding and protection of local biodiversity.
- **6.2.8.4** Recording and preserving traditional knowledge related to biodiversity from the local community, ensuring that valuable cultural insights are integrated into conservation efforts.

6.2.9 Conservation Measures

- **6.2.9.1** Implement habitat restoration initiatives to enhance biodiversity hotspots, aiming to restore natural ecosystems and improve species diversity.
- **6.2.9.2** Establish designated protected areas and wildlife corridors to safeguard critical habitats, ensuring connectivity for species migration and survival.
- **6.2.9.3** Regularly monitor and manage invasive species to mitigate their impact on native biodiversity, helping to preserve the ecological balance.
- **6.2.9.4** Promote sustainable landscaping that prioritizes native plant species, supporting local flora and fauna while reducing the ecological footprint.

6.2.10 Purchasing and Procurement

- **6.2.10.1.** Purchase plants that need to be conserved.
- **6.2.10.2.** Purchase earthworms for composting on campus, to be used as manure in the campus garden.

6.2.11 Community Engagement

- **6.2.11.1** Collaborate with local communities for the conservation and cultivation of various plants by providing them with seeds, seedlings, and other resources
- **6.2.11.2** Sharing resources and knowledge to promote environmental awareness beyond campus borders.

6.2.12 Monitoring and Reporting

- **6.2.12.1** Establishing mechanisms to monitor progress towards environmental goals.
- **6.2.12.2** Regularly assessing the institution's environmental performance.
- **6.212.3** Schedule regular meetings to assess progress, tackle challenges, and plan future actions.
- **6.2.12.4** Ensure transparent reporting of results to stakeholders to maintain accountability and transparency.

6.2.13. Compliance and Review

- **6.2.13.1** Conduct periodic reviews of biodiversity policies to ensure they remain relevant and effective.
- **6.2.13.2** Regularly update the checklist at specific intervals based on various feedbacks.

6.2.14 Conclusion

Offer hands-on learning experiences and interdisciplinary research opportunities to enhance ecosystem services, mitigate environmental impact, and foster environmental awareness, values, and stewardship among students, faculty, and staff, ultimately contributing to global biodiversity conservation efforts

6.3 METHODOLOGY

To safeguard and preserve biodiversity, the college has implemented a comprehensive biodiversity conservation strategy as part of its broader sustainability goals. The methodology involves forming a biodiversity audit team consisting of 7 members (5 students and 2 faculty members) responsible for conducting biodiversity assessments and coordinating internal audits.

6.3.1 Data sampling by categorizing the area in different zone

Key activities include conducting repetitive field surveys using random sampling, spot surveys, and transect walk surveys to collect taxonomical data on various species of flora (herbs, plants, trees) and for fauna transects were laid for birds and quadrates study was conducted for butterflies and insects.

6.3.2 Calculating the campus diversity

Biodiversity indices, particularly Simpson's Diversity Index, are calculated for major floral and faunal species through quadrat sampling and transect methods. The data is used to evaluate species richness and evenness, providing insights into overall biodiversity health.

6.3.3 Preparing the checklist & threat and challenges on biodiversity of college campus

The audit group also identifies potential threats and challenges to the biodiversity within the campus and proposes management plans or solutions based on both primary data and secondary sources. Progress is consistently monitored through periodic meetings, where programs promoting green initiatives and raising awareness are reviewed. The documentation of these activities is carried out by the assigned students and faculty members to ensure that all efforts contribute to fostering a culture of sustainability, starting within the campus and gradually extending to the wider community.

6.3.4 Assumption of Biodiversity audit ISO standards

Biodiversity is declining at an unprecedented rate in human history. The rapid loss of species, including animals, plants, and microorganisms, directly affects ecosystem structure, the natural environment, and human well-being. One major challenge in preserving biodiversity is the growing demand for biological resources driven by population growth and increased consumption. It is crucial for people worldwide to recognize the importance of ecosystems and the vital role biodiversity plays in sustaining life. Life on Earth is intricately linked to nature. Humans rely on the diversity of nature for essential services such as food, water, and economic opportunities. Protecting biodiversity is in everyone's interest, as ecosystems provide numerous goods, including seafood, game, fodder, firewood, timber, and medicines. Ecosystem services extend beyond material benefits, encompassing the purification of air and water, mitigation of droughts and floods, soil generation and fertility renewal, waste detoxification and decomposition, crop pollination, seed dispersal, nutrient cycling, and pest control. Additionally, ecosystems protect coastal shores from erosion, stabilize the climate, moderate extreme weather events, and offer aesthetic and cultural value.

The Biodiversity Areas Standard was developed to set objective, measurable, and relevant criteria for integrating biodiversity into land use practices. This standard promotes best practices that create healthier, more cost-effective environments and self-sustaining ecosystems, while minimizing the impact of human activities on natural landscapes. It aligns with global conservation goals to combat the catastrophic decline in biodiversity caused by habitat destruction, land transformation, and carbon emissions. Our cities and surrounding areas play a critical role in protecting and restoring ecological capital by integrating biomes—nature's foundational systems—into all land-use planning, ensuring a sustainable future for our planet.

6.3.5. Principles of Biodiversity Field Estimation techniques

Biodiversity estimation in the field is measuring, on the basis of three parameters:

- Species richness- No. of species: A systematic inventory of the number of species found in an area/sample. Richness tends to increase over area. It is a measure used to find out rapid impact on the biodiversity.
- Abundance: Total number of individuals of each species in a sample/area. Represents numerical strength of each species in a community. Described as the

number of individuals per sample unit (quadrate/ transect). It can be represented as biomass or percent ground cover (for terrestrial plants). Relative species abundance- represents how common or rare species is relative to other species in a given location.

- Species evenness: Defined as the relative abundance with which each species is represented in an area. When all species are equally abundant, such an ecosystem has high evenness. If some species are more abundant in an ecosystem, it has less evenness. It primarily depicts the distribution of a species in an area. Represents the relative contribution of each species to the total biomass or functioning of the ecosystems.
- Biodiversity indices: A mathematical measure of species diversity in a community- a composite value. They account species richness, abundance and evenness in varied degrees. It also provides information about the rarity and commonness of species in a community. An important tool to understand community structure.
- Simpson Index D: This is an intuitively simple, appealing biodiversity index. It is the probability that two consecutive samples drawn from the same population will be different species. It involves sampling individuals from a population one at a time.

  Simpson's Diversity Index is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases.

$$D = \sum (n / N)^2 \qquad D = \frac{\sum n(n-1)}{N(N-1)}$$

n = the total number of organisms of a particular species
N = the total number of organisms of all species

The value of D ranges between 0 and 1. With this index, 1 represents infinite diversity and 0, no diversity.

6.3.6 Stages of biodiversity audit

Biodiversity audit has the following three phases:

6.3.6.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with biodiversity conservation policy of the institution)
- Assigning each and every area of the campus (excluding interior of buildings) for specific groups of auditors
- This phase includes following specific activities:
- Preliminary observations will be made by each group in their assigned area for visible organisms including plants and animals (selected fauna and flora only- see scope/objectives)
- Scheduling the sampling dates for quadrat/transect study.
- Preparing data entry sheets and field equipment, devices or instruments (e g., binoculars; GPS device, identification field guides etc.)

6.3.6.2 Audit phase

The following data will be recorded. Photographs of the audit process and the observations also will be taken as much as possible in order to include in the report.

- Quadrat study for grasses, herbs, shrubs etc. All the trees will be identified and counted.
- Quadrat sampling: Sampling plots with identical measurements are laid in the study area in a random or systematic manner. The target species is searched on foot or from any vehicle within these plots. Quadrats can be of various shapes. Most common are square or rectangular. Circular quadrats are also useful since they have minimum bias related to the 'edge effect' i.e., whether a specimen is inside or outside a quadrat. The optimum number of quadrats necessary to sample a population is decided based on the rarefaction curve, which reaches a plateau if enough samplings are done. Quadrat sampling is widely used to sample vegetation.
- Transect study for butterflies, birds, dragonflies and damselflies of the campus.
- Line transect: In this method the observer searches for the focal organisms along straight lines or transect lines either selected randomly or laid in a systematic manner for repeated surveys. For the observations which are not on the transect line, the perpendicular distance is measured. Line transect method is useful in calculating population density when it follows the assumptions that a) No specimen on the transect line is missed, b) specimens do not move before they are sighted; in case of movement, the first detection is considered; utmost care is taken to avoid replicative observation, c) the sighting angle and the exact dis-

tance of any sighting away from the transect line, is calculated, d) each sighting is independent. For birds, mammals etc. this is a good method.

- Sign count: In case of animals, which are hard to detect, signs like fecal matter, movement tracks, scratch marks are considered. Other signs include nests or burrows.
- Point count method for birds/butterflies/dragonflies: In this method the observer stands at a specific point and counts the specimens within the circle of a certain radius. Usually the radius is determined based on the maximum distance, which can be sampled by the observer. While conducting many point count samplings in an area, the radius 64 for all should be the same to compare the data. Point count is widely used to sample bird populations. The numbers of birds seen or heard within a circle are recorded in this method.

6.3.6.3 Post audit phase

- Analysis of data: species list of fauna and flora in the campus; calculation of Simpson index for the biodiversity of the campus
- Biodiversity conservation action plan preparation (awareness and sensitisation programmes; display boards; tree naming project; planting drives; promotion of native wild and medicinal plants etc.)

Paddy field in the campus

6.3.7. Schedule of the Biodiversity audit of St. Aloysius college

Week	Week Days	Weekly Work Plan
First Week	01.07.2024 to 07.07.2024	• Organizing campus areas into three zones for biodiversity auditing. • Conduct a briefing session for survey participants to overview the survey areas and methodology. • Assign team's zone 1 of the campus for herb & shrub identification. • Attend weekly group meetings, capture photographs, and prepare meeting minutes.
Second week	08.07.2024 to 14.07.2024	• Analysis of the data collected from zone 1. • Plan data collection in zone 2 and 3 with data recording. • Attend weekly group meetings, take photographs, and prepare meeting minutes.
Third Week	15.07.2024 to 21.07.2024	• Conduct thorough surveys of tree diversity in the campus. • Analysis of the data collected from zone 2 and 3. • Ensure accurate recording of observations. • Attend weekly group meetings, document findings with photographs, and prepare meeting minutes.
Fourth week	22.07.2024 to 28.07.2024	• Conduct a comprehensive survey of Odonates diversity in the campus • Enter collected data by the end of the fourth week. • Hold weekly team meetings for discussions, capture photographs, and prepare meeting minutes.
Fifth Week	29.07.2024 to 04.08.2024	• Search for insect identification and their survey if present. • Analysis of data on campus tree diversity. • Attend weekly group meetings, take photographs, and prepare meeting minutes.
Sixth Week	05.08.2024 to 11.08.2024	• Survey of reptiles and amphibians across the campus. • Conduct weekly group meetings, take photographs, and prepare meeting minutes.
Seventh Week	12.08.2024 to 18.08.2024	• Conduct surveys of campus bird diversity. • Initiate conservation activities for various plant and animal species. • Attend weekly group meetings, capture photographs, and prepare meeting minutes.
Eight Week	19.08.2024 to 25.08.2024	• Compile all data collected. • Ensure all registers and documents are completed before preparing the final report.

Table 6.1. Schedule of the biodiversity audit

6.4 RESULTS AND OBSERVATION

6.4.1. Checklist of selected fauna and flora

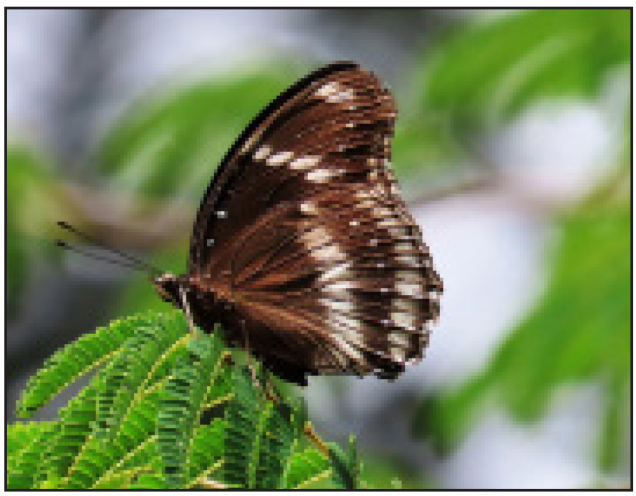
6.4.1.1 Checklist of butterflies

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	COMMON ROSE	*Pachliopta aristolochiae*	നാട്ടു റോസ്	10
2	CRIMSON ROSE	*Pachliopta hector*	ചക്കരശലഭം	5
3	COMMON MIME	*Papilio clytia*	വഴനപൂമ്പാറ്റ	9
4	COMMON MORMON	*Papilio polytes*	നാരകക്കാളി	8
5	SOUTHERN BIRDWING	*Troides minos*	ഗരുഡ ശലഭം	12
6	STRIPED TIGER	*Danaus genutia*	വരയൻ കടുവ	13
7	COMMON CROW	*Euploea core*	അരളിശലഭം	9
8	GREAT EGGFLY	*Hypolimnas bolina*	വൻചൊട്ടശലഭം	3
9	COMMON BUSHBROWN	*Mycalesis perseus*	തവിടൻ	1
10	PSYCHE	*Leptosia nina*	പൊട്ടുവെള്ളാട്ടി	16
11	PIONEER	*Belenois aurota*	കരീര വെളുമ്പൻ	10
12	COMMON PIERROT	*Castalius rosimon*	നാട്ടുകോമാളി	2
13	DARK BLUE TIGER	*Tirumala septentrionis*	കരിനീലകടുവ	2

Table 6.2. Checklist of butterflies of St. Aloysius College campus

Common bushbrown

Common crow



Great eggfly

Striped tiger

Psyche

Dark blue tiger

6.4.1.2 Checklist of odonates

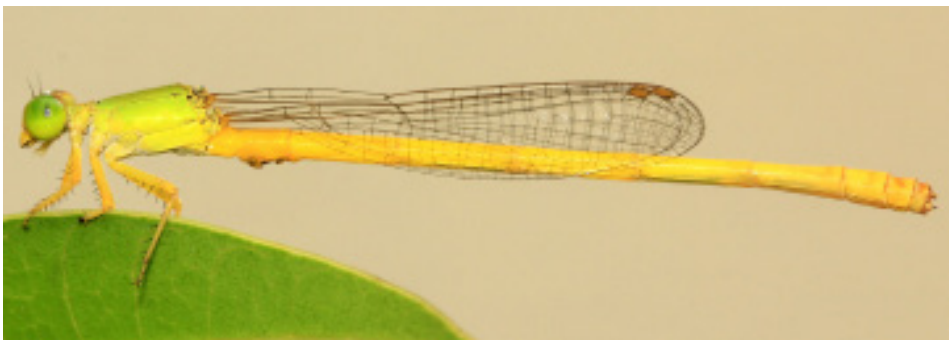
No.	COMMON NAME	SCIENTIFIC NAME	MALAYALAM NAME
1	COMMON PICTUREWING	*Rhyothemis variegata*	ഓണത്തുമ്പി
2	GREEN MARSH HAWK	*Orthetrum sabina*	പച്ചവ്യാളി
3	BLUE GRASS DART	*Pseudagrion microcephalum*	നാട്ടുപൂത്താലി
4	COROMANDEL MARSH DART	*Ceriagrion coromandelianum*	നാട്ടുചതുപ്പൻ
5	SENEGAL GOLDEN DARTLET	*Ischnura senegalensis*	നീല പുൽമാണിക്യൻ
6	CORAL-TAILED CLOUD WING	*Tholymis tillarga*	പവിഴവാലൻ
7	TRUMPET TAIL	*Acisoma panorpoides*	മകുടിവാലൻ
8	ORANGE-TAILED MARSH DART	*Ceriagrion cerinorubellum*	കനൽവാലൻ ചതുപ്പൻ
9	RUDDY MARSH SKIMMER	*Crocothemis servilia*	വയൽത്തുമ്പി
10	PIED PADDY SKIMMER	*Neurothemis tullia*	സ്വാമിത്തുമ്പി
11	SCARLET MARSH HAWK	*Aethriamanta brevipennis*	ചോപ്പൻകുറുവാലൻ
12	RUFOUS MARSH GLIDER	*Rhodothemis rufa*	ചെമ്പൻതുമ്പി
13	PYGMY DARTLET	*Agriocnemis pygmaea*	നാട്ടുപുൽചിന്നൻ
14	RUFOUS-BACKED MARSH HAWK	*Brachydiplax chalybea*	തവിട്ടുവെണ്ണീറൻ
15	DITCH JEWEL	*Brachythemis contaminata*	ചങ്ങാതിത്തുമ്പി
16	GREATER CRIMSON GLIDER	*Urothemis signata*	പാണ്ടൻ വയൽത്തെയ്യൻ
17	WANDERING GLIDER	*Pantala flavescens*	തുലാത്തുമ്പി
18	LITTLE BLUE MARSH HAWK	*Brachydiplax sobrina*	ചെറുവെണ്ണീറൻ
19	GROUND SKIMMER	*Diplacodes trivialis*	നാട്ടുനിലത്തൻ
20	AMBER WINGED MARSH GLIDER	*Hydrobasileus croceus*	പാണ്ടൻപരുന്തൻ

Table 6.3. Checklist of dragon flies and damselflies of St. Aloysius College campus

Ceriagrion cerinorubellum

Pseudagrion microcephalum

Acisoma panorpoides



Ceriagrion coromandelianum

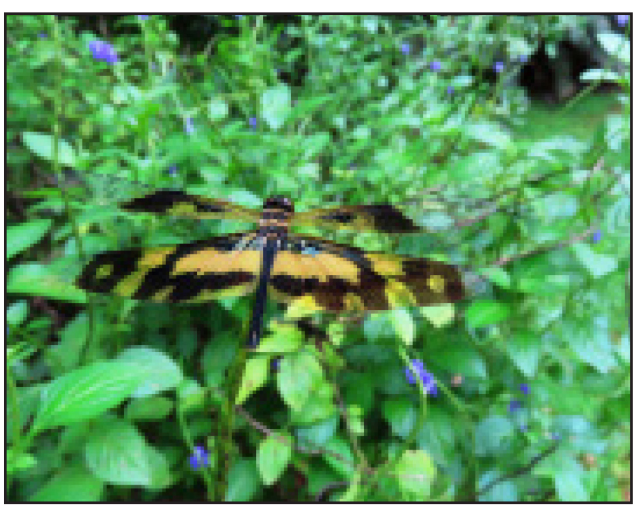
Diplocodes trivialis

Neurothemis tullia male

Orthetrum sabina

Neurothemis tullia female

Aethriamanta brevipennis



Rhyothemis varigata

6.4.1.3 Checklist of common insects

SI. NO.	SCIENTIFIC NAME	COMMON NAME
1	*Plocaederus obesus*	CASHEW STEM BORER
2	*Apis mellifera*	EUROPEAN HONEY BEE
3	*Apis florae*	RED DWARF HONEY BEE
4	*Oecophylla smaragdina*	WEAVER ANT
5	*Amegilla cingulata*	BLUE-BANDED BEE
6	*Belionota prasina*	JEWEL BEETLE
7	*Calosoma scrutator*	FIERY SEARCHER
8	*Macratoma palmata*	WOOD BORER
9	*Saperda calcarata Say*	POPLAR BORER
10	*Dicladispa armigera*	RICE HISPA
11	*Coccinella septempunctata*	SEVEN-SPOT LADYBIRD
12	*Photinus pyralis*	BIG DIPPER FIREFLY
13	*Mylabris pustulata*	BLISTER BEETLE
14	*Oryctes rhinoceros*	COCONUT RHINOCEROS BEETLE
15	*Macrodactylus subspinosus*	ROSE CHAFER
16	*Gonocephalum hofmanseggi*	DUSTY BROWN BEETLE
17	*Aedes albopictus*	ASIAN TIGER MOSQUITO
18	*Anopheles spp.*	MALARIA MOSQUITOES
19	*Culex spp.*	HOUSE MOSQUITO
20	*Tabanus striatus*	HORSE FLY
21	*Aleurodicus dispersus*	SPIRALING WHITEFLY
22	*Aspidiotus destructor*	COCONUT SCALE
23	*Apis dorsata*	ROCK BEE
24	*Iridomyrmex humilis*	ARGENTINE ANT
25	*Oecophylla spp.*	WEAVER ANTS
26	*Megachile spp*	LEAFCUTTER BEES
27	*Ammophila laevigata*	THREAD-WAISTED WASP
28	*Monobia quadridens*	FOUR-TOOTHED MASON WASP
29	*Xylocopa aestuans*	CARPENTER BEE
30	*Alabama argillacea*	COTTON LEAFWORM
31	*Pteroma plagiophleps*	BAGWORM
32	*Amarygmus cuprarius*	DARKLING BEETLE

Table 6.4. Checklist of common insects (other than lepidopterans and odonates) of the campus

6.4.1.4 Checklist of fishes

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	TARPON	*Megalops cyprinoides (Broussonet)*	പാലാൻ	11
2	INDIAN MOTTLED EEL	*Anguilla bengalensis (Gray)*	പാണ്ടൻ മനഞ്ഞിൽ	46
3	DAY'S ROUND-HERRING	*Dayella malabarica (Day)*	ഉരുളൻ നെത്തോലി	1366
4	INDIAN SPRAT	*Clupea brachysoma (Bleeker)*	കുരുടൻ തൊണ്ടി	2
5	CATLA	*Catla catla (Ham.)*	കട്ട്ള	288
6	MRIGAL	*Cirrhinus mrigala (Ham.)*	മൃഗാൾ	14
7	GRASS CARP	*Ctenopharyngodon idellus (Val.)*	ഗ്രാസ് കാർപ്	29
8	COMMON CARP	*Cyprinus carpio communis (Linn.)*	സൈപ്രൻ	81
9	ROHU	*Labeo rohita (Ham.)*	രോഹു	189
10	OLIVE BARB	*Barbodes sarana subnasutus (Val.)*	കുറിച്ചി	346
11	SCARLET-BANDED BARB	*Puntius amphibius (Val.)*	ഉരുളൻ പരൽ	285
12	ROSY BARB	*P. conchonius (Ham.)*	വാലേപൊട്ടൻ	20
13	BLACK SPOT BARB	*P. filamentosus (Val.)*	പൂവാലിപരൽ	1559
14	POOL BARB	*P. sophore (Ham.)*	ഉണ്ടക്കണ്ണി	146
15	TICTO BARB	*P. ticto (Ham.)*	കടുങ്ങാലി	57
16	GREEN STRIPE BARB	*P. vittatus (Day)*	കൈപ്പ	766
17	PARRAH BARB	*P. parrah (Day)*	പാറപരൽ	26
18	GREEN BARB	*P. chola (Ham.)*	കച്ചിപരൽ	367
19	ATTENTIVE CARPLET	*Amblypharyngodon melettinus (Val.)*	വയമ്പ്	3207
20	DANIO	*Danio aequipinnatus (McClelland)*	വരയൻ ഡാനിയോ	152
21	BLACK LINE RASBORA	*Rasbora daniconius*	തുപ്പലുകൊത്തി	140
22	MULLYA GARA	*Garra mullya (Sykes)*	കുള്ളൻ കല്ലൊട്ടി	81
23	SPINY LOACH	*Lepidocephalus thermalis (Val.)*	കൊഴുത്ത	355
24	GUNTHER'S CATFISH	*Horabagrus brachysoma (Gunther)*	മഞ്ഞക്കൂരി	95
25	KERALA MYSTUS	*Mystus armatus (Day)*	കൂരി	10
26	MALABAR MYSTUS	*M. oculatus (Val.)*	ചില്ലൻ കൂരി	430
27	HAMILTON'S CATFISH	*Arius arius (Ham.)*	ഏട്ട	46
28	STINGING CATFISH	*Heteropneustes fossilis (Bloch)*	കാരി	1117
29	INDIAN BUTTER CATFISH	*Ompok bimaculatus (Bloch)*	തോന്നാൻ വാള	145
30	FRESH WATER SHARK	*Wallago attu (Schneider)*	ആറ്റുവാള	105
31	FRESHWATER GARFISH	*Xenentodon cancila (Ham.)*	കോലാൻ	646
32	CONGATURI HALFBEAK	*Hyporhamphus limbatus (Val.)*	ആറ്റുകോലാൻ	307
33	MALABAR KILLIE	*Aplocheilus lineatus (Val.)*	മാനത്തു കണ്ണി	247
34	MALABAR SPINY EEL	*Macrognanthus guentheri (Day)*	ആരകൻ	80
34	ZIG-ZAG EEL	*Mastacembelus armatus (Lacepede)*	കല്ലാരകൻ	54
36	WESTERN GHAT GLASSY PERCHELT	*Parambassis thomassi (Day)*	അറിഞ്ഞീൻ	283
37	GANGETIC LEAFFISH	*Nandus nandus (Ham.)*	മൂത്താടി	580
38	ORANGE CHROMID	*Etroplus maculatus (Bloch)*	പള്ളത്തി	2397
39	PEARLSPOT	*E. suratensis (Bloch)*	കരിമീൻ	464
40	MOZAMBIQUE TILAPIA	*Oreochromis mossambicus (Peters)*	തിലാപ്പിയ	16
41	WHIPTAIL SILVER-BIDDY	*Gerres filamentosus (Cuvier)*	കൊടിയൻ പുരച്ചി	32

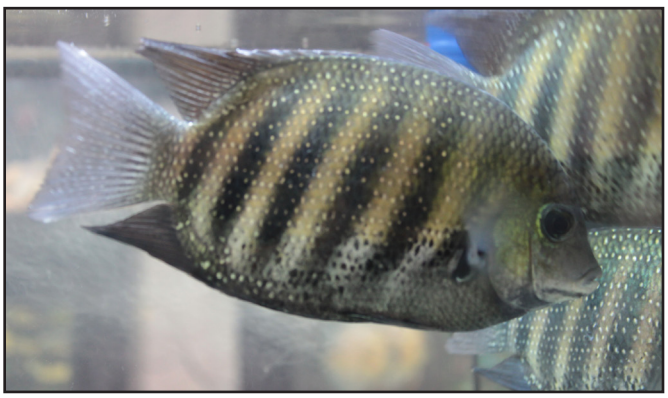
42	CREEK RED BREAM	*Lutjanus argentimaculatus (Forsskal)*	ചെമ്പല്ലി	11
43	SPOTTED BUTTERFISH	*Scatophagus argus (Linn.)*	നച്ചി കരിമീൻ	6
44	CUJA BOLA	*Macrospinosa cuja (Ham.)*	കൽ ചെമ്പല്ലി	10
45	TIGER-PERCH	*Terapon jarbua (Forsskal)*	കോത	48
46	TANK GOBY	*Glossogobius giuris (Ham.)*	പൂലോൻ	32
47	CLIMBING PERCH	*Anabas testudineus (Bloch)*	കല്ലട	1027
48	MACROPODUS	*Macropodus cupanus (Val.)*	കരിങ്കണ	428
49	GIANT SNAKEHEAD	*Channa marulius (Ham.)*	ബ്രാൽ	84
50	STRIPED SNAKE-HEAD	*Channa striatus (Bloch)*	വരാൽ	701
51	FLATHEAD GREY MULLET	*Mugil cephalus (Linn.)*	തിരുത	90
52	BLACK SOLE	*Euryglossa orientalis (Bloch and Schneider)*	പുള്ളി മാന്തൾ	4
53	DWARF INDIAN PUFFER	*Tetraodon travancoricus (Hora and Nair)*	ആറ്റുണ്ട	2047

Table 6.5. Checklist of common fishes of the campus (wetland area)

Puntius vittatus

Channa striatus

Etroplus maculatus



Etroplus suratensis

Garra mullya

Glossogobius giuris

Nandus nandus

Puntius assimilis

Puntius filamentosus

6.4.1.5 Checklist of frogs

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	COMMON ASIAN TOAD	*Duttaphrynus melanostictus*	ചൊറിതവള	9
2	COMMON INDIAN CRICKET FROG	*Minervarya agricola*	------	4
3	SKITTERING FROG	*Euphlyctis cyanophlyctis*	ചാട്ടക്കാരൻ തവള	18
4	COMMON TREE FROG	*Polypedates leucomystax*	മരത്തവള	2

Table 6.6. Checklist of common frogs of the campus

Duttaphrynus melanostictus

Euphlyctis cyanophlyctis

6.4.1.6 Checklist of reptiles

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	ORIENTAL GARDEN LIZARD	*Calotes versicolor*	ഓന്ത്	25
2	COMMON GREEN FOREST LIZARD	*Calotes calotes*	പച്ചയോന്ത്	10
3	COMMON GARDEN SKINK	*Lampropholis guichenoti*	അരണ	15
4	BRONZE GRASS SKINK	*Eutropis macularia*	ചെമ്പൻഅരണ	5
5	BUFF STRIPED KEELBACK	*Amphiesma stolatum*	തെയ്യൻ പാമ്പ്	1
6	CHECKERED KEELBACK	*Xenochrophis piscator*	നീർക്കോലി	2
7	COMMON TRINKET SNAKE	*Coelognathus Helena*	കാട്ടുപാമ്പ്	1
8	COMMON WOLF SNAKE	*Lycodon aulicus*	വെള്ളിവരയൻ പാമ്പ്	1
9	INDIAN RAT SNAKE	*Ptyas mucosa*	ചേര	4
10	RUSSELL'S VIPER	*Daboia russelii*	ചേനത്തണ്ടൻ	1
11	KUKRI SNAKE	*Oligodon taeniolatus*	വള്ളിചുരുട്ട	1
12	COMMON HOUSE GECKO	*Hemidactylus frenatus*	നാട്ടുപല്ലി	75
13	HOUSE GEKO	*Hemidactylus brookii*	വീട്ടുപല്ലി	50
14	BARK GECKO	*Hemidactylus leschenaultii*	പുള്ളിപ്പല്ലി	10
15	INDIAN BLACK TURTLE	*Melanochelys trijuga*	കാരാമ	40

Table 6.7. Checklist of common reptiles of the campus

Calotes calotes

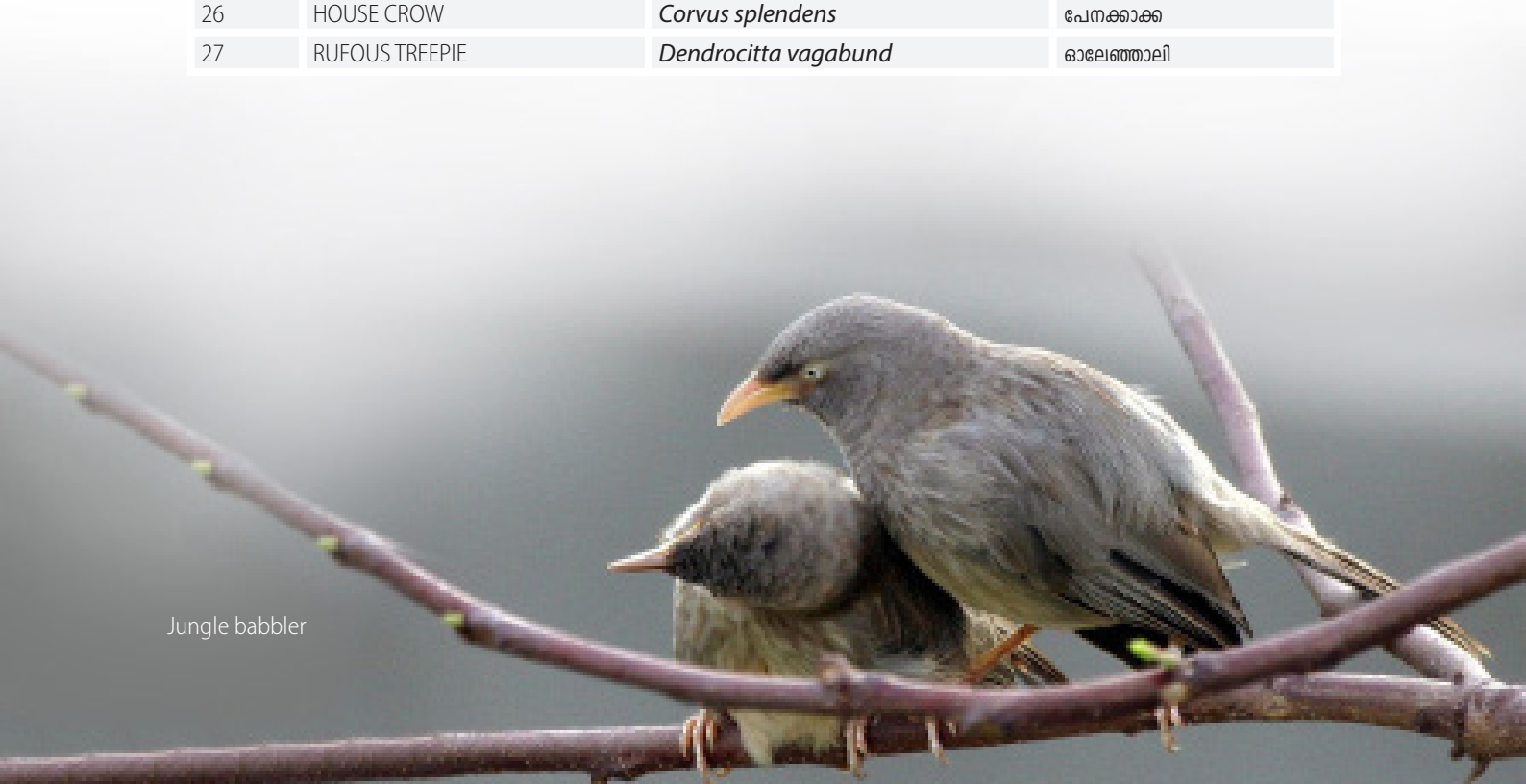
Eutropis macularia

Melanochelys trijuga

Ptyas mucosa

6.4.1.7 Checklist of birds

No.	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME
1	LESSER WHISTLING DUCK	*Dendrocygna javanica*	ചൂളൻഎരണ്ട
2	WHITE BREASTED WATERHEN	*Amaurornis phoenicurus*	കുളക്കോഴി
3	SLATY LEGGED CRAKE	*Rallina eurizonoides amauroptera*	നീലമാരൻ കുളക്കോഴി
4	BAILLONS CRAKE	*Porzana pusilla pusilla*	ചെറിയനെല്ലിക്കോഴി
5	RUDDY BREASTED CRAKE	*Porzana fusca zeylonica*	ചുവന്നനെല്ലിക്കോഴി
6	WATER COCK	*Gallicrex cinerea*	തീപ്പൊരിക്കണ്ണൻ
7	GREY HEADED SWAMPHEN	*Porphyrio porphyrio*	നീലക്കോഴി
8	COMMON MOORHEN	*Gallinula chloropus indica*	പട്ടക്കോഴി
9	COMMON COOT	*Fulica atra atra*	വെള്ളകൊക്കൻ കുളക്കോഴി
10	INDIAN PEAFOWL	*Pavo cristatus Linnaeus*	മയിൽ
11	COTTON PYGMY GOOSE	*Nettapus coromandelianus*	പച്ചഎരണ്ട
12	GARGANY	*Anas querquedula*	വരിയെരണ്ട
13	SPOT-BILLED DUCK	*Anas poecilorhyncha*	പുളിച്ചുണ്ടൻ താറാവ്
14	COMMON TEAL	*Anas crecca crecca*	പട്ടക്കണ്ണൻ എരണ്ട
15	NORTHERN PINTAIL	*Anas acuta*	വാലൻ എരണ്ട
16	PHEASANT TAILED JACANA	*Hydrophasianus chirurgus*	വാലൻ താമരക്കോഴി
17	BRONZE WINGED JACANA	*Metopidius indicus*	നാടൻ താമരക്കോഴി
18	COMMON MYNA	*Acridotheres tristis*	നാട്ടുമൈന
19	PURPLE RUMBED SUNBIRD	*Leptocoma zeylonica*	മഞ്ഞതേൻക്കിളി
20	COMMON KINGFISHER	*Alcedo atthis*	ചെറിയമീൻകൊത്തി
21	ORIENTAL DARTER	*Anhinga melanogaster*	ചേരക്കോഴി
22	GREATER COUCAL	*Centropus sinensis*	ചെമ്പോത്ത്
23	ROCK PIGEON	*Columba livia*	മാടപ്രാവ്
24	ORIENTAL MAGPIE-ROBIN	*Copsychus saularis*	മണ്ണാത്തിപ്പുള്ള്
25	LARGE-BILLED CROW	*Corvus macrorhynchos*	ബലികാക്ക
26	HOUSE CROW	*Corvus splendens*	പേനക്കാക്ക
27	RUFOUS TREEPIE	*Dendrocitta vagabund*	ഓലേഞ്ഞാലി



Jungle babbler

28	BLACK DRONGO	*Dicrurus macrocercus*	ആനറാഞ്ചിപക്ഷി
29	BLACK-RUMPED FLAMEBACK	*Dinopium benghalense*	നാട്ടുമരംകൊത്തി
30	ASIAN KOEL	*Eudynamys scolopaceus*	കുയിൽ
31	BRAHMINY KITE	*Haliastur indus*	കൃഷ്ണപ്പരുന്ത്
32	COMMON HAWK-CUCKOO	*Hierococcyx varius*	പേകുയിൽ
33	CHESTNUT-HEADED BEE-EATER	*Merops leschenaulti*	ചെന്തലയൻ വേലിത്തത്ത
34	BLUE-TAILED BEE-EATER	*Merops philippinus*	വലിയവേലിത്തത്ത
35	LITTLE CORMORANT	*Microcarbo niger*	ചെറിയനീർകാക്ക
36	BLACK KITE	*Milvus migrans*	ചക്കിപ്പരുന്ത്
37	PAINTED STORK	*Mycteria leucocephala*	വർണക്കൊക്ക്
38	HOUSE SPARROW	*Passer domesticus*	അങ്ങാടി കുരുവി
39	STORK-BILLED KINGFISHER	*Pelargopsis capensis*	കാക്കമീൻകൊത്തി
40	ROSE-RINGED PARAKEET	*Psittacula krameri*	മോതിരത്തത്ത
41	RED-WHISKERED BULBUL	*Pycnonotus jocosus*	ഇരട്ടത്തലച്ചി
42	FORK-TAILED DRONGO-CUCKOO	*Surniculus dicruroides*	കാക്കത്തമ്പുരാട്ടി കുയിൽ
43	YELLOW-BILLED BABBLER	*Turdoides affinis*	പൂത്താംകീരി
44	JUNGLE BABBLER	*Turdoides striata*	കരിയിലക്കിളി

Table 6.8. Checklist of common birds of the campus

Chestnut headed bee- eater

Oriental magpie robin

Indian pond heron

Rock pigeon

Greater coucal

Rose-ringed parakeet

Black drongo

Common kingfisher

Little cormorant

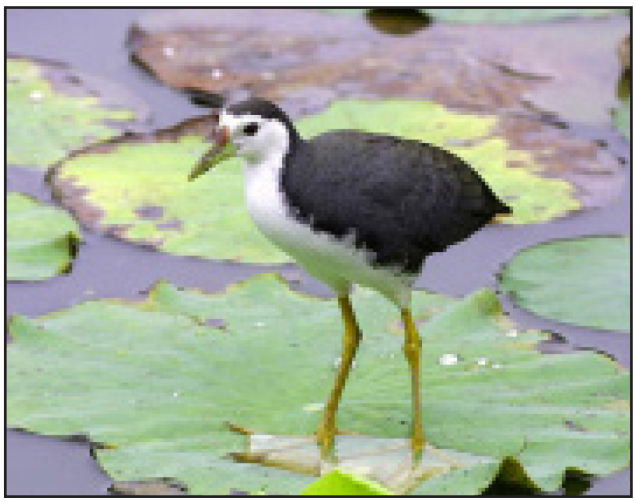
Bronze-winged jacana

Pheasant tailed jacana

Stork billed kingfisher

Asian koel

Brahminy kite



White breasted waterhen

Common myna

Black rumped flameback

Red whiskered bulbul

Common coot

Common hawk cuckoo

Cotton pygmy gooose

Grey headed swamphen

Indian spot billed duck

Painted stork

Slaty legged crake

6.4.1.8 Checklist of mammals

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	INDIAN GREY MONGOOSE	*Urva edwardsii*	കീരി	3
2	LESSER BANDICOOT RAT	*Bandicota bengalensis*	പെരുച്ചാഴി	6
3	HOUSE MOUSE	*Mus musculus*	ചുണ്ടെലി	2
4	BLACK RAT	*Rattus rattus*	കറുത്ത എലി	6
5	INDIAN PALM SQUIRREL	*Funambulus palmarum*	അണ്ണാൻ	15
6	HOUSE CAT	*Felis catus*	പൂച്ച	6
7	VILLAGE (STRAY) DOG (DOMESTICATED)	*domesticated*	പട്ടി	4
8	ASIAN PALM CIVET	*Paradoxurus hermaphroditus*	മരപ്പട്ടി	4
9	BLACK BAT	*Taphozous spp.*	നരിച്ചീർ	35
10	JACKAL	*Canis aureus*	കുറുക്കൻ	6

Table 6.9. Checklist of common mammals of the campus

Jackal

Indian palm squirrel

Indian grey mongoose

Asian palm civet

6.4.1.9 Checklist of common herbs

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME
1	WALKING MAIDEN-HAIR	*Adiantum philippense*	പന്നൽ
2	MOUNTAIN KNOT	*Aerva lanata*	ചെറൂള
3	ONE LEAVED CLOVER	*Alysicarpus vaginalis*	നില ഓരില
4	WILD PEANUT	*Arachis duranensis*	കടലച്ചെടി
5	CARPET GRASS	*Axonopus compressus*	കാർപെറ്റ് ഗ്രാസ്
6	AYAPANA	*Eupatorium ayapana*	അയ്യപ്പാന
7	LITTLE TREE PLANT	*Biophytum sensitivum*	മുക്കുറ്റി
8	LETTUCE LEAF BLUMEA	*Blumea lacera*	കാട്ടുമുള്ളങ്കി
9	FANCY LEAF CALADIUM	*Caladium bicolor*	വർണ്ണച്ചേമ്പ്
10	BALOON VINE	*Cardiospermum halicacabum*	വള്ളിയുഴിഞ്ഞ
11	INDIAN PENNY-WORT	*Centella asiatica*	കുടങ്ങൽ
12	WHITE MUSLI	*Chlorophytum borivilianum*	വെളുത്ത നിലപ്പന
13	BRIDAL VEIL	*Clerodendrum wallichii*	കോഴിയാപ്പ
14	WANDERING JEW	*Commelina benghalensis*	കാനവാഴ
15	BLACK MUSALE	*Curculigo orchioides*	നിലപ്പന
16	CYATHOCALYX	*Cyathocalyx zeylanicus*	കൊടവാഴ
17	WHITE WATER SEDGE	*Cyperus brevifolius*	വെളുത്ത
18	DESMODIUM	*Desmodium hirtum*	ഓരില
19	FALSE DAISY	*Eclipta prostrata*	കയ്യൂന്ന്യം
20	LILAC TASSEL FLOWER	*Emilia sonchifolia*	മുയൽച്ചെവിയൻ
21	MEXICAN FIREPLANT	*Euphorbia heterophylla*	പാൽപെരുക്കി
22	DWARF MORNING GLORY	*Evolvulus alsinoides*	വിഷ്ണുക്രാന്തി
23	WATER GLOBEHEAD	*Gomphrena celosioides*	നീർവാടാമല്ലി
24	TICK CLOVER	*Grona triflora*	നിലംപരണ്ട
25	RED IVY	*Hemigraphis alternata*	മുറികൂടി
26	RIBBON BUSH	*Homalocladium platycladum*	പഴുതാരചെടി
27	RAILWAY CREEPER	*Ipomoea cairica*	ഉദയമലരി
28	WHITE MORNING GLORY	*Ipomoea obscura*	തിരുതാളി
29	SENSITIVE PLANT	*Mimosa pudica*	തൊട്ടാവാടി
30	PEA PUMPKIN	*Mukia maderaspatana*	ചെങ്കുമ്മാട്ടി
31	DOVEWEED	*Murdannia nudiflora*	താളിപുല്ല്
32	GOANESE IPECAC	*Naregamia alata*	നിലനാരകം
33	AMERICAN BASIL	*Ocimum americanum*	കാട്ടുതുളസി
34	BASIL	*Ocimum basilicum*	രാമതുളസി
35	WAVY LEAF BASKETGRASS	*Oplismenus burmannii*	വള്ളിപുല്ല്
36	JAVA TEA	*Orthosiphon aristatus*	പൂച്ചമീശ
37	SACRED BASIL	*Ocimum sanctum*	കൃഷ്ണതുളസി
38	SHINING BUSH	*Peperomia pellucida*	മഷിപ്പച്ച
39	STONEBREAKER	*Phyllanthus urinaria*	ചുവന്ന കീഴാർനെല്ലി

40	ARTILLERY PLANT	*Pilea microphylla*	മതിൽപച്ച
41	LONG PEPPER	*Piper longum*	തിപ്പലി
42	BLACK PEPPER	*Piper nigrum*	കുരുമുളക്
43	FIRE PLANT	*Plumbago rosea*	ചെത്തി കൊടുവേലി
44	BELL WEED	*Ruellia prostrata*	ഉപ്പുതാളി
45	MINNIER ROOT	*Ruellia tuberosa*	ശിവകരന്ത
46	COMB RUNGIA	*Rungia pectinata*	റുങ്ങിയ
47	WHITE SIDA	*Sida rhombifolia*	വെളൂരം
48	POISON BERRY	*Solanum violaceum*	ചെറുചുണ്ട
49	MALAYAN GROUND ORCHID	*Spathoglottis plicata*	നീല ഓർക്കിഡ്
50	PIG GRASS	*Synedrella nodiflora*	മുടിയൻപച്ച
51	TRIDAX	*Tridax procumbens*	കമ്മൽപൂ
52	DWARF LILLY	*Typhonium roxburghii*	മുള്ളുരുക്കി
53	STINGING NETTLE	*Urtica dioica*	ആനതുമ്പ
54	LITTLE IRON WEED	*Vernonia cinerea*	പൂവാംകുറന്തൽ

Table 6.10. Checklist of common herbs of the campus

6.4.1.10 Checklist of common grass

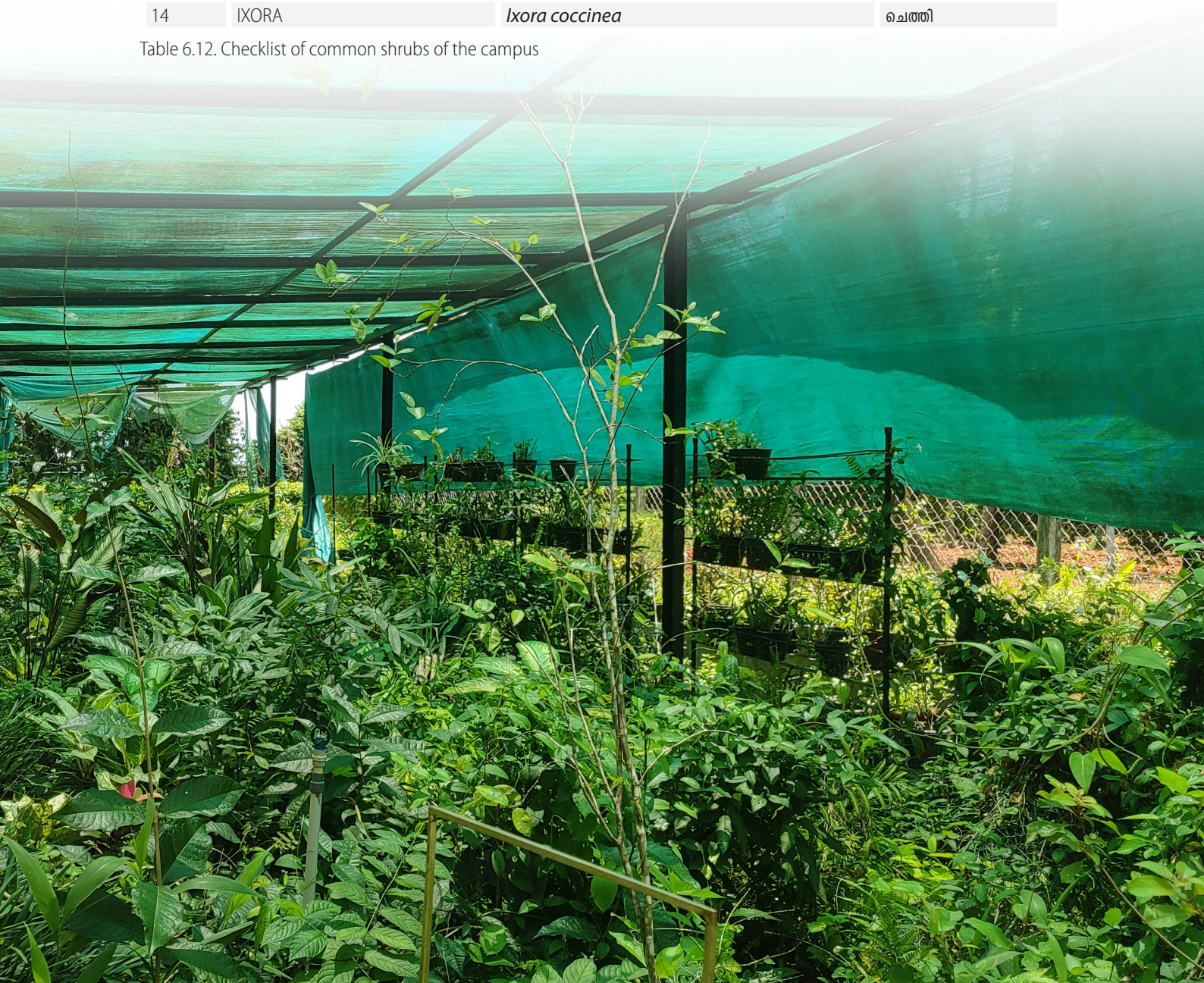
No	ENGLISH NAME	SCIENTIFIC NAME
1	CAT GRASS	*Dactylis glomerata*
2	CARPET GRASS	*Axonopus fissifolius*
3	HAIRY JOINT GRASS	*Arthraxon hispidus*
4	CROP GRASS	*Digitaria sanguinalis*
5	POA	*Poa trivialis*
6	SMALL CRAB GRASS	*Digitaria ischaemum*
7	BERMUDA GRASS	*Cynodon dactylon*
8	ORCHARD GRASS	*Dactylis glomerata*

Table 6.11. Checklist of common grasses of the campus

6.4.1.11 Checklist of common shrubs

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME
1	WILD CROTON	*Baliospermum montanum*	നാഗദന്തി
2	WHITE BAUHINIA	*Bauhinia acuminata*	വെള്ള മന്ദാരം
3	GAINT MILK WEED	*Calotropis gigantea*	എരിക്ക്
4	PAPAYA	*Carica papaya*	പപ്പായ
5	CROTON	*Codiaeum variegatum*	ഇലച്ചെടി
6	PURGING CROTON	*Croton tiglium*	കടലാവണക്ക്
7	CYCAS	*Cycas circinalis*	ഈന്ത്
8	SAGO PALM	*Cycas revoluta*	അലങ്കാര ഈന്ത്
9	INDIAN WILLOW	*Salix tetrasperma*	ആറ്റുപാല
10	SENNA	*Senna obtusifolia*	ചക്രത്തകര
11	WILD MUSSANDA	*Mussaenda frondosa*	വെള്ളില
12	FIRE BUSH	*Hamelia patens*	പവിഴമുല്ല
13	DWARF MUSSANDA	*Pseudomussaenda flava*	ചെറുവെള്ളില
14	IXORA	*Ixora coccinea*	ചെത്തി

Table 6.12. Checklist of common shrubs of the campus



6.4.1.12 Checklist of common trees

No	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	INDIAN BAEL	*Aegle marmelos*	കൂവളം	1
2	MOUNTAIN KNOT	*Aerva lanata*	ചെറൂള	many
3	RAIN TREE	*Samanea saman*	മഴമരം	10
4	GOLDEN TRUMPET	*Allamanda cathartica*	കോളാമ്പി	2
5	DEVIL TREE	*Alstonia scholaris*	ഏഴിലംപാല	2
6	APOROSA	*Aporosa lindleyana*	വെട്ടി	2
7	BETEL NUT PALM	*Areca catechu*	കവുങ്ങ്	10
8	JACK FRUIT TREE	*Artocarpus heterophyllus*	പ്ലാവ്	5
9	THORNY BAMBOO	*Bambusa bambos*	ഇല്ലി	1
10	HEDGES BAMBOO	*Bambusa multiplex*	അലങ്കാരമുള	5
11	BUDHA BELLY BAMBOO	*Bambusa wamin*	ബുദ്ധ മുള	2
12	PURPLE ORCHID TREE	*Bauhinia purpurea*	മരമന്ദാരം	3
13	FLAME OF THE FOREST	*Butea monosperma*	പ്ലാശ്	1
14	EAST INDIAN RED WOOD	*Caesalpinia sappan*	പതിമുഖം	1
15	CANANGA	*Cananga odorata*	കനകമരം	2
16	BLACK DAMMAR	*Canarium strictum*	കറുത്തകുന്തിരിക്കം	1
17	INDIAN LABURNUM	*Cassia fistula*	കണിക്കൊന്ന	3
18	PINK SHOWER	*Cassia javanica*	പിങ്ക് കൊന്ന	2
19	RED CASSIA	*Cassia roxburghii*	ചുവന്ന കൊന്ന	1
20	COAST SHE OAK	*Casuarina equisetifolia*	ചൂളമരം	1
21	FIDDLE WOOD	*Citharexylum spinosum*	പാരിജാതം	1
22	COCONUT TREE	*Cocos nucifera*	തെങ്ങ്	44
23	GREEN COMMIPHORA	*Commiphora caudata*	കിളിമരം	1
24	CANNON BALL TREE	*Couroupita guianensis*	നാഗലിംഗമരം	1
25	ROSEWOOD	*Dalbergia latifolia*	ഈട്ടി	17
26	GULMOHAR	*Delonix regia*	പൂമരം	2
27	ELEPHANT APPLE	*Dillenia indica*	മലമ്പുന്ന	1
28	VELVET APPLE	*Diospyros blancoi*	വെൽവെറ്റ് ആപ്പിൾ	1
29	INDIAN EBONY	*Diospyros ebenum*	കരിമരം	1
30	WHITE CEDAR	*Dysoxylum malabaricum*	അകിൽ	1
31	OIL PALM	*Elaeis guineensis*	എണ്ണപ്പന	1
32	BEAD TREE	*Elaeocarpus sphaericus*	രുദ്രാക്ഷം	1
33	BLUE GUM	*Eucalyptus globulus*	യൂക്കാലി	3
34	BANYAN TREE	*Ficus benghalensis*	പേരാൽ	2
35	WEEPING FIG	*Ficus benjamina*	വെള്ളാൽ	11
36	PEEPALTREE	*Ficus religiosa*	അരയാൽ	12
37	CAMBOGE TREE	*Garcinia gummi-gutta*	കുടംപുളി	1
38	GLIRICIDIA	*Gliricidia sepium*	ശീമക്കൊന്ന	43
39	MALABAR IRON WOOD	*Hopea parviflora*	തമ്പകം	1

40	WILLOW LEAVED JUSTICIA	*Justicia gendarussa*	വാതംകൊല്ലി	1
41	QUEEN'S CRAPE MYRTLE	*Lagerstroemia speciosa*	പൂമരുത്	2
42	MAHUA	*Madhuca longifolia*	ഇലിപ്പ	1
43	BLACK PEARL TREE	*Majidea zanguebarica*	പേൾ മരം	1
44	MANGO TREE	*Mangifera indica*	മാവ്	7
45	SPANISH CHERRY	*Mimusops elengi*	ഇലഞ്ഞി	4
46	BIRD CHERRY	*Muntingia calabura*	പഞ്ചസാരപഴം	-
47	ORANGE JASMINE	*Murraya paniculata*	മരമുല്ല	14
48	PLANTAIN	*Musa paradisiaca*	വാഴ	17
49	NUTMEG TREE	*Myristica fragrans*	ജാതി	15
50	CORAL JASMINE	*Nyctanthes arbor-tristis*	പവിഴമല്ലി	1
51	INDIAN TRUMPET FLOWER	*Oroxylum indicum*	പലകപ്പയ്യാനി	1
52	COPPER-POD	*Peltophorum pterocarpum*	മഞ്ഞവാക	2
53	INDIAN GOOSEBERRY	*Phyllanthus emblica*	നെല്ലി	2
54	SINGAPORE PLUMERIA	*Plumeria obtusa*	വെളുത്തരളി	1
55	PAGODA TREE	*Plumeria rubra*	ഈഴ ചെമ്പകം	1
56	INDIAN MAST TREE	*Polyalthia longifolia*	അരണമരം	15
57	INDIAN BEECH	*Pongamia pinnata*	ഉങ്ങ്	28
58	MUNJA	*Premna serratifolia*	മുഞ്ഞ	1
59	INDIAN KINO TREE	*Pterocarpus marsupium*	വേങ്ങ	1
60	BROWN SALWOOD	*Acacia mangium*	മാഞ്ചിയം	1
61	ASOKA TREE	*Saraca asoca*	അശോകം	1
62	PARADISE-TREE	*Simarouba glauca*	ലക്ഷ്മിതരു	2
63	AFRICAN TULIP TREE	*Spathodea campanulata*	ആഫ്രിക്കൻ പൂമരം	1
64	WILD MANGO	*Spondias pinnata*	അമ്പഴം	1
65	BLACK PLUM	*Syzygium cumini*	ഞാവൽ	5
66	JAVA ROSE APPLE	*Syzygium samarangense*	വലിയ ചാമ്പ	1
67	TEAK	*Tectona grandis*	തേക്ക്	29
68	BELARIC MYROBALAN	*Terminalia bellirica*	താന്നി	3
69	ARJUN TREE	*Terminalia arjuna*	നീർമരുത്	1
70	MADAGASCAR ALMOND TREE	*Terminalia neotaliala*	മഡഗാസ്കർ മരുത്	5
71	PALA INDIGO PLANT	*Wrightia tinctoria*	ദന്തപ്പാല	2
72	ROYAL PALM	*Roystonea regia*	രാജപന	9

Table 6.13. Checklist of common Trees of the campus

No.	Table No.	Flora/Fauna	Abundance
1	6.2	Butterflies	13
2	6.3	Odonates	20
3	6.4	Insects	32
4	6.5	Fishes	58
5	6.6	Amphibians	4
6	6.7	Reptiles	15
7	6.8	Birds	44
8	6.9	Mammals	10
9	6.10	Herbs	14
10	6.11	Grasses	8
11	6.12	Shrubs	14
12	6.13	Trees	72

Table 6.14. Biodiversity of the college campus

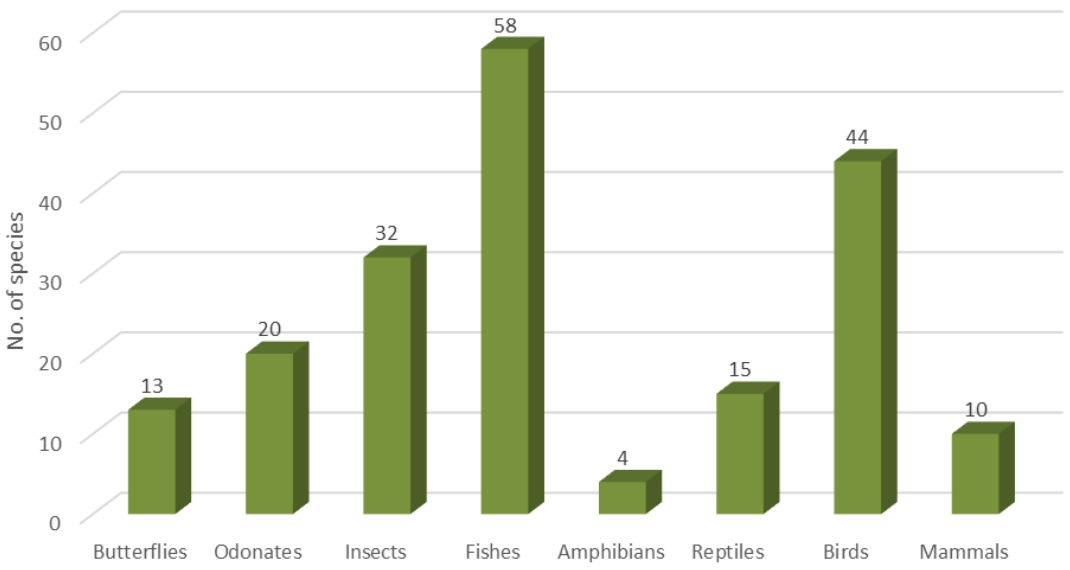


Fig.6.1. Faunal diversity of the campus

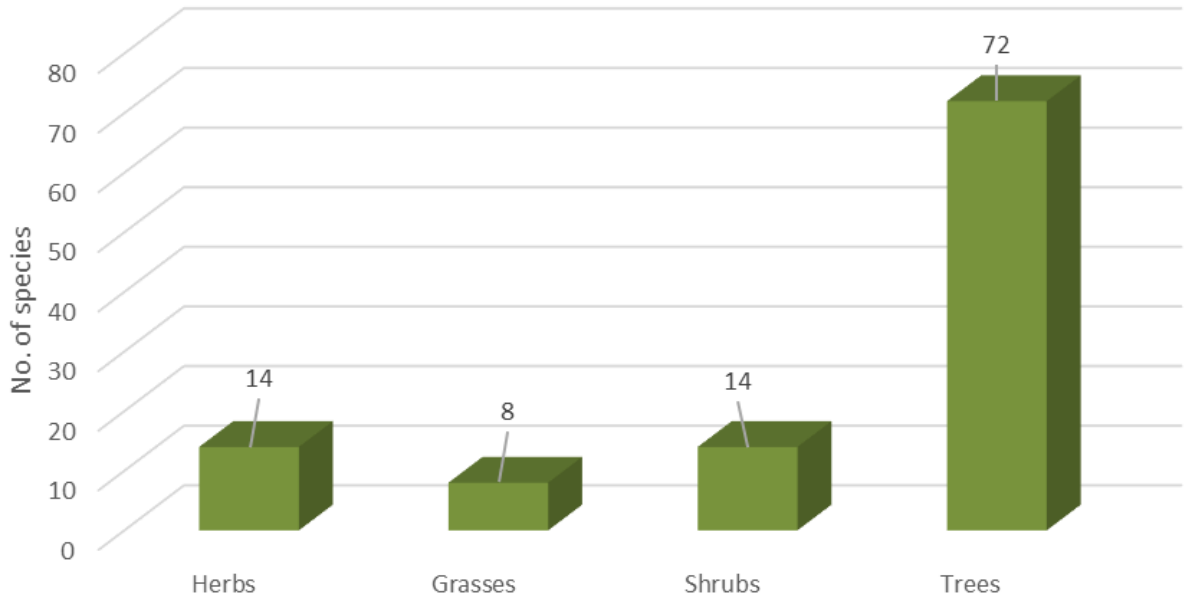


Fig.6.2. Foral diversity of the campus

6.4.2. Simpson index for selected faunal species

6.4.2.1. Butterflies

Sl No	Common Name	Scientific Name	Count
1	COMMON ROSE	*Pachliopta aristolochiae*	10
2	CRIMSON ROSE	*Pachliopta hector*	5
3	COMMON MIME	*Papilio clytia*	9
4	COMMON MORMON	*Papilio polytes*	8
5	SOUTHERN BIRDWING	*Troides minos*	12
6	PIONEER	*Belenois aurota*	10
7	STRIPED TIGER	*Danaus genutia*	13
8	COMMON CROW	*Euploea core*	9
9	GREAT EGGFLY	*Hypolimnas bolina*	3
10	COMMON BUSH BROWN	*Mycalesis perseus*	1
11	COMMON PIERROT	*Castalius rosimon*	2
12	WANDERING PSYCHE	*Leptosia nina*	16
	Simpson Index (D)		0.9

Table 6.15. Biodiversity index of the campus with respect to butterfly population (n=18)

6.4.2.2. Dragonflies and damselflies

SL No.	Scientific Name	Common Name	Total Count
1	*Rhyothemis variegata*	COMMON PICTURE WING	148
2	*Orthetrum sabina*	GREEN MARSH HAWK	75
3	*Pseudagrion microcephalum*	BLUE RIVER DAMSEL	10
4	*Ceriagrion coromandelianum*	COROMANDEL MARSH DART	183
5	*Ischnura senegalensis*	COMMON BLUE TAIL	4
6	*Tholymis tillarga*	EVENING SKIMMER	10
7	*Acisoma panorpoides*	ASIAN PINTAIL	234
8	*Ceriagrion cerinorubellum*	ORANGE TAILED MARSH DART	6
9	*Crocothemis servilia*	SCARLET SKIMMER	43
10	*Neurothemis tullia*	PIED PADDY SKIMMER	42
11	*Aethriamanta brevipennis*	SCARLET MARSH HAWK	6
12	*Rhodothemis rufa*	RUFOUS MARSH GLIDER	19
13	*Agriocnemis pygmaea*	WANDERING MIDGET	17
14	*Brachydiplax chalybea*	RUFOUS-BACKED MARSH HAWK	12
15	*Brachythemis contaminata*	DITCH JEWEL	93
16	*Urothemis signata*	GREATER CRIMSON GLIDER	6
17	*Pantala flavescens*	WANDERING GLIDER	16
18	*Brachydiplax sobrina*	LITTLE BLUE MARSH HAWK	1
19	*Diplacodes trivialis*	GROUND SKIMMER	36
20	*Hydrobasileus croceus*	AMBER-WINGED MARSH GLIDER	4
	Simpson Index (D)		

Table 6.16. Biodiversity index of the campus with respect to odonate population (n=18)

6.4.2.3. Amphibians

Sl. No	Common name	Scientific name	Count
1	COMMON ASIAN TOAD	*Duttaphrynus melanostictus*	9
2	COMMON INDIAN CRICKET FROG	*Minervarya agricola*	4
3	SKITTERING FROG	*Euphlyctis cyanophlyctis*	18
4	COMMON TREE FROG	*Polypedates leucomystax*	2
			0.63

Table 6.17. Biodiversity index of the campus with respect to frog population (n=6)

6.4.2.4. Reptiles

Sl no	Common name	Scientific name	Count
1	ORIENTAL GARDEN LIZARD	*Calotes versicolor*	25
2	COMMON GREEN FOREST LIZARD	*Calotes calotes*	10
3	COMMON GARDEN SKINK	*Lampropholis guichenoti*	15
4	BRONZE GRASS SKINK	*Eutropis macularia*	5
5	BUFF STRIPED KEELBACK	*Amphiesma stolatum*	1
6	CHECKERED KEELBACK	*Xenochrophis piscator*	2
7	TRINKET SNAKE	*Coelognathus helena*	1
8	INDIAN WOLF SNAKE	*Lycodon aulicus*	1
9	ORIENTAL RAT SNAKE	*Ptyas mucosa*	4
10	RUSSELL'S VIPER	*Daboia russelii*	1
11	KUKRI SNAKE	*Oligodon taeniolatus*	1
12	COMMON HOUSE GECKO	*Hemidactylus frenatus*	75
13	HOUSE GEKO	*Hemidactylus brookii*	50
14	BARK GECKO	*Hemidactylus leschenaultii*	10
15	INDIAN BLACK TURTLE	*Melanochelys trijuga*	40
			0.82

Table 6.18. Biodiversity index of the campus with respect to reptile population (n=6)

No.	Taxa	Simpson index	Biodiversity value
1	Butterflies	0.90	Very high
2	Odonates	0.86	High
3	Amphibians	0.63	Moderate
4	Reptiles	0.82	High

Table 6.19. Biodiversity indices of the campus with respect to selected fauna

6.5. CONCLUSION

- The college campus is rich in biodiversity considering the explored species. The abundance of fishes, birds, and trees are notable features. The number of butterflies and odonates observed significantly low in relation to the optimum habitat features.
- The unique feature of the biodiversity of St. Aloysius campus is its fresh water fish diversity (58 species; wetland is the part of the college campus).
- The biodiversity index of the campus was estimated and a high level of biodiversity observed. The plant diversity has to be improved in order to attract more fauna and improve the greenery.
- Studenty participation in conservation efforts are reported. Plant check list and album were prepared by the student efforts.
- There is a lapse of planned conservation efforts and attempts of enhancement of biodiversity of the campus.
- Engaging educational initiatives cantered around biodiversity awareness and conservation efforts underscore the importance of preserving the campus's rich ecological heritage.

6.6. RECOMMENDATIONS

- Organised efforts should be launched to monitor the current biodiversity and to improve its status through various drives.
- Campus community should be aware of the rich biodiversity existing in the campus and regular IEC programmes and participatory conservation projects are recommended.

- The farming area should be developed as a model for organic farming practices.
- Provide labels with QR code for all trees, shrubs etc. Place boards depicting photographs and names of common biodiversity of the campus at various places.
- Engage students, faculty, and staff in citizen science initiatives to monitor biodiversity on campus. This could involve organized bird watching events, insect surveys, or plant identification projects.
- Bird Nesting Boxes and Feeders: Install nesting boxes and bird feeders strategically across campus to provide additional resources for bird species, especially during nesting seasons and harsh weather conditions.
- Foster a sense of stewardship and community involvement in biodiversity conservation through outreach programs, volunteer opportunities, and educational workshops.
- Start an apiculture project in the campus in order to enhance the biodiversity as well as production of honey.

6.7. CAMPUS BIODIVERSITY MANAGEMENT PLAN

6.7.1. Establishment of Biodiversity Auditing Team

Form a dedicated team with representatives from various departments, particularly botany and zoology, including both faculty and students, to manage and coordinate all operations and administrative activities related to the campus biodiversity audit.

6.7.2. Assessment and Biodiversity Audit

- **6.7.2.1.** Assess various plant and animal groups on campus by dividing the area into distinct zones and employing standardized methods for data collection.
- **6.7.2.2.** Regularly assess and measure the progress and impact of biodiversity management efforts on the campus.
- **6.7.2.3.** Use standardized methods for data collection.

6.7.3. Set SMART Goals

- **6.7.3.1.** Nurturing of campus green space to create habitats for diverse forms of life.
- 6.7.3.2. Establish a campus composting program.
- 6.7.3.3. Promote sustainable landscaping practices.
- 6.7.3.4. Organize tree planting events.

6.7.4. Advancing Curriculum Integration and Educational Initiatives

- **6.7.4.1.** Conduct on-campus fieldwork activities, including habitat restoration projects.
- **6.7.4.2.** Encourage students to engage in research projects that focus on local biodiversity and conservation efforts.
- **6.7.4.3.** Organize competitions in photography, and writing with a focus on campus biodiversity themes.

6.7.5. Promoting Sustainable Conservation and Restoration

- **6.7.5.1.** Host hands-on workshops to teach practical skills, including recycling, composting, and energy conservation.
- **6.7.5.2.** Create student-led environmental clubs to organize and implement sustainability projects and initiatives.
- **6.7.5.3.** Promote the planting of native trees, shrubs, and plants that support local wildlife. Replace non-native or invasive species with native alternatives.
- **6.7.5.4.** Launch campaigns to promote sustainability through posters, social media, and school announcements.
- **6.7.5.5.** Establish habitats such as butterfly gardens, birdhouses, and land mass to support various species.
- **6.7.5.6.** Award and acknowledge students who actively contribute to sustainability efforts with certificates, awards, or eco-friendly prizes.
- **6.7.5.7.** Create green corridors that connect fragmented habitats within and around the campus, allowing wildlife to move freely.
- **6.7.5.8.** Conduct regular sustainability assessments of campus operations and involve Students in the process.

6.7.6. Facilitating the development of frameworks

- **6.7.6.1.** Connect students with mentors who are professionals in the sustainability field for guidance and inspiration.

- **6.7.6.2.** Host webinars accessible to students' families and the public, covering various sustainability topics with opportunities for Q&A sessions.
- **6.7.6.3.** Utilize the college's website and social media channels to share updates on sustainability, family-friendly activities, and educational content.
- **6.7.6.4.** Incorporate discussions about sustainability into regular parent-teacher meetings, showcasing the college's initiatives and how families can contribute.

6.7.7. Enhance sustainable procurement practice

- **6.7.7.1.** Prioritize the purchase of college supplies made from recycled materials, such as paper, pens, and folders, and ensure these items are recyclable at the end of their lifecycle.
- **6.7.7.2. I**ntroduce programs in dining services to minimize food waste, including composting, donating surplus food, and practicing portion control.

6.7.8. Research Support and innovative practice

- **6.7.8.1.** Offer opportunities for undergraduate and graduate students to base their dissertations on environmental topics.
- **6.7.8.2.** Organize regular workshops, seminars, and symposiums to bring together researchers from diverse fields to discuss environmental challenges and collaborative solutions.
- **6.7.8.3.** Create awards and recognition programs to honour exceptional interdisciplinary research focused on environmental issues.

6.7.9. Community Engagement practices

- **6.7.9.1.** Organize one-day seminars with experts on topics such as lawn maintenance, composting etc.
- **6.7.9.2.** Offer live sessions on landscaping techniques led by professionals who specialize in the field.
- **6.7.9.3.** Establish advisory boards with representatives from local communities and environmental organizations to provide input and guidance on campus sustainability efforts.
- **6.7.9.4.** Organize workshops and training sessions led by experts from local environmental organizations to educate the campus and community on sustainable practices.

6.7.10. Monitoring and Reporting

- **6.7.10.1.** Schedule regular meetings to assess progress, tackle challenges, and plan future actions.
- **6.7.10.2. E**nsure transparent reporting of results to stakeholders to maintain accountability and transparency.

6.7.11. Compliance and Review

- **6.7.11.1.** Consult with ecologists and biologists who have experience in conducting biodiversity audits and are knowledgeable about legal requirements for species protection and habitat assessment.
- **6.7.11.2.** Continuously review and update audit protocols and compliance procedures in response to feedback, legal changes, and emerging best practices.

6.7.12. Sustainable Resource Stewardship

- **6.7.12.1.** Use drought-tolerant native plants to reduce irrigation needs and enhance local biodiversity.
- **6.7.12.2.** Install drip irrigation systems to deliver water directly to plant roots, minimizing waste and evaporation
- **6.7.12.3.** Collect rainwater in barrels for irrigation and landscaping purposes.
- **6.7.12.4.** Promote the use of compost derived from campus waste in college gardens to reduce reliance on chemical fertilizers, protect beneficial soil organisms, and minimize campus waste.

6.7.13. Eco-Conscious Initiative

- **6.7.13.1.** Restoration Projects: Incorporate habitat restoration efforts into the auditing process, including activities like planting native species and removing invasive plants, to enhance biodiversity outcomes.
- **6.7.13.2.** Eco-Friendly Products: Use biodegradable or compostable products for campus events and dining services to reduce environmental impact.
- **6.7.13.3. I**ncorporate green walls or vertical gardens in campus buildings to boost air quality and provide extra insulation.

6.7.14. Long-term Vision

Align the biodiversity management plan with the institution's long-term sustainability goals, ensuring that conservation efforts are maintained and expanded over time.

6.7.15. Funding and Resources

Secure funding through grants, partnerships, and alumni donations to support ongoing biodiversity management and enhancement projects.

6.8. ACTIVITIES CONDUCTED

മലയാള മനോരമ

കടൽത്തീരത്തെ പ്ലാസ്റ്റിക് മാലിന്യം ശേഖരിച്ചു

ചാവക്കാട് ● ലോക സമുദ്രദിന ത്തോടനുബന്ധിച്ച് എൽത്തുരു ത്ത് സെന്റ് അലോഷ്യസ് കോള ജും ചാവക്കാട് നഗരസഭയും ഗ്രീൻഹാബിറ്റാറ്റും ചേർന്ന് ചാവ ക്കാട് ബ്ലാങ്ങാട് കടൽത്തീരത്തെ പ്ലാസ്റ്റിക് മാലിന്യങ്ങൾ ശേഖരി ച്ചു.
120 കിലോ പ്ലാസ്റ്റിക് മാലിന്യ ങ്ങൾ ശേഖരിച്ചു. നഗരസഭാധ്യ ക്ഷ ഷീജ പ്രശാന്ത് ഉദ്ഘാടനം ചെയ്തു. കോളജ് പ്രിൻസിപ്പൽ ഡോ.ചാക്കോ ജോസ്, കോ-ഓഡിനേറ്റർമാരായ ജയിൻ തേനാട്ടിൽ, എൻ.ജെ.ജയിംസ്, ജയ്സൺ ജോസ്, മെറിൻ ജോ യ്, ഫാ.അരുൺ ജോസ് എന്നി വർ നേതൃത്വം നൽകി.

ചാവക്കാട് നഗരസഭയും എൽത്തുരുത്ത് സെന്റ് അലോഷ്യസ് കോളജു ചേർന്ന് ചാവക്കാട് ബ്ലാങ്ങാട് കടൽത്തീരത്തെ പ്ലാസ്റ്റിക് മാലിന്യങ്ങൾ വൃത്തിയാക്കിയപ്പോൾ.

11/06/2024 | Thrissur(Guruvayoor) | Page : 4

ജന്മഭൂമി

11

ചാവക്കാട് കടപ്പുറം പ്ലാസ്റ്റിക് വിമുക്തമാക്കി

ചാവക്കാട് കടപ്പുറം പ്ലാസ്റ്റിക് വിമുക്തമാക്കുന്ന ചടങ്ങ് ഷിജപ്രശാന്ത് ഉദ്ഘാടനം ചെയ്യുന്നു

ചാവക്കാട്: ലോക സമുദ്ര ദിനത്തോടനുബന്ധിച്ച് എൽ തുരുത്ത് സെന്റ് അലോഷ്യസ് കോളേജും, ചാവക്കാട് നഗര സഭയും, ഗ്രീൻ ഹാബിറ്റാറ്റി ന്റെ സഹകരണത്തോടുകൂടി ചാവക്കാട് കടപ്പുറം പ്ലാസ്റ്റിക് വിമുക്തമാക്കി. ചാവക്കാട് നഗരസഭ ചെയർപേഴ്സൺ ഷിജപ്രശാന്ത് ഉദ്ഘാടനം ചെ യ്തു. ഡോ. ചാക്കോ ജോസ്, ജയിൻ തേനാട്ടിൽ, എൻ.ജെ. ജെയിംസ്, ജയ്സൺ ജോ സ് മെറിൻ ജോയ്, ഫാദർ അരുൺ ജോസ് എന്നിവർ നേതൃത്വം നൽകി.

ഗ്രീൻ ഹാബിറ്റാറ്റിന്റെ നേ തൃത്വത്തിൽ സമുദ്ര പഠന ക്ലാസുകൾ സംഘടിപ്പിച്ചു. ഏകദേശം 120 ഓളം കിലോ പ്ലാസ്റ്റിക് കടൽ തീരത്ത് നിന്ന് ശേഖരിച്ച് ഹരിത കർമ്മസേന യ്ക്ക് കൈമാറി. സുവോളജി ബോട്ടണി എൻഎസ്എസ് വിഭാഗത്തിലെ അമ്പതോളം വിദ്യാർത്ഥികളാണ് പരിപാ ടിയിൽ പങ്കെടുത്തത്.

SARPA- Awareness programme on snake and snake bite

Awareness program on snakes and snake bites was conducted by Nature club & department of zoology in association with Social forestry division ,Thrissur for the students of St. Aloysius College on 30/11/23 at 10.30 AM in auditorium. The session was done by Joju C.T,Master trainer,Snake rescue guideline,Kerala forest department. Principal, Dr.Chacko Jose P presided the function.Coordinator of nature club Mr.Jain J Therattil introduced the resource person and gave general welcome address.The session included the following:

1. Presentation on common snake species found in the local area and their characteristics.

2. Differentiation between venomous and non-venomous snakes.

3. Use of visual aids such as pictures and videos to enhance learning.

4. Step-by-step guide on what to do immediately after a snake bite

5. Demonstration of basic first aid techniques.

The session was concluded by the vote of thanks by Sarang of first B.Sc.Zoology.

തണ്ണീർത്തടദിനത്തിൽ പാടത്തിറങ്ങി വിദ്യാർഥികൾ

ലോക തണ്ണീർത്തടദിനത്തിൽ എൽത്തുരുത്ത് സെയ്ന്റ് അലോഷ്യസ് കോളേജിലെ വിദ്യാർഥികൾ കോളേജിനോടുചേർന്ന കോൾപ്പാടത്ത് ഞാറ് നടുന്നു

തൃശ്ശൂർ ▸ ലോക തണ്ണീർത്തടദിനത്തിൽ പാടത്തിറങ്ങി ഞാറുനട്ട് കോളേജ് വിദ്യാർഥികൾ. എൽത്തുരുത്ത് സെയ്ന്റ് അലോഷ്യസ് കോളേജിലെ അലോഷ്യൻ കോം പഠനഗവേഷണകേന്ദ്രത്തിന്റെ ആഭിമുഖ്യത്തിലായിരുന്നു പരിപാടി. കോളേജിനോടുചേർന്നുള്ള എൽത്തുരുത്ത് കോംപാടത്തിലാണ് വിദ്യാർഥികൾ ഞാറ് നട്ടത്.

ഗവേഷണകേന്ദ്രം കൺവീനർ ജെയിൻ തോട്ടിൽ, പ്രിൻസിപ്പൽ ചാക്കോ ജോസ്, മാനേജർ ഫാ. തോമസ് ചക്രമാക്കിൽ, അഡ്മിനിസ്ട്രേറ്റർ ഫാ. അരുൺ ജോസ് എന്നിവർ നേതൃത്വം നൽകി. സെന്ററിന്റെ നേതൃത്വത്തിൽ കോംപ്പാടങ്ങളുമായി ബന്ധപ്പെട്ട ഗവേഷണപദ്ധതികളും പരിപാടികളും നടപ്പാക്കുന്നുണ്ട്. കോളേജിലെ ജൈവവൈവിധ്യ ക്ലബ്ബും എല്ലാ വകുപ്പുകളും പ്രവർത്തനത്തിൽ പങ്കാളികളാകുന്നുണ്ട്.

03/02/2024 THRISSUR Pg 04

Nammbu- Paddy Cultivtion Initiatives

Students of Dept of Zoology and Botany in association with KOLE CENTRE initiated the Paddy cultivation drive in Kole wetlands of Elthuruth on 02/02/24, World wetland day. College Manager Rev Fr. Thomas Chakkramakkil, College Principal Dr. Chacko Jose P , Centre Coordinator , Jain Theratil and 70 students from college participated the green initiative. The seed used was this cultivation drive was ' Jyothi'.

Report on "Nature, therefore Literature" Workshop

On January 17, 2024, St. Aloysius College, Elthuruth, Thrissur, Kerala, in collaboration with the Kerala Sahitya Akademi, hosted a one-day workshop titled "Nature, therefore Literature." The event, held at the College Auditorium from 10:30 am to 3:30 pm, was an engaging exploration of the interconnection between the natural world and literary expression, with a focus on promoting environmental awareness through literature.

The workshop was organized by the Departments of English (UG, PG & Research) and Malayalam, along with the Aloysian Centre for Kole Wetland Studies and Research. The organizing committee comprised Dr. Betsy Paul C., Mr. Jaison Jose, Mr. Jain J. Thattatil, Dr. Deepti Parangot, Dr. Merin Joy, and Ms. Vincy T.P., who collectively ensured the smooth execution of the event.

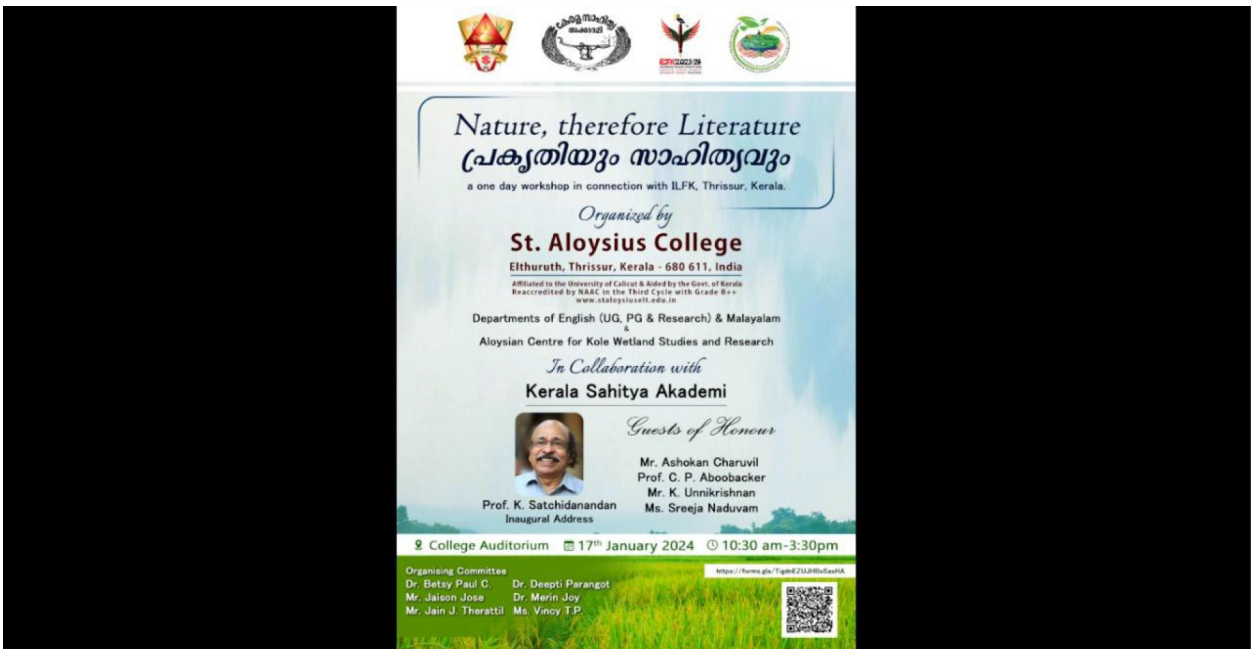
The inaugural address was delivered by the eminent poet and scholar Prof. K. Satchidanandan, who set the tone for the day with his insightful reflections on the symbiotic relationship between nature and literature. His address highlighted the role of literature in fostering a deeper understanding of the environment and the need for a more ecocentric worldview in literary studies.

The event also featured a distinguished panel of Guests of Honour, including Mr. Ashokan Charuvil, Prof. C. P. Aboobacker, Mr. K. Unnikrishnan, and Ms. Sreeja Naduvam. Each of the guests brought their unique perspectives to the discussion, enriching the participants' understanding of how literature can be a powerful tool in environmental advocacy.

Throughout the day, the participants engaged in various sessions that delved into the themes of ecocriticism, the representation of nature in literature, and the cultural significance of the environment in literary traditions. The discussions were both enlightening and thought-provoking, encouraging participants to consider the vital role that literature plays in shaping our perceptions of the natural world.

The workshop concluded with a call to action for integrating environmental concerns more deeply into literary studies and for using literature as a means to inspire positive environmental change. The participants left with a renewed commitment to exploring and advocating for the preservation of nature through the power of the written word.

The "Nature, therefore Literature" workshop was a significant contribution to the academic discourse on the intersection of nature and literature, reflecting St. Aloysius College's dedication to promoting environmental awareness through education and research.


Nature, therefore Literature
പ്രകൃതിയും സാഹിത്യവും
a one day workshop in connection with ILFK, Thrissur, Kerala.
Organized by
St. Aloysius College
Elthuruth, Thrissur, Kerala - 680 611, India
Affiliated to the University of Calicut & Aided by the Govt. of Kerala
Reaccredited by NAAC in the Third Cycle with Grade B++
www.staloysiuselt.edu.in
Departments of English (UG, PG & Research) & Malayalam
&
Aloysian Centre for Kole Wetland Studies and Research
In Collaboration with
Kerala Sahitya Akademi
Guests of Honour
Mr. Ashokan Charuvil
Prof. C. P. Aboobacker
Mr. K. Unnikrishnan
Ms. Sreeja Naduvam
Prof. K. Satchidanandan
Inaugural Address
College Auditorium
17th January 2024
10:30 am-3:30pm
Organising Committee
Dr. Betsy Paul C.
Dr. Deepti Parangot
Mr. Jaison Jose
Dr. Merin Joy
Mr. Jain J. Therattil
Ms. Vincy T.P.


Nature, therefore Literature
പ്രകൃതിയും സാഹിത്യവും
a one day workshop in connection with ILFK, Thrissur, Kerala.

Chapter VII

WASTE MANAGEMENT SYSTEM AUDIT REPORT (WMS)

WASTE MANAGEMENT COMMITTEE (WMC 2021-24)

Eldhose Mathachan
Umadevi P
Helna K Paul
(Assistant Professors)

Rohini V
Thejus V S
Aakash P S
Devi Krishna T S
Devika T R
Nandana Byju
Aleesha Sheeju
Gaya P S
Liyana Abdul Latheef
Akmal Hussain K Z
(Students)

7

Waste Management System Audit Report

7.1 INTRODUCTION

Annually, the world produces an average of 2.01 billion tons of waste. The World Bank's findings reveal that East Asia and the Pacific region lead in waste production, contributing 23 percent (468 million tons) of the total annual waste output. To grasp the enormity of this, consider that 468 million tonnes equate to the weight of 46,337 Eiffel Towers (each weighing 10,100 tons) or 4.5 million blue whales (weighing 105 tons each). The escalating volume and intricacy of waste, a by-product of our modern economy, pose significant threats to ecosystems and human health. Globally, an estimated 11.2 billion tonnes of solid waste are collected annually, with the decay of organic waste contributing roughly 5 percent of global greenhouse gas emissions. Among the various waste streams, the disposal of electrical and electronic equipment, which contains new and complex hazardous substances, emerges as the swiftest-growing challenge in both developed and developing nations

India annually produces 62 million tonnes of waste, of which 70% is collected, but only 12 million tonnes undergo treatment; the remaining 31 million tonnes end up in landfills. Projections indicate that by 2030, due to evolving consumption patterns and rapid economic growth, municipal solid waste generation will surge to 165 million tonnes. Despite the significant role played by the informal sector in extracting value from waste, India grapples with numerous waste management challenges. These range from deficient collection systems to ineffective disposal methods, resulting in air pollution, water, and soil contamination. Open, unsanitary landfills further exacerbate drinking water contamination, posing infection risks and transmitting diseases. Ecosystems suffer from debris dispersal, while hazardous substances from electronic and industrial waste strain both urban residents' health and environmental integrity. Urban areas, home to 377 million people, churn out 62 million tons of solid waste annually, but only 43 million tons are collected, leaving the remainder untreated or destined for landfills. E-waste emerges as a pressing concern, with projections foreseeing a significant uptick in its generation. Inadequate garbage collection infrastructure compounds the issue, with a mere 21 million garbage collectors compared to China's 700 million. Additionally, a mere 30% of waste undergoes proper sorting, leading to valuable recyclable materials such as aluminium and plastics being erroneously consigned to landfills instead of being recycled.

Waste management in India falls under the jurisdiction of the Union Ministry of Environment, Forests, and Climate Change, where regulations are guided by the principles

of "sustainable development," "precaution," and "polluter pays." These principles mandate responsible action from cities and businesses to mitigate environmental harm they may cause, ensuring the well-being of the surroundings. With the surge in economic growth, the volume of waste has escalated, prompting the enactment of laws governing waste handling under the Environment Protection Act of 1986.

In the context of college and university campuses in India, two primary categories of waste are typically produced: solid waste and liquid waste. Solid wastes generated in community activity centres are commonly referred to as Municipal Solid Waste (MSW), and the waste management strategy suggested for campuses now focuses solely on MSW, while liquid wastes are addressed through Water Audit initiatives. The main sources of solid waste on campuses encompass stationary items, food and other organic waste, metals, tins, cans, packaging materials, chemicals, hazardous material containers (from laboratories), electronic wastes, and more.

7.1.1What is Waste Management Audit?

A waste audit is a systematic review of all waste that is generated within a campus. It gives a college a clear idea of what they are throwing out, how much, and what common contaminants people are producing. It helps determine how effective a waste management system already is, and identify areas for implementing new strategies.

- Detailed inventory of quantity of wastes generated in the college/university campus at various sources (Canteen, Hostel, Class rooms, Office, laboratories etc.)
- A detailed review of the existing waste management system at each source points (evaluation of existing practices) and their impacts on environment and health of stakeholders.
- Implementation of proper scientific waste management system in the campus in order to enhance waste management processes and contribute nature conservation (habitual modifications, installation of Biogas Plant, composting unit; MCF etc.).

7.1.2 Need for waste Management Audit

Waste management and environment policy aims to provide an education and awareness in a clean environment to the stakeholders with regard to environmental compliance. Scope of the policy applies to all employees and students of the college/university to provide an eco-friendly atmosphere. Waste Management Policy dealt with cleanliness of the campus maintained through proper disposal of wastes and steps to be followed to recycle the biodegradable wastes and utilization of eco-friendly supplies to maintain the campus free from hazardous wastes /pollutants (Cardenas and Halman, 2016). The concept of eco-friendly culture is disseminated among the students as well as rural community through various awareness programmes. Head of the Organization, Departmental Heads and Senior Managers/ Management Representatives are responsible for monitoring the "waste management" initiatives of the College / University and maintain a clean campus while each and every individuals of the organisation should adhere to the policy.

Waste Management may be beneficial to the campus in improving the greenery activities which in turn useful to save the planet for future generation. It is necessary to conduct Waste Management audit frequently at least once in three years in campus because students and staff members should aware of the Waste Management and its beneficial effects in order to save planet by means of 'Go green concept' which in turn support the institution to set environmental models ('icon') for the community. Waste Management is a professional and useful measure for an academic institution also in order to determine how and where they are retaining the campus eco-friendly manner (Kaseva and Gupta, 1996).

7.2 WASTE MANAGEMENT SYSTEM POLICY

7.2.1 Statement of Commitment

Major environmental challenges stem from waste generation and the inadequate collection, transport, treatment, and disposal of waste. Current systems are struggling to manage the increasing volumes generated by growing urban populations, which negatively impacts the environment and public health. While the challenges and barriers are significant, they also present substantial opportunities. Despite advancements in social, economic,

and environmental sectors, waste management systems have remained relatively unchanged. However, these issues can be addressed through the active participation of civil society, policymakers, the industrial sector, and educational institutions, where the next generation's behaviors are shaped, these issues can be addressed. The institution is committed to creating a sustainable and environmentally responsible campus community, thereby setting a model for families and society at large. This policy outlines the guidelines for effective waste management practices on campus.

7.2.2 Goal

Develop and implement a comprehensive waste management strategy on campus that reduces waste through responsible consumption and reuse, establishes effective waste segregation and recycling systems, ensures safe disposal of non-recyclable materials, and enhances college community awareness of waste management practices and their environmental impacts.

7.2.3 Objectives

- To minimize waste generation in the college campus through responsible consumption and reuse strategies.
- To implement a comprehensive system for waste segregation in the campus itself.
- To promote and facilitate recycling of all recyclable materials.
- To ensure safe and responsible disposal of non-recyclable waste.
- To educate the campus community on waste management practices and their environmental impact that leading to habituation.
- To educate the stakeholder commu0nities of the college with sustainable waste management practices.

7.2.4 Resource Management

The policy aims to develop a framework for the effective management of waste generated by the college, based on the 5 R principles: respect, rethink, reduce, reuse, and recycle. It prioritizes minimizing waste generation and devising a strategic plan to manage waste on campus, ensuring it does not pose a threat to the well-being of the community or the aesthetic and natural beauty of the college. The following are the strategic plans:

7.2.4.1. Waste Assessment and Segregation

- **7.2.4.1.1** Conduct a waste audit to understand the types and quantities of waste generated on campus. Categorize waste into organic, recyclable, non-recyclable, and hazardous waste. And provide separate bins for each waste category across the campus.
- **7.2.4.1.2** Install recycling bins in prominent locations and ensure regular collection and transportation to recycling centres. Encourage the use of recycled products and materials within campus facilities.
- **7.2.4.1.3** The use of reusable water bottles, plates, and cutlery will be encouraged in canteens and cafeterias. Promote the use of recycled paper and explore ways to minimize waste generation through responsible purchasing practices.

7.2.5. Hazardous Waste Management

- **7.2.5.1** Implement strict protocols for the handling, storage, and disposal of hazardous waste such as chemicals, laboratory discards, batteries, and electronic waste. Provide specialized containers for hazardous waste and ensure proper labelling and segregation. And Partner with authorized agencies for the safe dispose al of hazardous materials.

7.2.6. Curriculum integration

- **7.2.6.1** Waste management education will be integrated into relevant academic programs.
- **7.2.6.2.** Awareness campaigns will be conducted to educate the campus community on proper waste disposal practices.

7.2.7. Research and innovation

- **7.2.7.1** Encourage student to initiative vide research program to develop innovative method in effective waste management practice. Like exploring the possibilities of waste to energy, Organize nation and international conference on sustainable waste management practice

7.2.8. Green initiative

- **7.2.8.1** Encouraging the student and faculty members for vegetable garden by utilizing the natural fertilizer generated out of compost pit.

- **7.2.8.2.** Creating sharing economics for books, uniforms and other materials.
- **7.2.8.3.** A student-led Green Committee will be established to oversee waste management initiatives and promote participation.

7.2.9. Purchase and procurement

- **7.2.9.1** Designing sustainable buildings and infrastructure with waste reduction in mind
- **7.2.9.2.** Purchasing products with minimal packing or those made from recycled materials
- **7.2.9.3.** Buy in bulk to reduce packaging waste and coast.

7.2.10. Community engagement

- **7.2.10.1.** Will actively collaborate with the Thrissur Municipal Corporation to understand local waste management regulations and explore collaborative opportunities (Optional)
- **7.2.10.2.** Fostering partnership with organizations for waste management solutions.

7.2.11. Monitoring and Reporting

- **7.2.11.1.** Regular monitoring of waste segregation and disposal practices will be conducted.
- **7.2.11.2.** A system for reporting and addressing non-compliance with the policy will be established.
- **7.2.11.3. I**ncentive programs or recognition systems may be implemented to encourage participation.

7.2.12. Compliance &Review

- **7.2.12.1.** This policy will be reviewed and updated periodically to reflect best practices and changing needs.
- **7.2.12.2.** All members of the College community, including students, faculty, staff, and visitors, are responsible for adhering to this policy.

7.2.13 Conclusion

By embracing innovative solutions and fostering a culture of sustainability, the institution can turn these challenges into opportunities for positive environmental change. The institution commitment to responsible waste management not only supports a healthier campus but also inspires broader societal shifts towards a greener future. Together, can create a lasting impact that benefits both present and future generations

7.3 METHODOLOGY

Effective waste management is crucial for maintaining clean and healthy environments, reducing pollution, conserving natural resources, and protecting public health. This is achieved through a structured approach led by a dedicated waste management group (internal auditors) comprising 13 members 10 student representatives and 3 faculty members—tasked with overseeing all waste management activities. The team operates according to a comprehensive waste management policy that outlines their objectives, action plans, and strategies for ensuring efficient waste management. Regular meetings are held to evaluate progress and refine strategies as necessary.

7.3.1 Data sampling and categorization of waste

The waste management audit is conducted by assessing per year generation of various categories of wastes like food waste, plastic, litter, and e-waste, with separate records maintained for each category. These records track waste quantities generated from key areas, including the canteen, and campus.

7.3.2 Register and Document to monitor the process

Detailed records are also kept for waste disposal methods, documenting the amounts sent to recycling facilities, composting units, and other disposal systems. Student representatives are responsible for managing records related to recycling facilities and waste processing units.

7.3.3 Assumption

Waste generation is an increasing global, regional, and local challenge. Traditional waste management practices, such as incineration and landfilling, often lead to harmful emissions and discharges into the soil, air, and water, contributing to pollution and environmental degradation. These challenges are further intensified by unsustainable production and consumption patterns and the rapid pace of global urbanization. The cost of environmentally sound waste management can be seen as prohibitive, leading to improper disposal methods that pose significant risks to both human health and the environment. Globally, waste management presents a dichotomy. Developed countries, particularly those in the OECD, have implemented structured waste management systems, whereas non-OECD nations continue to face challenges, including reliance on unregulated landfills and a lack of comprehensive

waste classification frameworks. In many countries, waste management policies still prioritize incineration or landfill disposal, especially as industrialization progresses. However, in the last few decades, the concept of 'integrated waste management,' based on the principles of the Waste Hierarchy, has gained traction. This approach, endorsed by ISO 14001, emphasizes waste prevention, reuse, recycling, and recovery before resorting to disposal, ensuring a more sustainable and environmentally responsible method of managing waste.

7.3.4 Stages of Waste management audit

Waste Management audit has three phases: Pre audit, audit and post audit.

7.3.4.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with waste management policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the waste generation pattern, and provisions of their management.
- Preparation of inventory for quantity of various types of solid waste generation (location wise): MSW (general- litter, paper, stationary waste etc.); biowastes (food, plant litter etc.); plastic waste; hazardous waste (chemical residue from labs; discarded e wastes etc.); construction and demolition wastes; biomedical waste (e.g., from life science laboratories); e wastes (computers, CDs, pen drives, mobile phones etc.).
- Documentation of all existing practices and provisions of solid waste management in the campus

7.3.4.2 Audit phase

Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:

- Assessment of collected data in relation with environmental policy and waste management policy of the college/university
- Review of present waste management systems and enhancement suggestions

7.3.4.3 Post audit phase

- The plan of action for the post-audit phase implementation and follow-up. All possible suggestions for the improvement of WMS of the institution is implemented.
- WMS committee will ensure that the Waste Management System is functional at expected level and the college is participating, by making the entire college/university community well informed through regular communications; monitoring through periodical evaluation programmes etc.

7.3.5 Steps of Waste Management Audit

7.3.5.1 Site assessment

Collection of contour map and campus diagram; mark the waste generation points and storage points in the diagram.

- Walk through survey; quantification process of each kind of waste at each location;
- Survey on existing waste management practices in the campus. Data on quantity and type of processing of each kind of waste is recorded

7.3.5.2 Data analysis

Analysis of current and past performance (pre audit and post audit performances, previous audit data etc.)

- Regression analysis involves the comparison of waste production on the Y axis versus the potential waste management driver on the X axis (weather, working days/holidays etc.).
- Carbon credit calculation

7.3.5.3 Final audit by external audit team

- Data verification- identifying non conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

7.4. Work plan & Schedule

Activities	Frequency	Dates of study	Mode of data collection
Recording waste generation and collection food waste, plastic, litter and e-waste) OR manual one time evaluation	6 week, one time a day of sampling	Three working day ;2-7-2024, 3-7-2024, 4-7-2024, 5-7-2024, 8-7-2024, 9-7-2024,10-7-2024,11-7-2024,12-7-2024,15-07-2024,16-07-2024,17-07-2024,18-07-2024,19-07-2024,22-07-2024,23-07-2024,24-07-2024,25-07-2024,26-07-2024 29-07-2024,30-07-2024,31-07-2024,1-8-2024,2-8-2024,05-08-2024,06-08-2024,07-08-2024,08-08-2024 09-08-2024 holidays (Sunday; 07-07-2024,14-07-2024, 21-07-2024 28-07-2024, 04-08-2024,11-08-2024 Three semi holiday Saturday ; 6-7-2024 , 13-07-2024,20-07-2024 27-07-2024 27-07-2024,03-08-2024 10-08-2024,(completed by six weeks)	Entry in the given format

Table 7.1. Work plan for the audit of the waste management

Week	Week days	Weekly work plan	Activity implementation
First week	01.07.2024 TO 07.07.2024	Assessment of the types and amounts of waste generated on campus.	• Grouping of internal student auditors • Identification of waste generation points in the college • Assigning internal audit team to each point • Documentation of existing waste management practices.
Second week	08.07.2024 to 14.07.2024	• Preparation of registers to be kept at various waste generation points Conduct awareness campaigns in the campus regarding waste management	• Conduct a meeting of internal auditors • Internal audit team distributes the registers among the staffs of canteen, office and labs and asked them to record the weights of waste generated in each place • Organize competitive events among students and staffs to reduce and recycle the waste.
Third week	15.07.2024 TO21.07.2024	Primary data gathering, preliminary analysis and auditing by internal auditors	• Conduct a meeting of internal auditors • Baseline data collection and analyze the quantity of waste produced in each point. • Develop the measure for waste segregation and management
Fourth week	22.07.2024 TO 28.07.2024	Identification & development to effective waste management system	• Identify & introduce waste management strategies • Conceive, develop and refine ideas • Review the previous ideas suggested by unit personal
Fifth week	FIF 29.07.2024 TO 04.08.2024	Assessment of Waste Management system	• Reporting, Documenting and presenting in the internal audit meeting
Sixth week	05.08.2024 TO 11.08.2024	Report submission on Waste audit	Report preparing and presentation

Table 7.2. Schedule of the audit of the waste management at St. Aloysius College

7.4. RESULTS AND OBSERVATION

7.4.1. Data survey on solid waste collection

The college has established six designated waste collection points ([1]. Office; [2]. Campus; [3]. Canteen; [4]. Library; [5]. Physics Lab; [6]. Zoology Lab) to facilitate data collection and tracking of the total annual waste generation. Waste is segregated and categorized into five distinct streams: [1] Plastic, [2] paper,[3] bio-waste, [4] e-waste, and [5] other waste (chemicals, broken glass, construction waste, textile waste, packing waste and stationary waste). The collected data provides valuable insights into the annual waste generation patterns on campus, differentiating between waste produced on working days, holidays, and semi-holidays.

7.4.1.1. Waste collection point I- Office

Plastic		
Days	Average waste per day	Average per year waste generation (in Kg.)
Holiday	0	0
Working day	0.01	0.95
Semiholiday	0.01	2
Total waste generation of plastic		2.95

Table 7.3. Average production of plastic waste in Point I.

The overall plastic waste generation at the location is relatively low, totalling only 2.95 kg annually. Waste generation remains consistent between working days and semi-holidays, with a slight but measurable accumulation over time due to regular office operations. Notably, no plastic waste is produced during holidays, indicating that activity levels such as fewer people or reduced facility usage significantly influence waste production. This pattern could inform efforts to reduce plastic waste, especially on working and semi-holiday days, by promoting reusable materials and implementing more efficient waste management strategies.

Paper		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0.01	0.95
Working day	0.2	40
Total waste generation of paper		40.95

Table 7.4. Average production of paper waste in Point I.

During holidays, no paper waste is generated, likely due to the lack of activities and operations. In contrast, during semi-holidays, the paper waste is minimal, averaging just 0.01 kg per day, which totals about 0.95 kg annually. This indicates that limited activities occur during semi-holidays, leading to reduced waste. On working days, however, paper waste increases significantly, averaging 0.2 kg per day, resulting in approximately 40 kg over the year. This highlights that most waste is produced during full operational days. In total, the annual paper waste amounts to 40.95 kg, with the majority originating from working days. Thus, reducing paper usage on these days could greatly enhance overall waste reduction.

7.4.1.2. Waste collection Point II- Library

Plastic		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0.01	0.9
Working day	0.01	2
Total waste generation of plastic		2.9

Table 7.5. Average production of plastic waste in Point II.

No plastic waste is generated on holidays, suggesting either a lack of activities or a strict no-waste policy in place. On semi-holidays, plastic waste is minimal, averaging 0.01 kg per day, leading to an estimated annual total of 0.9 kg. This points to reduced activity or partial operations on these days. During working days, waste generation remains low at an average of 0.01 kg per day, but because these days are more frequent, the annual total rises to 2 kg. Overall, the total plastic waste generated annually, including holidays, semi-holidays, and working days, is 2.9 kg. The data indicates that plastic waste generation is relatively low, even on working days, which may reflect effective waste reduction practices or limited plastic usage in this environment. While the difference in waste between working days and semi-holidays is minor, the cumulative impact of working days contributes significantly to the total waste. This suggests that targeted efforts to further minimize plastic use during working days could enhance waste reduction initiatives.

Paper		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0.08	7.6
Working day	0.24	48
Total waste generation of paper		55.6

Table 7.6. Average production of paper waste in Point II.

On Sundays, no paper waste is generated, indicating a lack of activities that involve paper use. During semi-holidays, the average daily paper waste is 0.08 kg, resulting in an annual total of 7.6 kg. Conversely, on full working days, paper waste rises significantly to 0.24 kg per day, culminating in an annual total of 48 kg. Overall, the total annual paper waste amounts to 55.6 kg, waste occurring on full working days. The minimal waste on semi-holidays and the absence of waste on holidays highlight the correlation between institutional activity levels and paper consumption, suggesting that reducing paper use on working days could lead to a substantial decrease in overall waste.

7.4.1.3. Waste collection point III- Campus

Plastic		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0.09	6.3
Working day	0.46	92
Semiholiday	0.12	11.4
Total waste generation of plastic		109.7

Table 7.7. Average production of plastic waste in Point III.

On working days, the highest generation of plastic waste occurs, averaging 0.46 kg per day, which totals 92 kg annually. In contrast, holidays and semi-holidays produce considerably less, with 6.3 kg per day and 11.4 kg per year, respectively. This trend can be linked to heightened activity and resource consumption during working days, as more people are on campus, resulting in increased plastic use. Conversely, holidays and semi-holidays experience reduced campus activity, leading to lower waste generation. This underscores the direct relationship between human presence and plastic waste production.

Paper		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0.09	6.3
Working day	0.33	66
Semiholiday	0.1	9.5
Total waste generation of paper		81.8

Table 7.8. Average production of paper waste in Point III.

The data shows that working days are the largest contributors to paper waste at the institution, averaging 0.33 kg of waste per day, which totals 66 kg annually. In contrast, holidays and semi-holidays produce significantly less waste, at 6.3 kg and 9.5 kg per year, respectively. Overall, the institution generates 81.8 kg of paper waste each year, with 81% occurring on working days. This indicates that regular institutional operations during these days are the primary source of paper waste. Therefore, targeting reductions in paper usage or enhancing recycling efforts on working days could greatly minimize overall waste. The marked disparity in waste generation between working days and holidays underscores the direct correlation between paper use and institutional activity. Adopting sustainable paper practices during these peak periods could lead to considerable waste reduction.

Other waste		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0.11	7.7
Working day	0.82	164
Semiholiday	0.12	11.4
Total waste generation of other waste		183.1

Table 7.9. Average production of paper waste in Point III.

The average daily waste generated is 0.11 kg, leading to an estimated annual total of 7.7 kg. The reduced waste on holidays can be attributed to minimal campus activity, fewer people, and limited operations. In contrast, average daily waste increases significantly to 0.82 kg on working days, resulting in an anticipated annual total of 164 kg. This sharp rise reflects heightened activity levels, with more students, staff, and services contributing to greater waste production. On semi-holidays, daily waste generation is only slightly higher than on holidays, at 0.12 kg, which results in an annual total of 11.4 kg. These days may involve partial operations, such as administrative functions, leading to marginally more waste than full holidays but still significantly less than regular working days. Overall, "other" waste totals 183.1 kg annually, indicating that waste is produced during working days. This data highlights that working days are the primary contributors to waste production, underscoring the need for targeted waste management strategies during these times to mitigate environmental impact.

7.4.1.4. Waste collection Point IV- Canteen

Plastic		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0	0
Working day	0.56	112
Total waste generation of plastic		112

Table 7.10. Average production of plastic waste in Point IV.

The data shows that the average plastic waste generated on working days is 0.56 kg, resulting in an annual total of 112 kg. Notably, no waste is produced on holidays or semi-holidays, highlighting the strong link between regular activities on working days and plastic waste generation. This indicates that daily routines significantly contribute to plastic waste. To effectively reduce overall plastic waste, targeted strategies should be implemented during working days such as promoting reusable materials, enhancing recycling initiatives, and raising awareness about reducing plastic use

Paper		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0	0
Working day	0.96	192
Total waste generation of paper		192

Table 7.11. Average production of paper waste in Point IV.

Based on the provided data, it appears that the average paper waste generated per working day is relatively low at 0.96 kg, resulting in an annual total of 192 kg. Notably, no waste was produced on holidays and semi-holidays, suggesting that paper use aligns closely with operational days. With an average of less than 1 kg of paper waste daily, this level can be deemed manageable, highlighting opportunities for further improvement through awareness and sustainable practices, such as digitizing documents and promoting recycling. The annual total of 192 kg can serve as a benchmark for future sustainability initiatives. Targeted interventions significantly contribute to overall waste reduction goals. This data also opens the door for implementing strategies like paperless practices and optimizing paper usage to further minimize waste generation.

Bio-waste		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0	0
Working day	1.13	226
Total waste generation of Bio-waste		226

Table 7.12. Average production of bio waste in Point IV.

The data reveals that bio-waste generation is significantly higher on working days, averaging 1.13 kg daily and totalling 226 kg annually. Notably, no bio-waste is produced on holidays or semi-holidays, underscoring the direct link between waste generation and institutional activity levels, particularly food consumption and related activities on working days. The college has a system in place requiring the contractor responsible for managing the canteen to collect food waste regularly.

7.4.1.5. Waste collection Point V- Zoology Lab

Plastic		
Days	Average (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semiholiday	0	0
Working day	0.04	8
Total waste generation of other plastic		8

Table 7.13. Average production of plastic waste in Point V.

The average daily plastic waste generation on working days is quite low, at just 0.04 kg, resulting in an annual total of approximately 8 kg. This indicates that plastic waste generation is minimal in this context, likely due to effective waste management practices, low individual plastic usage, or limited activities that produce plastic waste. The lack of waste on holidays and semi-holidays further suggests that plastic waste is mainly linked to working days, reinforcing the notion that levels of engagement and activity influence waste generation

Paper		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0.07
Semi holiday	0	0
Working day	0.07	0.2
Total waste generation of paper		0.27

Table 7.14. Average production of plastic waste in Point V.

The data indicates that paper waste is minimal during holidays and semi-holidays, with only 0.07 kg on holidays and none on semi-holidays. In contrast, the average waste generated on working days is 0.2 kg. This trend suggests that increased activity such as meetings, classes, and administrative tasks during working days contributes to higher paper usage. Conversely, the absence of these activities on holidays and semi-holidays correlates with negligible paper waste. Implementing practices such as digital documentation, recycling, and reducing paper consumption could effectively reduce this waste. Focusing on decreasing paper usage during working days could have a significant impact on overall paper waste generation and support sustainability initiatives.

Other waste		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semi holiday	0	0
Working day	0.04	8
Total waste generation of other waste		8

Table 7.15. Average production of other waste in Point V.

The data shows that waste generation is minimal on working days, totalling just 8 kg annually. This suggests that the existing waste management practices are either effective or that the activities during these days do not produce significant waste. The low waste volume may reflect successful recycling or waste reduction strategies in place. If the activities on working days are less waste-intensive perhaps using fewer materials this could naturally lead to lower waste generation. Additionally, the absence of waste on holidays and semi-holidays indicates that waste primarily arises from specific operational activities or events.

Bio waste		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	0
Semi holiday	0	0
Working day	0.26	52
Total generation bio-waste		52

Table 7.16. Average production of bio- waste in Point V.

The data reveals that bio-waste generation is predominantly limited to working days, averaging 0.26 kg daily, which totals 52 kg annually. This trend indicates that activities on working days, particularly due to the handling and disposal of biological materials used in experiments and research. This waste can include animal tissues, organs, and fluids, as well as unused specimens and contaminated materials from dissections, significantly contribute to waste generation. The lack of bio-waste on holidays and semi-holidays underscores that waste production is closely linked to operational activities

7.4.1.6. Waste collection Point VI- Physics Lab

Plastic		
Days	Average waste (per day)	Average per year waste generation (in Kg.)
Holiday	0	2
Semiholiday	0	0
Working day	0.01	2
Total waste generation plastic		2

Table 7.17. Average production of plastic waste in Point VI.

The low average of 0.01 kg indicates that measures to reduce plastic usage are actively implemented during operational periods. The lack of waste during holidays suggests that activities contributing to plastic waste are largely tied to the institution's operations, highlighting the effectiveness of management strategies. With only 2 kg generated in a year, this suggests that the institution is either successfully minimizing plastic consumption or is not involved in activities that typically produce substantial plastic waste

Paper		
Days	Average day per year	Average per year waste generation (in Kg.)
Holiday	0	0
Semi holiday	0.01	0.95
Working day	0.17	34
Total waste generation paper		34.95

Table 7.18. Average production of paper waste in Point VI.

On holidays, no waste is generated, indicating a complete absence of paper-related activities. During semi-holidays, only 0.95 kg of paper waste is recorded, suggesting minimal paper usage on days with reduced operations. In contrast, working days see a substantial paper waste generation of 34 kg, reflecting a high level of activity and reliance on paper during these times. This data underscores that most paper waste occurs on working days. The negligible waste on holidays and minimal waste on semi-holidays present opportunities for reduction through digitalization and recycling initiatives on working days. By focusing on the working days, where paper consumption peaks, strategies such as minimizing unnecessary printing, encouraging double-sided printing, and raising awareness about recycling can significantly reduce waste. These efforts will further support sustainability initiatives in your project by promoting efficient resource management.

Other waste		
Days	Average waste (per day)	Average per day consumption
Holiday	0	0
Semi holiday	0	0
Working day	0.085	17
Total waste generation other waste		17

Table 7.19 Average production of other waste in Point VI.

Based on the data provided, it's clear that there is a consistent generation of other waste on working days, with an average of 0.085 kg produced daily alongside an average consumption of 17 kg. Conversely, there is no waste generated on holidays and semi-holidays. The presence of waste during working days indicates that ongoing activities or operations are directly responsible for waste production, highlighting a pattern where operational activities drive waste generation. Since waste is generated solely on working days.

No.	Collection Point	Area covered	Type of waste collected (in Kg. per year)			
			Plastic	Paper	Others	Biowaste
1	Point I	Office	02.95	40.95	-	-
2	Point II	Library	02.90	55.60	-	-
3	Point III	Campus	109.70	81.80	183.10	-
4	Point IV	Canteen	112.00	192.00	-	226.00
5	Point V	Zoology Lab	08.00	0.27	08.00	-
6	Point VI	Physics Lab	02.00	34.95	17.00	-
	Total		237.55	405.57	208.10	226.00

Table 7.20. Average production of various types of wastes in the college

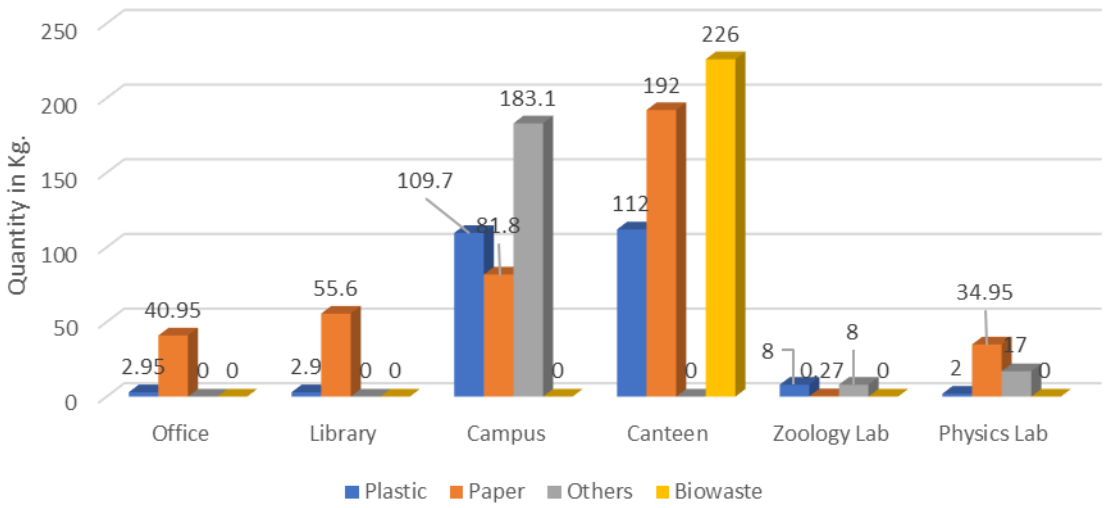


Fig. 7.1. Comparison of solid waste generation at various collection points of the college during a year

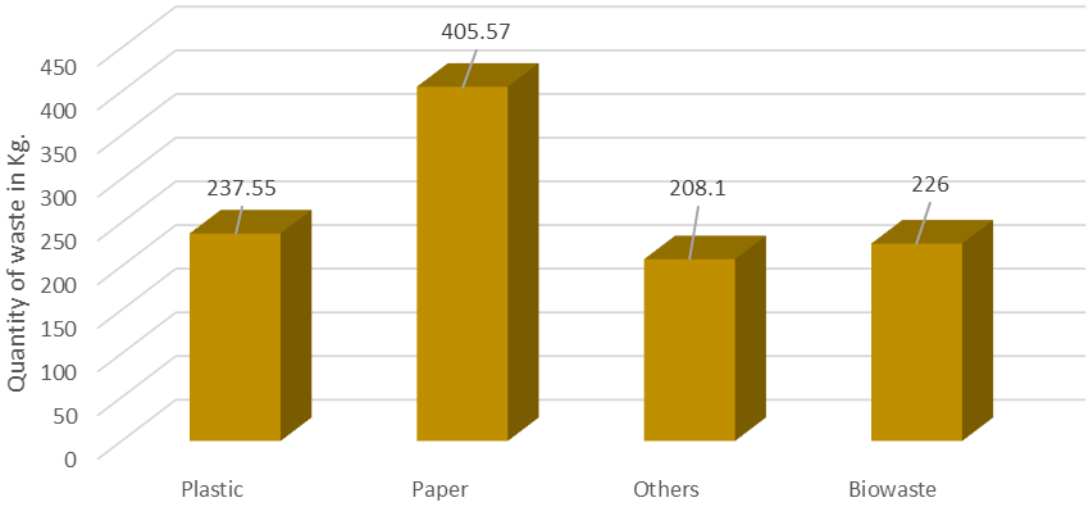


Fig. 7.2. Comparison of various types wastes generated in the college during a year

As per the data collected the highest waste generated in the college is paper, followed by plastics. Interestingly, bio-waste is estimated only in canteen and that too taken to the composting unit of nearby monastery.

7.4.2. Survey on Grey water generation in the campus

AREA 1	Rate of discharge (Litre/ day)
Toilet & wash area	625
Chemistry Lab	14.5
Toilet & wash area	532
Laboratories	19
Toilet & wash area	410
Laboratories	15
Toilet & wash area	25
Laboratories	0
Toilet & wash area	30
Laboratories	0
Toilet & wash area	15
Laboratories	0
Toilet & wash area	10
Laboratories	0
Toilet & wash area	10
Laboratories	0
Per day	1705.5
Grey water release per year	3,41,100.00

Table 7.21. Liquid waste generated in Area I (Main block consisting of administrative office, physics and chemistry block)

Area 2	Rate of Discharge (Litre/day)
Laboratories	270
Common Wash Area and Toilets	769
Laboratories	270
Common Wash Area and Toilets	686
Laboratories	270
Common Wash Area and Toilets	632
Laboratories	0
Common Wash Area and Toilets	84
Laboratories	0
Common Wash Area and Toilets	70
Laboratories	0
Common Wash Area and Toilets	176
Laboratories	0
Common Wash Area and Toilets	0
Laboratories	0
Common Wash Area and Toilets	0
Laboratories	0
Common Wash Area and Toilets	0
Per day	3227
Grey water release per year	6,45,400.00

Table 7.22. Liquid waste generated in Area II (Language block consisting of Zoology and botany laboratories)

AREA 3	Rate of Discharge (Litre/day)
Toilet and wash area	606
Zoology Lab	103
Toilet and wash area	607
Zoology Lab	103
Toilet and wash area	610.5
Zoology Lab	103
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Toilet and wash area	0
Zoology Lab	0
Per day	2132.5
Grey water release per year	4,26,500.00

Table 7.23. Liquid waste generated in Area III (Commerce department near chavara block)

AREA 4	Rate of discharge (Litre/ day)
Toilet & wash area	910
Canteen(Cleaning)	300
Toilet & wash area	870
Canteen(Cleaning)	300
Toilet & wash area	895
Canteen(Cleaning)	300
Toilet & wash area	60
Canteen(Cleaning)	0
Toilet & wash area	110
Canteen(Cleaning)	0
Toilet & wash area	35
Canteen(Cleaning)	0
Toilet & wash area	0
Canteen(Cleaning)	0
Toilet & wash area	0
Canteen(Cleaning)	0
Toilet & wash area	0
Canteen(Cleaning)	0
	3780
Grey water release per year	7,56,000.00

Table 7.24 Liquid waste generated in Area IV (Auditorium, canteen and Mathematics)

No.	Area code	Area covered	Grey water production/year (in litre)
1	I	Main block consisting of administrative office, physics and chemistry block	3,41,100.00
2	II	Language block consisting of Zoology and botany laboratories	6,45,400.00
3	III	Commerce department near chavara block	4,26,500.00
4	IV	Auditorium, canteen and Mathematics	7,56,000.00
	Total		21,69,000.00

Table 7.25. Comparison of grey water generation from various areas in the college during a year

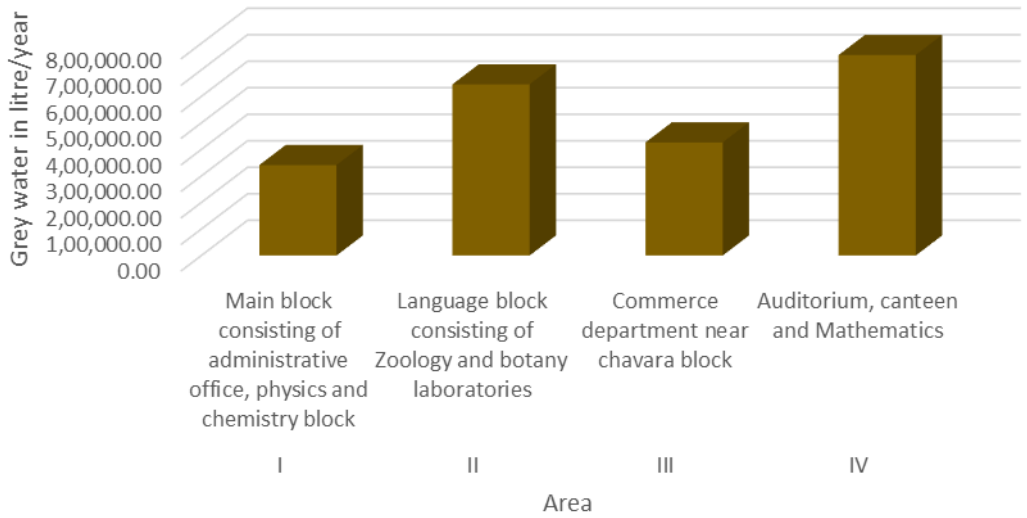


Fig. 7.3. Comparison of grey water generation from various areas in the college during a year

Auditorium, canteen and Mathematics has the highest rate of discharge at 3780 L/day, indicating it either consumes or generates the most water discharge, possibly due to larger population, industrial activity, or water sources. Main block consisting of administrative office, physics and chemistry box has the lowest discharge rate at 1705.5 L/day, suggesting lower water use or output in comparison to the others. Language block consisting of Zoology and botany laboratories and Commerce department near chavara block fall in between, having 3227 L/day and Area 3 at 2132.5 L/day. The higher discharge areas may require more focused interventions to manage water usage efficiently, such as optimizing water conservation practices or monitoring waste discharge.

7.5 CONCLUSION

- 7.5.1 Before the audit, the college had basic waste management strategies in place, but the auditing process has led to the development of a more responsible waste management system. Waste sampling indicates that overall waste accumulation is relatively low, with paper waste being the most significant contributor. While the college has effective waste management practices, there are no initiatives to convert waste into energy, despite the potential to reduce LPG consumption. Although the college has a biogas plant, it is currently non-functional. However, the college successfully manages bio-waste, with proper segregation into color-coded bins and regular collection. Bio-waste is handed over to nearby monasteries, and used for agriculture and animal husbandary. "College have notable use of paper. Mostly using paper plates and cups in canteen, usage in college office, classroom and library when it is switched to digital documentation can reduce the paper waste and encourage the practice for reuse of paper.
- 7.5.2 Plastic waste is relatively low on the college campus due to the efforts of the Green Initiative Cell, which actively monitors and reduces plastic usage. College programs and events are common occasions where large amounts of plastic waste are generated; however, to mitigate this, a green protocol is followed. This includes the use of biodegradable cups and serving food on banana leaves. Additionally, the college has partnered with the waste recycling company 'ASTRTECH,' which has installed a plastic recycling machine on campus and provides training to selected members of the college community to efficiently recycle plastic waste.
- 7.5.3 Other types of waste also show significant quantities, but there is currently no specified method for dealing with them. It is essential to introduce a system for categorizing and segregating these wastes. According to the college authorities, e-waste is either sent directly to service centres (chemicals, broken glass, construction waste, textile waste, packing waste and stationary waste) or replaced by purchasing new gadgets. However, the college does not maintain records of the amount of e-waste generated each year, highlighting the need for better tracking and management practices

7.6 RECOMMENDATION

- 7.6.1 Sustain Responsible Waste Management Practices
  Continue the existing responsible waste management practices. Implement upcoming plans and adapt them as per evolving strengths and challenges. Regularly review the system for improvements.
- 7.6.2 Systematic Recording of E-Waste Segregation
  Ensure monthly segregation of e-waste and maintain systematic records. This will help in tracking the volume of e-waste generated and enable better disposal or recycling practices.
- 7.6.3 Optimize Biogas Plant for Biomass Generation
  Ensure the efficient functioning of the biogas plant to generate biomass for college use. Explore possibilities of utilizing the generated fertilizer in developing and maintaining a campus vegetable garden.
- 7.6.4 Enhance Waste Segregation System
  Introduce an effective and streamlined waste segregation system on the campus to manage all other waste categories. This will ensure proper disposal and recycling of different waste types.
- 7.6.5 Ensure Proper Operation and Maintenance of Grey water Systems
  Implement a robust grey water management system that efficiently collects, treats, and recycles grey water from the canteen and laboratories (chemistry). Ensure that the system follows eco-friendly standards and is regularly maintained to prevent contamination. Establish soppit tank for the safe and effective disposal of grey water, which includes routine checks, treatment processes, and designated discharge areas. This will minimize environmental impact, promote water conservation, and enhance the overall sustainability of the campus."

7.7. WASTE MANAGEMENT SYSTEM PLAN

7.7.1. Assessment and Baseline Study

- 7.7.1.1. **Conduct a Waste Audit:** Analyse the types, sources, and quantities of waste generated on campus. Identify areas with high waste generation and opportunities for reduction.
- 7.7.1.2. **Categorize Waste:** Segregate waste into categories such as recyclable, organic, hazardous, e-waste, and non-recyclable.

7.7.2. Waste Reduction Strategies

- **7.7.2.1. Source Reduction:** Encourage practices that reduce waste generation, such as double-sided printing, reducing packaging waste, and promoting digital rather than paper-based processes.
- **7.7.2.2. Reusable Items:** Promote the use of reusable items like water bottles, coffee cups, and lunch containers. Distribute reusable bags and encourage their use.
- **7.7.2.3. Paperless Communication:** Implement paperless policies for administrative tasks, student communication, and event promotions.

7.7.3. Segregation and Collection

- **7.7.3.1. Install Segregated Bins:** Provide color-coded bins across the campus for different types of waste (e.g., blue for recyclables, green for organics, red for non- recyclables).
- **7.7.3.2. Awareness Programs:** Educate students, staff, and faculty on proper waste segregation practices. Use posters, workshops, and digital campaigns.
- **7.7.3.3. Scheduled Collection:** Establish a regular collection schedule for different types of waste, ensuring timely and efficient removal.

7.7.4. Recycling and Reuse initiatives

- **7.7.4.1. Recycling Programs:** Partner with local recycling companies to ensure proper processing of recyclable materials. Implement on-campus recycling centers if feasible.
- **7.7.4.2. Composting:** Set up composting facilities for organic waste. Use the compost produced for campus landscaping or community gardening projects.
- **7.7.4.3. E-Waste Management:** Create a collection point for electronic waste and partner with certified e-waste recyclers.

7.7.5. Hazardous Waste Management

- **7.7.5.1. Safe Disposal:** Ensure proper disposal methods for hazardous waste, such as chemicals from laboratories. Work with certified disposal companies.
- **7.7.5.2. Training and Safety:** Train staff and students on the safe handling and disposal of hazardous materials. Provide appropriate safety gear and equipment.

7.7.6. Awareness and Education

- **7.7.6.1. Workshops and Training:** Conduct regular workshops on waste management, sustainability, and environmental stewardship for students and staff.
- **7.7.6.2. Green Ambassadors:** Create a student-led Green Ambassadors program to promote waste management initiatives and peer education.
- **7.7.6.3. Sustainability Week:** Organize events like Sustainability Week to focus on waste reduction, recycling drives, and eco-friendly practices.

7.7.7. Monitoring and Reporting

- **7.7.7.1. Track Progress:** Regularly monitor waste generation and the effectiveness of the waste management plan. Use this data to identify areas for improvement.
- **7.7.7.2. Annual Report:** Publish an annual waste management report detailing achievements, challenges, and future goals.

7.7.8. Incentives and Recognition

- **7.7.8.1. Recognition Programs:** Acknowledge departments, student groups, or individuals who excel in waste reduction efforts.
- **7.7.8.2. Incentives:** Offer incentives such as certificates, awards, or eco-friendly products to encourage participation in waste management programs.

7.7.9. Community Engagement

- **7.7.9.1. Collaboration with Local Communities:** Work with local authorities and communities to manage waste effectively and promote sustainability beyond the campus.
- **7.7.9.2. Outreach Programs:** Engage students in community outreach programs that focus on waste management and environmental awareness.

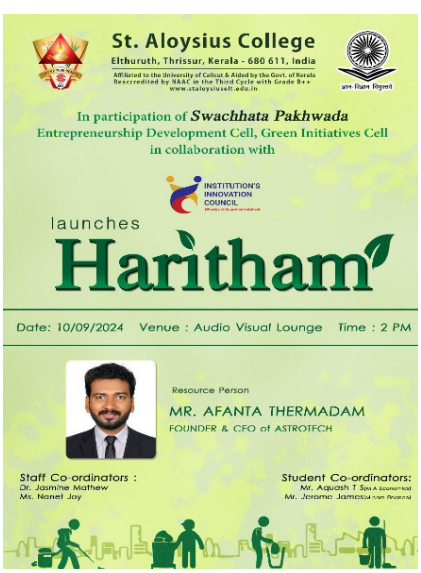
7.7.10. Continuous Improvement

7.7.10.1. Feedback Mechanism: Implement a feedback mechanism where students and staff can suggest improvements to the waste management system.
7.7.10.2. Periodic Review: Review and update the waste management plan periodically to incorporate new technologies, methods, and best practices.

7.8. ACTIVITIES CONDUCTED

REPORT ON HARITHAM

The HARITHAM programme, held on 10th September 2024, was a resounding success, with Mr. Afanta Thermadam , Founder and CEO of Astrotech , delivering an insightful talk on sustainable practices and innovative solutions for a greener future. The event was organized by the Entrepreneurship Development Cell, Green Initiative Cell, and Institutions Innovation Council of St. Aloysius College, Elthuruth.The programme commenced at 2 PM in the Audio Visual Lounge, with Dr . Jasmin Mathew and Ms. Nanet Joy, as staff coordinators, welcoming the resource person and introducing the theme of the event. The inaugural function was done by the principal Dr Chacko Jose P. Mr. Afanta Thermadam's presentation focused on the importance of adopting eco-friendly measures and exploring entrepreneurial opportunities in the field of sustainability.The audience, comprising students and faculty members, actively engaged with the resource person, asking questions and sharing their thoughts on the topic. Fr Arun Jose CMI(administrator) &Dr Jain .J Therattil (coordinator ,green initiative cell) came up with the idea "Waste to Money" by forming a club for collecting the waste generated in the campus and recycling them thereby raising fund from those . The programme concluded with a vote of thanks and a call to action, encouraging participants to take small steps towards a more sustainable lifestyle. The HARITHAM programme was a significant step towards fostering a culture of innovation and sustainability within the college community, aligning with the Swachhata Pakhwada initiative. The event's success was a testament to the collaborative efforts of the organizing cells and the enthusiasm of the participants.



WASTE MANAGEMENT AWARENESS DRIVE

As part of our college's initiative to promote sustainability and environmental responsibility, we organized a waste management awareness program. The program aimed to educate students about the importance of proper waste disposal and encourage them to take action in reducing waste on campus.

We created eye-catching slogans on chart papers to convey key messages about waste management. These slogans were displayed in strategic locations around the college. The slogans focused on themes such as:

-Go green,keep green.

-Recycle today for a a better tomorrow.

The program received a positive response from students and faculty members. We observed a significant increase in proper waste disposal practices, with more students segregating waste and using recycling bins. The program also sparked conversations and raised awareness about the importance of waste management.

Our waste management awareness program was a success, and we plan to build on this initiative by implementing more sustainable practices on campus. We believe that small actions can lead to significant positive change and look forward to continuing our efforts towards a more environmentally responsible college community.

There is no such things as away.
When we throw anything away
it must go somewhere

- Annie Leonardv

Chapter VIII

OCCUPATIONAL HEALTH & SAFETY (OHS) MANAGEMENT SYSTEM AUDIT REPORT

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM (2021-24)

Ms.Rajitha A.G
Ms. Sheena K L
Ms Thulasi Venugopalan
Ms.Sukruthy Sadanandan
(Assistant Professors)

Devika P M
Anchima S Nair
Neethal Peter
Vegha K P
Nidhuna Anil
Niranjana A.S
Karukayil Surendran Midhun
Amrutha A.S
Shithul Santhos
(Students)

8

Occupational Health & Safety Management System Audit Report

8.1 INTRODUCTION

The implementation of an Occupational Health and Safety (OHS) management system in educational institutions is a critical step in ensuring a safe and comfortable environment for students and staff to work productively. The primary objective of the OHS management system is to identify risks, assess hazards across the campus, and address these issues through appropriate measures. Conducting health and safety audit aids colleges/universities in comprehending the effectiveness of their internal safety protocols, providing a comprehensive overview of the functionality of internal controls. Moreover, it enhances motivation among students and staff, showcasing a serious commitment to the well-being of all members within the institution. By promptly identifying hazards and implementing necessary measures to mitigate risks, health and safety audits significantly diminish the likelihood of injuries or unforeseen safety incidents, consequently minimizing the potential for production delays within facilities. Additionally, these audits contribute to enhancing an institution's reputation and safeguarding it against negative publicity that may adversely affect the stake of the college.

8.1.1What is Health and Safety Audit?

A health and safety audit entails evaluating a college's systems, procedures, and policies concerning students and staff's health and safety to ensure adherence to prevailing regulations. Audit aim to pinpoint potential health or safety risks, assess the efficiency of internal controls for hazard management, and verify regulatory compliance.

8.1.2 Need of Health and safety audit

Identifying vulnerabilities and weaknesses in an institution's safety measures, reviewing compliance with regulatory legislation, and recommending improvements for safeguarding the health and safety of its workforce. Additionally, ensuring that machinery, equipment, and facilities meet safety requirements through inspection.

8.2 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM POLICY

8.2.1 Statement of Commitment

Health and safety measures are becoming increasingly important for students and staff in educational institutions. A strategy to promote a culture of prevention and protection must address all parts of society, fostering a culture that values health and risk prevention. Therefore, it is essential to incorporate risk prevention into training programs at all levels of education, including vocational and university education. This culture plays a crucial role in primary education and basic preventive habits acquired in childhood. Educational institutions must have to ensure a safe and healthy working environment appropriate for education both physical and mental. The Occupational Health and Safety Policy at St. Aloysius College, Elthuruth, outlines the college's commitment to providing a safe and healthy environment for all employees, students, and visitors. The institution recognizes the importance of occupational health and safety and aims to minimize the risk of injury, illness, and accidents through proactive measures and continuous improvement.

8.2.2 Goal

Create a safe and health-conscious campus environment by ensuring compliance with legislation, mitigating risks, promoting safety awareness, and providing training and resources to educate students and staff on health and safety practices, as well as disaster management and mitigation.

8.2.3 Objectives

- To ensure compliance with relevant health and safety legislation and regulations.
- To provide a safe and healthy environment for all individuals on campus.
- To identify and mitigate potential hazards and risks.
- To promote a culture of safety and health awareness.
- To provide adequate training and resources for health and safety management.
- Promote a Safe and Healthy Learning Environment through integrating sustainable practices in safety procedures
- To enhance Mental Health and Well-being by fostering a safe environment.

8.2.4 Responsibilities

It is noted that the institution gives prime importance to health and safety of their students and staff.

8.2.4.1. College Management

- Ensure that the health and safety policy is implemented and maintained by ensuring safety. Safety drills and first aid protocols to be followed in case of emergency are provided to students and staff.
- Provide the necessary resources, including training and equipment, to support health and safety initiatives. CPR training, fire and safety training provided to students, office staff and faculties.
- The needs of disabled people must be taken into account by making arrangements for accessible entrances and exits, such as constructing ramps with handrails and non-slip surfaces.
- If vehicles enter the institution then the signposts must be clear and, wherever possible, the driveway and the pedestrian area must be clearly demarcated
- Regularly review and update the health and safety policy.
- Ensure compliance with relevant legislation and standards.

8.2.4.2. Employees (staff and faculty)

- Follow all health and safety procedures and guidelines.
- Report any hazards, incidents, or unsafe conditions to their supervisor.
- Participate in health and safety training programs.
- Use personal protective equipment (PPE) as required.

8.2.4.3. Students

- Adhere to safety guidelines and procedures. Safety drills are conducted for students explaining the measures, precautions and responsibility to be exercised during fire hazards. Provide the students regarding precautions while using labs chemicals and instruments.
- Report any hazards or unsafe conditions to the appropriate authority.
- Participate in health and safety training and awareness programs.

8.2.4.4. Visitors and Contractors

- Comply with the institution's health and safety policies and procedures.

- Report any hazards or unsafe conditions to the appropriate authority.
- 8.2.4.5 Parents
- Comply with the institution's health and safety policies and procedures
- Promptly report any hazards or unsafe conditions or health risk of their child to the appropriate authority.

8.2.5. Risk Management

- Conduct regular risk assessments to identify potential hazards (lab, construction, kitchen hostel, electricity connections cables).Timely checking of instruments, plug points, switches and maintenance registers are maintained.
- Indoor workplaces, such as a classroom or a staff office or a kitchen, must be adequately ventilated and properly illuminated, have the correct level of humidity, enough space and be clean.
- Doors and the transparent windows must be clearly marked and made of a suitable material
- Implement control measures to mitigate identified risks. An adequately stocked first-aid kit is available in a prominent location.
- Maintain records of risk assessments and control measures. It can be done by exhibiting the precautions and risks while operating machines, electronic instruments etc. Sign boards can be displayed regarding the dangers while operating instruments and dealing with chemicals. Initiate students to use personal protective equipment.
- The floors must be well maintained and kept clean to reduce the risk of slipping and stumbling Special attention should be given to the prevention of falls from heights in places such as balconies and staircases. Extra railings for very young children may be necessary
- Ensure that emergency procedures are in place and communicated to all relevant parties.

8.2.6 Awareness and Education

8.2.6.1 Health and Safety Training

- Provide regular training on health and safety procedures for all employees and students.
- Ensure that training is relevant, up-to-date, and effective.
- Maintain records of all training sessions and attendees.

8.2.6.2 Disaster Management Training

- Introduction to Disaster Management: Understanding different types of disasters (natural, technological, and human-made) and their potential impacts on the campus community.
- Risk Assessment: Identifying specific risks that the institution may face based on its location, infrastructure, and community dynamics.
- Communication Strategies: Establishing clear lines of communication for disseminating information during a disaster, including the use of social media, campus alert systems, and emergency hotlines.

8.2.7 Emergency Procedures

- Develop and maintain emergency response plans, including evacuation procedures. And provide training on emergency procedures for all employees and students. Moreover conduct regular emergency drills to ensure preparedness.

8.2.8 Accident and Incident Reporting

- Establish a clear procedure for reporting accidents, incidents, and near misses.
- Investigate and maintain all reported incidents to identify root causes and implement corrective actions.

8.2.9 Health and Wellbeing

- Promote initiatives that support the physical and mental wellbeing of employees and students by providing faculties for workout (open gym) and recreational activities. Provide access to health and wellbeing resources and support services. Yoga classes, counselling sessions can be done for students and employees.
- Counselling sessions is being done by the department of psychology of the college. Encourage a healthy work-life balance. Provide mental health education and awareness. Conduct workshops and trainings on managing stress, coping with anxiety and depression

8.2.10 Monitoring and Review

- Regularly monitor health and safety performance through audits, inspections, and reviews. Internal audit team within the campus can monitor the updates. Make use of feedback from audits and inspections to im-

prove health and safety practices. Review and update the health and safety policy annually or as needed.

8.2.11 Communication

Ensure that the health and safety policy is communicated to all employees, students, visitors, and contractors using all communication channels and encourage open communication about health and safety concerns.

8.2.12 Compliance

Ensure compliance with all relevant local, state, and federal health and safety regulations, stay updated with changes in legislation and industry best practices.

8.2.13 Conclusion

St. Aloysius College, Elthuruth committed to maintaining a safe and healthy environment for all individuals on campus. Through the proactive management of health and safety risks, continuous improvement, and fostering a culture of safety, the institution aims to protect the wellbeing of its community.

8.3 METHODOLOGY

8.3.1 Context and Rationale

Educational institutions are required by law to maintain safe environments for everyone on campus. Failing to comply with Occupational Health and Safety (OHS) regulations can lead to serious consequences, including legal penalties, lawsuits, and damage to the institution's reputation. By following OHS guidelines, schools not only protect themselves legally but also build credibility and trust with parents and the wider community.

Students, particularly as minors, depend on the institution to provide a secure environment that shields them from potential accidents, injuries, and health hazards. Well-maintained classrooms, laboratories, playgrounds, cafeterias, and sanitation facilities are essential for ensuring students' physical and mental well-being. Teachers, administrative staff, and other personnel also spend a significant amount of time at the institution, and their safety is equally important. A safe workplace reduces the risk of accidents and illness, while also enhancing morale and productivity.

In addition to being a legal requirement, protecting the health and safety of employees is an ethical obligation. It also helps the institution avoid potential legal issues. Furthermore, parents place their trust in schools to ensure their children's safety. A robust OHS program reassures parents and fosters positive relationships with the community, which can lead to higher enrolment rates and a stronger reputation for the institution.

8.3.2 Assessment Procedure Outline

The college adheres to the ISO 45001:2018 standards to establish a framework for maintaining and regulating the occupational health and safety of students, teachers, and staff. This approach aims to enhance the institution's strength, productivity, and overall well-being while ensuring long-term credibility. A comprehensive plan has been developed to address both current and future safety requirements. The college systematically monitors health hazards reported on campus and ensures the safety of laboratory equipment, including regular checks on expiration dates. Emergency rescue measures are clearly defined and recorded for use during critical situations.

To safeguard the health of students, staff, and visitors, the institution conducts regular inspections of food items in the canteen to ensure they are within their expiry dates. Additionally, first aid kits are regularly inspected to ensure they are fully stocked with valid and functional supplies, such as bandages, antiseptics, and medications. Keeping these resources up to date is crucial for providing immediate care in case of minor injuries or emergencies. By removing expired items and maintaining hygiene standards, the college reduces potential health risks and legal liabilities, reinforcing trust among parents and the community. Visitor entry is also periodically recorded to enhance campus security and manage external visitors. By requiring visitors to register, the institution can monitor who is on campus, the purpose of their visit, and their duration. This helps prevent unauthorized access and ensures the safety of students, staff, and property. Additionally, maintaining these records allows for proper identification of individuals during emergencies or incidents, promoting a secure and orderly campus environment.

Legal frameworks and guidelines such as EU-OSHA, HSE, and OSHA emphasize the importance of integrating occupational health and safety (OHS) into educational institutions. Instead of treating OHS as a separate subject, it is more effective to incorporate it into various academic subjects through activity-based learning and real-life examples. This approach helps convey OHS principles more effectively to students of all ages, from primary school to vocational training colleges. Repeating key messages

in age-appropriate ways ensures that the information is relevant and memorable. The "whole-school" approach is considered the best model, where OHS is embedded into the entire educational environment. This model involves combining educational activities with school management practices to create a safe and healthy learning environment. While integrating OHS into further education, particularly at the university level, presents more challenges and is less developed, the same "whole-institute" model remains applicable. Successful integration relies on collaboration with OHS authorities and fostering partnerships. The whole-college approach involves:

- Risk Education and OHS Management: Engaging students and staff in identifying and managing hazards.
- Health Education and Promotion: Initiatives to promote healthy school environments.

Dignity and Respect: Implementing programs such as anti-bullying campaigns to foster a respectful atmosphere.

8.3.3. Implementation of internal auditor team

The OHS management committee (internal audit team) consist of 13 members 4 faculty members and 9 student representatives. A comprehensive register and documentation system is developed to facilitate periodic analysis and monitoring of safety practices among staff, students, and campus visitors. This system operates in alignment with the institution's OHS policy, which outlines specific objectives, action plans, and strategies for managing safety effectively. Regular team meetings are conducted to evaluate progress and ensure the effectiveness of safety management efforts.

8.3.4. List of register and document to monitor OHS

Internal audit team examined existing OHS policies, procedures, and compliance records. This includes safety guidelines, its communication mechanisms, emergency response plans, and incident reports. Identified potential hazards in different areas of the campus, such as chemical storage in laboratories, physical hazards in workshops, traffic systems inside and outside campus and ergonomic risks in office settings.

8.3.5. Respondent's comments and observation

Internal audit team conducted thorough inspections of campus facilities to observe safety practices, maintenance issues, and compliance with safety standards. They engaged with staff, faculty, and students to gather feedback on their experiences and perceptions of health and safety practices. A detailed review of existing risk control measures and assessment of their effectiveness in mitigating identified hazards also performed. Evaluated documentation related to staff and student training on health and safety protocols.

8.3.6. Assumption

Shaping the long-term future of an institution involves prioritizing the safety and health of staff and students. The well-being of these groups directly impacts the institution's success, both now and in the future. By implementing structured and certified occupational health and safety (OHS) practices, institutions can foster motivated employees and productive work environments. A professional ISO standard OHS management system, along with proper certification, helps prevent injuries and illnesses among teachers, staff, and students, ensuring a safe learning environment, reducing liability, preventing potential lawsuits, and increasing operational efficiency. Furthermore, it enhances the institution's reputation as a responsible and attractive role model committed to sustainability. Establishing an ISO 45001:2018 occupational health and safety management system in academic settings ensures compliance with national and local OHS laws, as well as educational sector-specific regulations. Through a thorough audit process, key safety areas can be identified, including classroom and laboratory safety, ergonomic hazards, chemical and biological risks, fire safety, emergency preparedness, and slip, trip, and fall hazards. This approach encourages a culture of safety and well-being, boosts employee morale and job satisfaction, and helps reduce absenteeism. The benefits of conducting an ISO Occupational health and safety audit include reduced staffs 'and students compensation claims, improved reputation and trust within the community, enhanced student and staff retention, and increased productivity and efficiency. Key OHS areas encompass classroom and laboratory safety, emergency preparedness, fire safety and evacuation procedures, hazardous materials management, ergonomics, workplace violence prevention (ragging), and student and staff wellness programs.

Various stakeholders play critical roles in OHS:

Administration	: Develop and implement OHS policies.
Teachers and Staff	: Follow safety protocols and report hazards.
Students	: Adhere to safety guidelines and report concerns.

OHS audit monitor and review OHS performance, conduct regular risk assessments, and identify hazards (e.g., chemical, biological, ergonomic). Implementing control measures, such as safety equipment and training, regular OHS training for employees and students, and specialized training (e.g., laboratory safety, first aid), is essential. New employees and students should also receive OHS orientation. Additionally, institutions should develop emergency response plans for fire evacuations and medical emergencies, conduct regular drills, and ensure that emergency equipment is maintained and readily available. Key strategies to ensure occupational health and safety, include conducting regular risk assessments, developing and communicating OHS policies, providing training and orientation, establishing emergency response plans, and continuously monitoring and reviewing OHS performance. Ultimately, implementing OHS measures in educational institutions is vital for protecting employees, students, and visitors, preventing injuries and illnesses, promoting a healthy learning environment, ensuring regulatory compliance, and enhancing the institution's reputation, morale, and productivity.

8.3.7. Stages of occupational health and safety management audit

Waste Management audit has three phases: Pre audit, audit and post audit.

8.3.7.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with occupational health and safety management policy of the institution)
- Discusses with the responsible persons of each location (staff, teachers, lab assistants, sweepers, watchmen, students etc.) about the waste generation pattern, and provisions of their management.
- Documentation of all existing materials and provisions for health and safety measures inside the campus.

8.3.7.2 Audit phase

- Auditors collect all data collected to ensure that nothing is overlooked completely in the audit. The following information has been collected during the audit phase:
- Assessment of collected data in relation with environ-

mental policy and waste management policy of the college/university
- Review of present emergency health and safety management systems and enhancement suggestions

8.3.7.3Post audit phase

- The plan of action for the post-audit phase implementation and follow-up. All possible suggestions for the improvement of OHS in the respective institution.
- OHS committee will ensure that the Occupational health and safety Management System is functional at expected level and the college is participating, by making the entire college/university community well informed through regular communications; monitoring through periodical evaluation programmes etc.

8.3.8 Steps of Occupational Health & Safety Management Audit

8.3.8.1. Site assessment

Collection of contour map and campus diagram; For ensuring safety infrastructure and alternative method applied during renovation of campus.
Walk through survey

8.3.8.2 Data analysis

- Analysis of current and past performance (pre audit and post audit performances, previous audit data etc.)

8.3.8.3 Final audit by external audit team

- Data verification- identifying non conformities
- Action plan –long tern and short term
- Final report & certification as per ISO standards.

8.3.9. Schedule of the audit of occupational health & safety

Period	Week days	Activity implementation
I[st] week	8.07.2024-13.07.2024	1. Record the List of external origin. 2.Documentation of maintenance Register in each department
2[nd] week	16.07.2024-20.07.2024	1.Record the List of First aid product and their Expiry period 2.Documentation of First aid Register in each department
3[rd] week	23.07.2024-27.07.2024	1.Record the List of Lab Equipment's 2.Documentation of Lab Register in each Lab
4th week	30.07.2024-2.08.2024	1.Prepare calibration Register in Labs
5th week	6.08.2024-10.08.224	1.Record the List and Expiry of Food Items in Canteen
6th week	13.08.2024-17.08.2024	1.Risk assessment -Identifying Potential risk,hazards.2.Documentationof Medical Register for Health hazards
7th week	20.08.2024-24.08.2024	1.Record the List of Emergency Rescue Measures taken by the College
8th week	27.08.2024-30.08.2024	1.Report Preparation and Presentation

Table 8.1. Schedule of the audit of the occupational health & safety.

8.4. RESULT AND DISCUSSION

8.4.1 Campus OHS Risk Assessment

This section provides detailed assessments of various hazards identified during the audit.

8.4.1.1. Physical, Chemical, Biological & Psychological Hazards

- Proper ventilation is crucial for maintaining a steady flow of fresh air, lowering CO_2 levels, and managing indoor pollutants. Without adequate ventilation, students may face respiratory problems, decreased focus, and general discomfort, all of which can negatively affect their health and learning. Good lighting is important for clear visibility, reducing eye strain, and supporting cognitive function. Well-lit classrooms help students stay focused, avoid headaches, and reduce eye fatigue, with natural light being especially beneficial for aligning with their circadian rhythms and improving mood and productivity. Additionally, ensuring electrical safety through regular inspections, maintenance, and adherence to standards prevents risks like electrical fires and shocks, protecting both students and staff from potential hazards
- Each department in the college laboratory maintains a medical record register and detailed records of lab equipment and chemicals. This practice ensures that hazardous substances are stored properly to prevent accidents and comply with safety regulations. Chemicals are stored based on their compatibility and in designated areas to avoid dangerous reactions. Proper storage minimizes the risk of contamination, spills, or leaks, which could pose health or environmental risks. Additionally, using personal protective equipment (PPE) such as gloves, lab coats, safety goggles, and face shields creates a barrier between hazardous substances and laboratory personnel, reducing the risk of exposure and injuries. Compliance with PPE requirements is crucial for adhering to safety standards and protecting lab workers.
- Regular maintenance and inspection of kitchen equipment are operated to avoid accidents and ensure smooth operation. Faulty or outdated equip-

ment can cause injuries or unsafe food handling for avoiding such condition routine checks and servicing, along with training staff on safe equipment use, help reduce risks and keep the kitchen safe. Additionally, acquired an FSSAI certificate confirms that the canteen meets the safety and hygiene standards established by the authority. This certification demonstrates a commitment to high food safety practices, including proper handling, storage, and preparation of food.

- Make sure to properly maintain surfaces to prevent slips and falls, which can avoid the cause of injuries, Regular surface inspections and maintenance keep conditions safe for everyone. Similarly, maintaining equipment ensures it operates smoothly and avoids unexpected breakdowns, which is essential for productivity and safety. Well-maintained equipment also helps prevent accidents and complies with safety standards. Additionally, having accessible first aid kits and trained personnel ensures quick response to injuries or emergencies, reducing the severity of accidents and aiding faster recovery. This commitment to safety and preparedness enhances the overall safety of the working environment.
- Regular routine of cleaning for preventing the spread of infectious diseases and keeping environments hygienic. Contaminated areas can harbour harmful bacteria, viruses, and pathogens, posing health risks. Additionally, a clean environment minimizes accident risks; for instance, spills or clutter in kitchens can cause slips, while unclean restrooms can create unpleasant odors and discomfort. Proper waste segregation is crucial to avoid mixing hazardous materials with regular waste, which helps prevent environmental contamination. For example, biomedical waste requires specific handling to prevent pollution and health risks. Adhering to waste management regulations to avoid legal issues and encourage responsible practices. Effective segregation also supports recycling and resource recovery by separating recyclable materials from non-recyclables, which reduces landfill waste and conserves natural resources.
- For students, staff and faculty to assess the risks related to stress, burnout, or other mental health issues. The college has established a Counselling Cell named "Jeevani", which includes a psychiatrist offering consultations and guidance. To maintain client confidentiality, students can schedule appointments through a Google form, allowing the psychiatrist to provide private consultations.
- The establishment of a women's cell is supported by policies addressing bullying and harassment. This cell is designed to address issues faced by women, including students, teaching, and non-teaching staff. It ensures clear reporting procedures and raises awareness through campaigns.
- For physical wellness and relaxation open gym faculties is provide to students and staffs

Sl No	Particulars	Data	Remarks
1	Average width of main roads (m)	9 m	Vehicular movement is restricted
2	Road with pedestal path way (m)	90 m	Only main road. But no separations shown
3	Total number of roads in the campus	7	-
4	Road for bicycles (Km)	No separate system	
5	Traffic signals and signage displayed	Speed limit 15 - one board each at 2 locations Zebra cross markings at two in number	More traffic signages required
6	Vehicles prohibited area/roads (If yes how much Km)	Yes Around 200m	Only 3 students are using bicycles for travelling

Table 8.2. Road system in the college and related risk factors

- The college has a well-managed road system on campus. However, many roads lack separate pavements for pedestrians. Additional signage should be installed in high-traffic areas. This non-conformity will be addressed before the first surveillance audit.
- Currently, very few students use bicycles. In contrast, the neighboring school has hundreds of students who use bicycles. As cycling is an energy-saving and healthy practice, programs should be implemented to promote the use of bicycles among students and staff as well.

SL No	Location/Site	Type of risk	Possible Hazards	Remarks measures adopted
1	Classroom	Absence of proper ventilation	Mild Health problem	Proper ventilation ensures fresh air, reduces CO2 levels, and controls indoor pollutants. Classrooms are well-lit with natural light. Electrical safety is maintained through regular inspections. First aid kits and trained personnel are readily available for quick response to injuries. Clear emergency contact signs are provided
2	Laboratories	Chemicals burn, injury, toxic chemicals, electrical shock and system fault	Injury, burn, intoxication even fatal health hazard	Maintain a medical record register and detailed records of lab equipment and chemicals. Proper storage minimizes contamination, spills, or leaks that could pose health or environmental risks. Regularly monitor and remove expired products. Ensure the use of personal protective equipment (PPE) such as gloves, lab coats, safety goggles, and face shields during practical work when necessary.
3	Kitchen	Contamination, water quality issue	Food poisoning, water borne diseases	·Conduct regular maintenance and inspections of kitchen equipment to prevent accidents and ensure smooth operation. Perform routine checks to identify faulty or outdated equipment. Keep dining areas clean and tidy. Serve freshly prepared food daily, avoiding leftovers. Ensure the quality of water used for food preparation to prevent waterborne diseases.
4	Building & Campus	Slippery steps , lack of disabled friendly walk way		Maintain surfaces to prevent slips and falls, reducing injury risks. Keep equipment well-maintained to prevent accidents and ensure compliance. Ensure accessible first aid kits and trained personnel for quick injury response. Place signs in open balcony areas to discourage students from sitting. Equipped with ramps, lifts, and accessible washrooms for differently-abled individuals.

5	Road pavements	Vehicle accidents, pedestrian risk	Accident , Vehicle damage	The college has a well-managed road system on campus. To enhance safety, separate pedestrian pavements will be constructed, and additional signage will be placed in high-traffic areas.
6	waste management collection point			Maintaining a clean environment reduces accident risks, such as slips from spills or clutter in kitchens. Proper waste segregation prevents hazardous materials from mixing with regular waste and ensures timely removal, reducing contamination and foul odors.
7	Campus	Stress& anxiety, Lack of social networking	Cause destruction in academic performance Ethical code of behaviour	Offer psychological consultations to address mental health issues Provide meditation sessions for relaxation and mindfulness."

Table 8.3. Major risk factors and remedial measures adopted

8.4.2 Emergency Preparedness Response and Crises Management system in college

- Fire extinguishers were strategically placed in laboratories, canteen to quickly control small fires. These extinguishers regularly inspected, check expiry date and kept easily accessible. Emergency exits should be clearly marked, unobstructed, and easy to reach, allowing for swift evacuation during a fire. Clear signs is placed to direct people to the nearest exit in case of an emergency.
- First aid in a college setting to ensure the health and safety of students, staff, and visitors. The college have well-equipped first aid kits placed in accessible locations such as laboratories, offices and a trained personnel, including teachers, staff, take the responsibility to provide immediate medical assistance in case of injury or illness.
- College has emergency medical services (EMS) or nearby hospitals (Family health care centre Emergency contact information should be posted visibly in key locations. A crisis communication system is headed by the representative of health club to notify all students, staff, and faculty of the situation. This could be through public address systems, emails, text messages. After the immediate crisis is handled, detailed reports were documented specifying the nature of the incident, the response actions taken, and any injuries or damages.

8.4.3 Training and Awareness Programs

- Training sessions are regularly conducted by experts in yoga and physical exercises, guided by the head of the Physical Education Department. Fire extinguisher training is periodically arranged by collaborating with Kerala State Fire Force. Additionally, the college has signed a Memorandum of Understanding with Amala Nursing College to offer first aid training, including CPR, for college staff and students. Teachers from respective departments also provide guidance on the safe use of chemicals and glassware in laboratories.
- College also organises student health and safety program like workshop on promoting the usage of menstrual cup. Substance abuse campaign

- Signage is installed throughout the campus to ensure the safety and security of staff, students, and parents. Clear signs are provided to direct individuals to contact points in case of emergencies. Additionally, signs are positioned in the open balcony areas to discourage students from sitting there, reducing the risk of accidents.
- Service-oriented programs, such as blood donation drives, medical camps, and hair donation events, are organized on college campuses to promote community welfare and social responsibility. These initiatives not only provide essential services to those in need but also foster a sense of civic duty among students. They offer practical benefits, such as supporting local healthcare systems and helping individuals in urgent situations, while also encouraging students to actively contribute to societal well-being.

No.	Year	Programme	No.of students participated	Receiving Community organisation
1	2021	Blood donation	11	IMA Blood Bank, Thrissur
2	2022	Blood donation	46	IMA Blood Bank, Thrissur
3	2023	Blood donation	55	IMA Blood Bank, Thrissur
4	2024	Hair Donation for cancer patients	22	Amala Institute of Medical Sciences, Thrissur

Table 8.4. Contributions of the college for social well being through hair and blood donation

8.4.4 Empowering Inclusivity System in college

- The college provides facilities that create an inclusive environment for differently-abled individuals, such as wheelchair-accessible ramps, disability-friendly washrooms, wheelchair availability, and lift services to ensure their safety and security on campus.

8.5 CONCLUSION

- The college has established a well-maintained system and strategic approach to Occupational Health and Safety Management. The campus is designed to ensure proper ventilation and lighting, contributing to a comfortable and nature-rich environment for students, staff, parents, and visitors. Adequate ventilation helps maintain fresh air circulation, reduces CO2 levels, and manages indoor pollutants. Additionally, risk management protocols are in place, including regular electrical safety inspections and maintenance to prevent hazards such as electrical fires or shocks, ensuring the safety of both students and staff.
- Each department maintains a separate register to monitor the expiration of chemicals, and faculty members enforce the use of Personal Protective Equipment (PPE), such as gloves, lab coats, safety goggles, and face shields in laboratories. The college emphasizes cleanliness to prevent slips and ensures the quality of drinking water and food in the canteen to avoid waterborne diseases, with the canteen being FSSAI certified.
- The college also implements responsible waste management practices, segregating waste to avoid contamination and foul odors. Previously, first aid boxes were available for distributing medicines on request. After the audit, the college appointed personnel from the physical education department to handle the provision of medicines only when necessary, or refer cases to the nearest family health center when required.
- Adequate parking space, pedestrian pathways, and traffic control measures are in place for high-traffic areas. The college provides psychological and meditation counseling for students and staff, along with a women's cell to address issues related to women on campus. For physical well-being, the college offers gym facilities.
- While the college already had basic health and safety facilities in place, the audit has helped strengthen systems for identifying emergency preparedness, response, and crisis management, addressing physical, chemical, biological, and psychological hazards, and promoting inclusivity throughout the institution.

8.6. RECOMMENDATIONS

- Fire Extinguisher Placement and Maintenance: It was identified that placing fire extinguishers in high-risk areas such as offices, laboratories, and the canteen is essential. Regular monthly inspections should be conducted to check for expiry and maintenance issues. Additionally, it is important to provide training to staff and students on the proper use of fire extinguishers during emergencies.
- Improved Campus Signage: To enhance safety and smooth movement within the campus, it is recommended to install additional signage, especially in high-traffic areas and along pedestrian walkways. This will help to prevent congestion and improve both vehicle and pedestrian flow.
- Occupational Health and Safety System: Previously, the college lacked a comprehensive system for occupational health and safety management. After the audit, the institution now has a framework to address emergency preparedness, response, and crisis management, covering physical, chemical, biological, and psychological hazards. It is essential to continue this process and adapt to new requirements as they arise, ensuring inclusivity and safety for all members of the campus.

8.7. OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM PLAN

8.7.1 Objective and Scope

- **8.7.1.1. Objective: T**o ensure a safe and healthy environment for all individuals on campus.
- **8.7.1.2. Scope: T**his plan covers all employees, students, contractors, parents and visitors across all campus facilities.

8.7.2 Roles and Responsibilities

- 8.7.2.1. Management: Ensure compliance with OHS regulations, allocate resources, and support the implementation of safety measures.
- 8.7.2.2. OHS Committee: Develop policies, conduct risk assessments, and review incident reports.
- 8.5.2.3. Faculty and Staff: Adhere to safety procedures, report hazards, and participate in training.
- 8.7.2.4. Students: Follow safety guidelines, report unsafe conditions, and participate in relevant training.
- 8.7.2.5. Contractors and Visitors: Comply with campus OHS requirements.

8.7.3 Risk Assessment and Hazard Identification

- 8.7.3.1. Identify Hazards: Regularly inspect all areas (laboratories, classrooms, workshops, dormitories, etc.) for potential hazards.
- 8.7.3.2. Risk Assessment: Evaluate the likelihood and impact of identified hazards, prioritizing high-risk areas.
- 8.7.3.3. Control Measures: Implement control measures (administrative controls, personal protective equipment) to mitigate risks.

8.7.4 Emergency Preparedness

- 8.7.4.1. Emergency Procedures: Develop and communicate clear procedures for fire, chemical spills, medical emergencies, and natural disasters.
- 8.7.4.2. Evacuation Plans: Design and post evacuation maps and procedures in all buildings.
- 8.7.4.3. First Aid: Ensure that first aid kits are accessible, and staff are trained in first aid and CPR.
- 8.7.4.4. Drills and Training: Conduct regular emergency drills (e.g., fire drills) and training sessions for all campus members.

8.7.5. Safety Training and Education

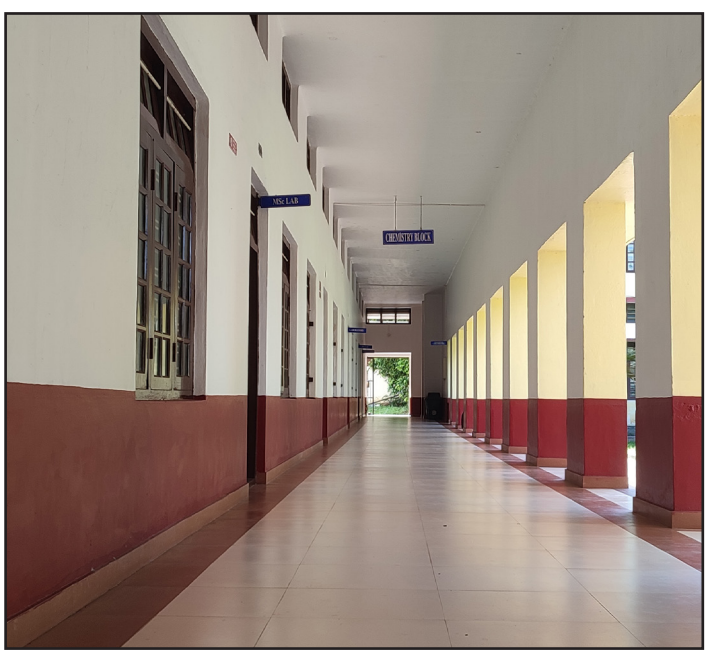
- 8.7.5.1. Induction Training: Provide mandatory OHS training for all new employees and students.
- 8.7.5.2. Specialized Training: Offer specific training for high-risk activities (e.g., laboratory safety, working at heights).
- 8.7.5.3. Continuous Education: Regularly update and refresh training to incorporate new regulations and technologies.

8.7.6 Incident Reporting and Investigation

- 8.7.6.1. Reporting System: Establish a clear, accessible system for reporting accidents, near misses, and hazards.
- 8.7.6.2. Investigation: Promptly investigate all incidents to identify root causes and prevent recurrence.
- 8.7.6.3. Record Keeping: Maintain detailed records of all incidents, investigations, and corrective actions.

8.7.7 Health and Well-being Programs

- 8.7.7.1. Mental Health Support: Provide access to



counseling and mental health services for students and staff.
- 8.7.7.2. Ergonomics: Assess and improve workstations to prevent repetitive strain injuries.
- 8.7.7.3. Wellness Programs: Promote physical health through fitness programs, healthy eating options, and stress management workshops.

8.7.8 Compliance and Continuous Improvement

- 8.7.8.1. Legal Compliance: Ensure that all activities comply with national and local OHS regulations.
- 8.7.8.2. Audits and Inspections: Conduct regular internal and external audits to assess the effectiveness of the OHS management plan.
- 8.7.8.3. Feedback Mechanism: Encourage feedback from all campus members to improve safety measures continuously.
- 8.7.8.4. Review and Update: Regularly review and update the OHS plan to address new risks, technologies, and regulations.

8.7.9. Communication and Reporting

- 8.7.9.1. Safety Bulletins: Regularly update the campus community on safety issues, changes in procedures, and tips.
- 8.7.9.2. OHS Meetings: Hold regular OHS committee meetings to discuss issues, review incidents, and plan improvements.
- 8.7.9.3. Annual Report: Prepare an annual OHS report detailing achievements, challenges, and plans for the coming year.
-

8.7.10. Monitoring and Evaluation

- 8.7.10.1. Performance Indicators: Use metrics (e.g., number of incidents, training completion rates) to evaluate the effectiveness of the OHS plan.
- 8.7.10.2. Continuous Improvement: Based on monitoring results, make necessary adjustments to policies, procedures, and training.

8.7.11 Special Considerations for Higher Education

- 8.7.11.1. Laboratories: Ensure stringent safety protocols for chemical handling, waste disposal, and equipment use.
- 8.7.11.2. Fieldwork: Implement safety guidelines for field trips, research expeditions, and off-campus activities.
- 8.7.11.3. International Students and Staff: Address language barriers and cultural differences in safety communication and training.

8.7.12 Resource Allocation

- 8.7.12.1. Budget: Allocate sufficient resources for OHS training, equipment, and staff.
- 8.7.12.2. Personnel: Employ or designate OHS officers responsible for implementing and monitoring the plan.

8.7.13. Review and Continuous Improvement

- 8.7.13.1. Annual Review: Conduct a comprehensive review of the OHS management plan annually.
- 8.7.13.1. Feedback Integration: Integrate feedback from audits, incident reports, and community input to enhance the plan.

8.8. ACTIVITIES CONDUCTED

Report on International Yoga Day Program 2024

Introduction

In celebration of International Yoga Day 2024, a special Yoga Day program was organized at the Research Block on June 21, 2024. The event aimed to promote the practice of yoga, enhance physical and mental well-being, and foster a sense of community within the institution. This initiative was led by the Department of Physical Education, with Mr. Elthose Mathachan, the Head of the Department, serving as the event coordinator.

Objective of the Event

The primary objective of the event was to:

- Encourage the practice of yoga for physical, mental, and spiritual well-being.
- Educate participants on the benefits of yoga and how to incorporate it into daily routines.
- Build a sense of community by bringing together students, staff, and faculty through a shared experience.

Program Highlights

The program featured Vaxerin Varghese, a highly esteemed yoga expert known for his extensive experience in yoga and holistic health. His session was designed to be inclusive, catering to participants of all skill levels, from beginners to advanced practitioners. The event started promptly at 10:00 AM with an opening ceremony. Mr. Elthose Mathachan welcomed the participants, emphasizing the significance of International Yoga Day and the critical role of yoga in maintaining physical, mental, and spiritual health. This set a positive and motivational tone for the day's proceedings.

Yoga Session Overview

The yoga session, led by Vaxerin Varghese, comprised the following key elements:

Asanas (Yoga Poses)

Vaxerin led participants through a series of yoga postures designed to promote physical strength, flexibility, and balance. The poses were carefully selected to accommodate different skill levels, ensuring all participants could comfortably follow the session.

Pranayama (Breathing Exercises)

Participants were introduced to various breathing techniques aimed at enhancing lung capacity and mental focus. Vaxerin's instructions emphasized the importance of breath control and mindfulness during each exercise.

Meditation

The session concluded with a guided meditation to promote relaxation, mindfulness, and mental clarity. Participants were guided into a state of deep relaxation, helping them connect with their inner peace.

Interactive Q&A Session

Following the yoga session, Vaxerin Varghese engaged in an interactive Q&A session, offering participants the opportunity to ask questions about yoga techniques, its health benefits, and ways to incorporate yoga into their daily lives. Vaxerin provided insightful and practical answers, enhancing participants' understanding of yoga's holistic benefits.

Participant Feedback

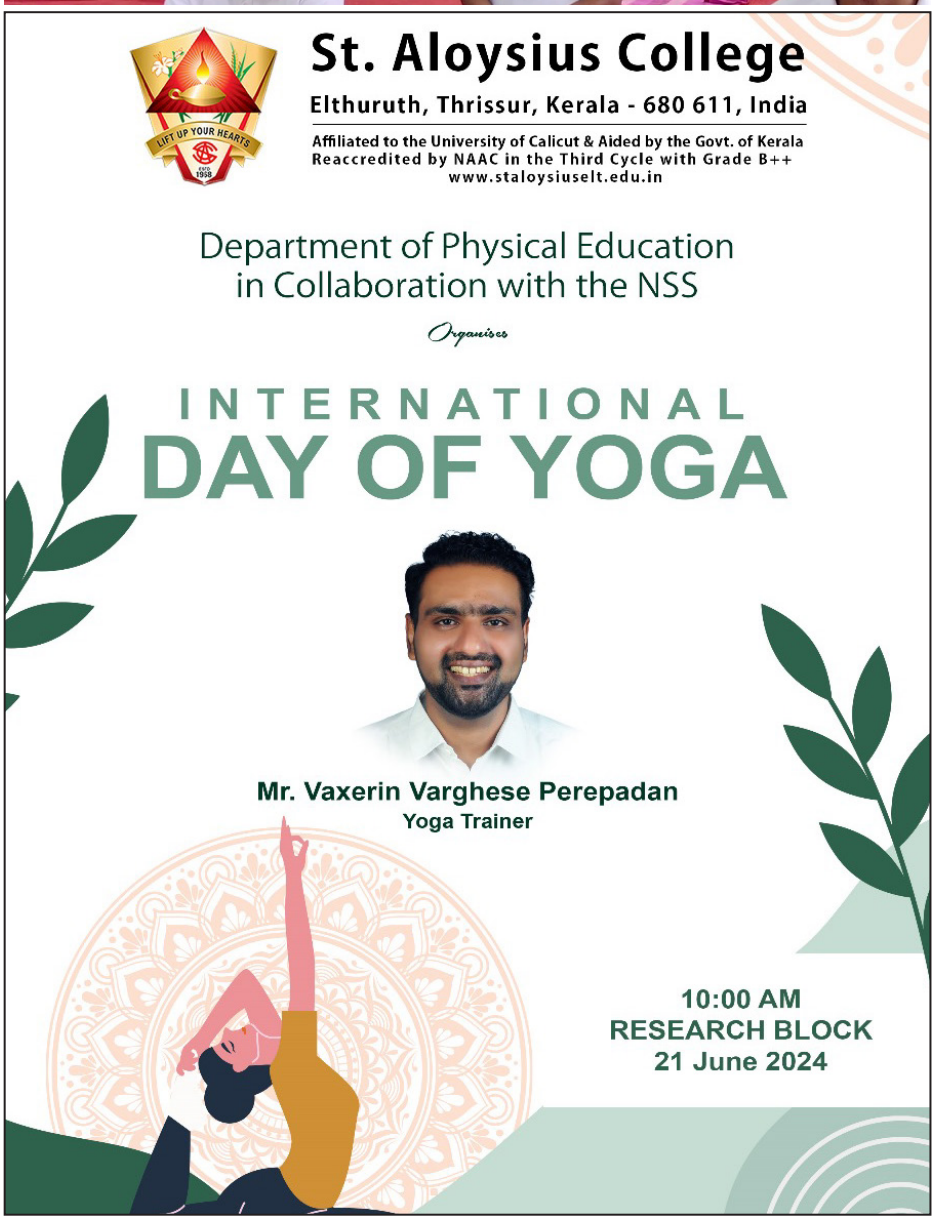
The feedback from participants was overwhelmingly positive. Attendees praised the organization of the event and Vaxerin Varghese's expertise. Key highlights from the feedback included:

- The inclusive nature of the session, allowing individuals of all skill levels to benefit.
- The focus on practical aspects of yoga, with clear instructions on breath control and mindfulness.
- The Q&A session, which many found invaluable for addressing personalized questions and deepening their understanding of yoga.

Conclusion

The International Yoga Day 2024 program was a resounding success. The event, led by Vaxerin Varghese, achieved its objective of promoting yoga and fostering well-being among participants. The session was both educational and inspiring, providing valuable insights into yoga and its health benefits. The Department of

Physical Education extends its heartfelt thanks to Vaxerin Varghese for his invaluable contribution and to all the participants for their enthusiastic involvement. We look forward to organizing similar events in the future to continue promoting health and wellness within our community.



Report on Anti-Drug Awareness Program 2023

Introduction

On October 6, 2023, the NSS Unit 5 & 46 of St. Aloysius College organized an Anti-Drug Awareness Program m aimed at educating NSS volunteers about the dangers of drug abuse and promoting a drug-free lifestyle. The program was attended by a total of 73 students and commenced at 2:15 PM.

Program Overview

The event began with a warm welcome from Ms. Rejitha A G, NSS Program Officer (P.O), who addressed the gathering and set the stage for the program. The primary objective of the session was to raise awareness about the adverse effects of drug abuse and to provide information on resources and support available for those affected. The session featured a keynote address by Binju Jacob C, Junior Health Inspector (JHI) from the Family Health Centre, Kandanissery. Binju Jacob C provided valuable insights into the impact of drug abuse on individuals and society, discussed preventive measures, and highlighted the importance of community involvement in combating drug abuse. The resource person's expertise and engaging presentation significantly contributed to the effectiveness of the program. The program concluded with Mr. Jaison Jose P, NSS Program Officer (P.O), delivering the vote of thanks. Mr. Jose expressed gratitude to the resource person, attendees, and everyone involved in organizing the event. His remarks acknowledged the importance of the initiative and encouraged continued efforts to promote awareness and prevention of drug abuse.

Participant Engagement

The program provided an interactive platform for students to engage with the resource person and gain a deeper understanding of the issues related to drug abuse. The attendees actively participated in the discussions and showed a keen interest in learning about ways to contribute to the fight against drug abuse.

Conclusion

The Anti-Drug Awareness Program 2023was a significant initiative organized by NSS Unit 5 & 46 of St. Aloysius College. The event successfully met its objectives by educating students on the dangers of drug abuse and fostering a sense of responsibility towards maintaining a drug-free environment. The NSS Unit extends its sincere thanks to Binju Jacob C for his valuable contribution as the resource person, Ms. Rejitha A G for her welcoming address, and Mr. Jaison Jose P for the concluding vote of thanks. The active participation and enthusiasm of the students were greatly appreciated. The NSS Unit looks forward to organizing similar programs in the future to further promote health, awareness, and community well-being.

Life skill development programme in Occupational Safety and Health

The Life Skill Development in Occupational Safety and Health (OSH) Awareness Programme was conducted to enhance participants' understanding of safety practices, risk management, and health protocols in the college. The program aimed to equip participants with essential life skills that promote a culture of safety and well-being. The practical part of the programme was conducted at open space in the college. The demonstrated the use of fire extinguishers to the students and staff. The theory part of the session was conducted in college on 21.12.22 at 3 PM in seminar hall.

The primary objectives of the programme were:

- To raise awareness of occupational safety and health standards.
- To develop critical life skills related to risk assessment and accident prevention.

Resource person

Jimson Thomas,HSE trainer, Al Salama School of safety studies and training

Report on "Keshadanam" Hair Donation Camp

St. Aloysius College, Thrissur, through its student association Christals and the Internal Quality Assurance Cell (IQAC), in collaboration with Amala Medical College, successfully organized the "Keshadanam" hair donation camp on 27th October 2023. The event aimed to collect hair donations for creating wigs for cancer patients who lose their hair during chemotherapy, offering them emotional support and confidence.

Objective of the Event:

The primary objective of "Keshadanam" was to support cancer patients by providing wigs made from natural hair donations, helping them regain a sense of normalcy during their treatment. Additionally, the event aimed to spread awareness about cancer, hair loss, and the importance of community involvement in healthcare initiatives.

Event Highlights:

Organizers and Partnerships: The event was spearheaded by the Christals student association and IQAC, with significant support from Amala Medical College. This partnership demonstrated the collaborative efforts between academic institutions and healthcare organizations in fostering social responsibility.

Participation: The event saw enthusiastic participation from the college as well as the neighbouring school. Students donated a minimum of 12 inches of hair, which will be used to create wigs for cancer patients. The sense of solidarity was evident as people from diverse backgrounds contributed to the cause.

Hair Donation Process: Professionals from Amala Medical College oversaw the hair donation process, ensuring that all donated hair met the required standards for wig-making. Proper hygiene and care guidelines were followed during the cutting process, and participants received instructions on post-donation hair care.

Awareness Session: In addition to the donation drive, the event featured an awareness session conducted by management board member from Amala Medical College. The session covered the physical and emotional challenges faced by cancer patients, especially the impact of hair loss, and how hair donations can uplift their spirits.

Recognition and Appreciation: To recognize the generosity of the participants, certificates of appreciation were distributed to all donors. This token of recognition not only honoured their contribution but also encouraged others to come forward for future hair donation drives.

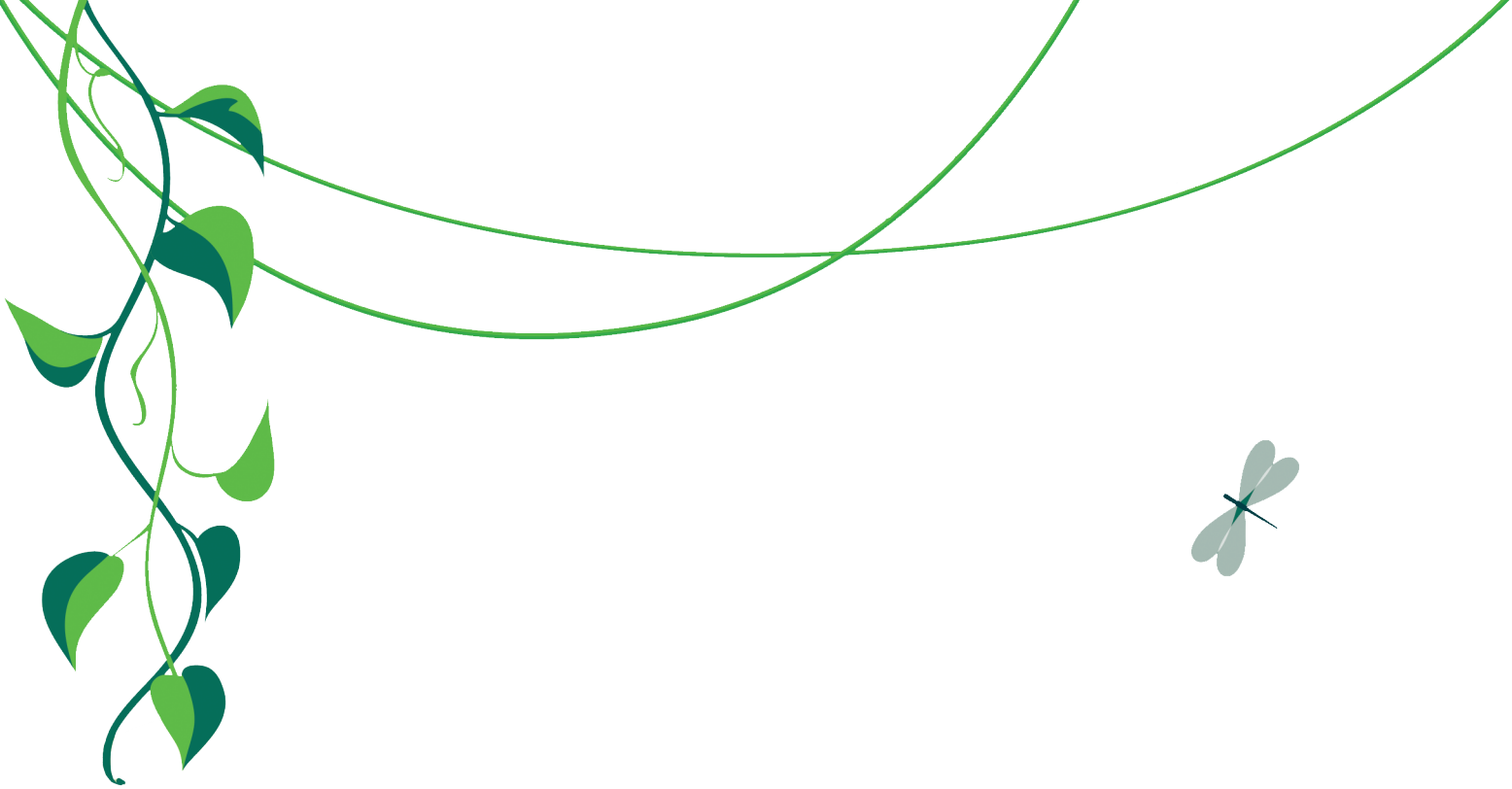
Media Coverage: The event garnered attention from local media, further amplifying the message of compassion and the importance of supporting cancer patients. Media coverage played a vital role in inspiring more people to join similar initiatives in the future.

Impact and Outcome:

The "Keshadanam" camp resulted in a significant collection of hair donations, which will be processed to make wigs for cancer patients. The event also raised awareness about the emotional toll of cancer and the importance of community support in the recovery process. Both Christals and IQAC, along with Amala Medical College, received positive feedback for their efforts in organizing this charitable event.

Conclusion:

The "Keshadanam" hair donation camp, organized by Christals and IQAC of St. Aloysius College in association with Amala Medical College, was a tremendous success. It not only collected valuable hair donations but also fostered a sense of social responsibility among the participants. The event served as a meaningful step toward supporting cancer patients, and the college looks forward to continuing such initiatives in the future to contribute to society's well-being.



There is no such things as away.
When we throw anything away
it must go somewhere

- Annie Leonardv

Chapter IX

CARBON FOOT PRINT AUDIT REPORT

9.1. INTRODUCTION

Carbon dioxide (CO_2) stands as the predominant greenhouse gas (GHG) stemming from human activities. Institutions of higher learning are urged to embrace goals aimed at achieving carbon neutrality in the foreseeable future, setting a standard for others to emulate. Increasing greenhouse gas emissions is one of the primary causes of global warming. The primary sources of GHG's are transportation, electricity production, industry, commercial and residential, agriculture and land use and forestry. The four major GHG's are CO_2, methane (CH_4), Nitrous Oxide (N_2O) and Chlorofluorocarbons (CFCs). In addition to this water vapor (H_2O) also contributes to Greenhouse effect. An essential element of the atmosphere, carbon dioxide (CO_2) is emitted through natural processes, such as volcanic eruptions, as well as human activities, including the combustion of fossil fuels and deforestation.

There is substantial evidence demonstrating that the primary cause of this warming is largely attributed to the emission of GHGs resulting from human activities. Consequently, measures must be implemented to mitigate these GHG emissions. A crucial initial step in emission reduction and comprehending disaster risk involves quantifying GHG emissions from various human activities. Likewise, Carbon foot printing has emerged as a tool to direct pertinent emission reduction efforts and verifications, thereby aiding in the understanding of the risks associated with global warming from its outset.

9.1.1. What is Carbon Footprint?

CO2 is emitted into the atmosphere across the entire span of human existence. Through the utilization of electricity sourced from fossil fuel power plants, the combustion of gas for heating, or the operation of petrol or diesel vehicles, each individual bears responsibility for CO_2 emissions. Moreover, every product or service consumed indirectly contributes to CO_2 emissions, as energy is requisite for their production, transportation, and disposal. The total set of greenhouse gas emissions caused directly and indirectly by an individual, organization, event or product is commonly called their carbon footprint (CF). A carbon footprint is defined as the total amount of greenhouse gases, specifically carbon dioxide (CO_2) and other equivalents like methane (CH_4) and

nitrous oxide (N_2O), that are emitted directly or indirectly by human activities. The United Nations Climate Change Conference (COP 28, 2023) ended with an agreement that signals the "beginning of the end" of the fossil fuel era by laying the ground for a swift, just and equitable transition, underpinned by deep emissions cuts and scaled-up finance. Carbon footprint is an inevitable thing to attain the climate action, the 13th SDG.

An organizational carbon footprint assesses the greenhouse gas (GHG) emissions stemming from all activities within the organization, encompassing energy consumption in buildings, industrial processes, and company vehicles. Beyond simply quantifying the organization's overall GHG impact, conducting a Carbon Footprint (CF) analysis furnishes the organization with a thorough GHG inventory, enabling the identification and targeting of reductions in major emissions sources. Research has indicated that various types of organizations make significant contributions to global GHG emissions.

9.1.2. Carbon Footprint for Universities and colleges

Universities or colleges, as organizations engaged in education, research and community services, play an important role in generating knowledge, integrating sustainability in education and research projects, and promoting environmental issues in society, as well as in preparing responsible graduates capable of maintaining sustainable development. In addition, universities or colleges typically consist of a mix of buildings used for classrooms, laboratories, offices, canteens, residences, etc. that generate significant GHG emissions. Furthermore, the Carbon Footprint (CF) serves as a valuable decision-making instrument, empowering organizations such as universities to enhance their oversight of environmentally impactful activities. It furnishes a quantifiable metric, enabling comparisons of environmental footprints across academic institutions. Additionally, it establishes a foundational benchmark for assessing the efficacy of future mitigation endeavors on campus. The carbon footprint serves as a crucial instrument not only for pinpointing major emitters but also for fostering awareness among faculty and students regarding the diverse impacts of everyday actions on campus. This encompasses all facets, spanning from research and education to administrative matters. Given these factors, it is imperative for universities, as pioneers in science and technology, to take on a leadership role in computing, monitoring, disclosing, minimizing, or even offsetting their carbon emissions. By doing so, they exemplify sustainable organizations and champion the transition towards a carbon-neutral society. The carbon footprint as a form of greenhouse gas emission inventory provides the possibility to define a baseline for institutions of higher education aiming for carbon neutrality.

9.2. METHODOLOGY

In the context of St.Aloysius College, various aspects of resource consumption and environmental impact are being
evaluated (See the Matrix given in Table 9.1). This assessment encompasses several key areas, including energy consumption (encompassing both electricity and fuel usage), water consumption on a monthly basis, waste generation, and the digital footprint of the institution. But, full data is not available for any such parameters used to calculate carbon foot print, from the current audit at K.G.College, Pampady, Kottaym.

When examining waste generation specifically, the focus primarily lies on biowaste, indicating organic waste materials such as food scraps, garden waste, or other biodegradable items. This emphasis on biowaste suggests a recognition of its significance in terms of both environmental impact and potential for sustainable management practices. Here the daily waste generated was accounted.

Overall, this comprehensive approach to assessing re-source usage and environmental impact reflects a commitment to understanding and potentially mitigating the college's ecological footprint, with specific

attention paid to areas such as energy efficiency, water conservation, waste management, and digital sustainability.

9.2.1. Assumptions

- Emissions of greenhouse gases, especially carbon dioxide from burning fossil fuels for energy, are causing climate change. Climate change is a significant threat to life on Earth, so humankind needs to first reduce and then ultimately eliminate emissions of carbon dioxide (CO2).
- There is clear evidence that increases in atmospheric green house gas concentrations–including CO2 from burning fossil fuels for energy and transportation –are changing Earth's climate. Other important greenhouse gases are methane (CH4), often produced during the decomposition of organic waste such as waste water, nitrous oxide (N2O) and halogenated compounds.
- According to the Intergovernmental Panel on Climate Change (IPCC), we must limit the increase in average global temperature to below15°C by 2030.This means we must use More efficient energy, replacing fossil energy sources. Energy using carbon-free renewable energy sources to transition to a carbon-free sustainable economy.

9.2.1.1. ISO 14064

- The standard specifies how an organization develops verifiable GHG inventories, where the inventory is defined as "the sum of the organization's GHG sources and sinks". ISO has designed the standard for any organization that needs tools and guidance for assessing and reporting greenhouse gas emissions. There are two types of institutional boundaries are applied:
  (1) the organizational boundaries refer to any facilities for which the organization has practical and financial responsibilities
  (2) The operational boundaries refer to the organization's activities, such as burning fossil fuels for heating and industrial processes.
- ISO14064-2 describes processes for quantifying, monitoring and reporting emission reductions or greenhouse gas removal improvements at the project level. In this regard, a project is defined as a distinct activity or endeavour; Some examples include:
- An anaerobic digestion plant in a waste water treatment plant is designed to capture methane and then use the methane to generate energy in a gas engine
- A carbon capture and storage facility, in which underground well would provide a reservoir for the captured CO2.
- ISO 14064 -2 applies a life cycle approach to assess greenhouse gas emission and eliminate from project. This standard describes how users quantify baseline emissions from sources, and then explains the requirements for quantifying the amount of greenhouse gases that will reservoirs remove from the atmosphere.

9.2.1.2. ISO 14067

- Coverage for a single type of impact: a product's impact on climate change, where carbon foot print (CFP) is defined as the total amount of greenhouse gas emissions and removals in a product system, expressed as CO2 equivalent. ISO 14067 applies the proven and widely used international standards for lifecycle assessment (LCA), ISO14040 and ISO14044. The elimination of greenhouse gases is relevant because a product can reduce impacts of climate change; for example, CO2 removal techniques, such as carbon capture and storage, or methane capture and utilization from anaerobic digestion.
- ISO 14067 describes procedures for determining direct and in direct CO2 emissions from products. Coverage applies to a single type of impact–a product's impact on climate change, where carbon foot print (CFP) is defined as the total amount of green house gas emissions and removals over a period of time system of products, expressed in CO2 equivalents. ISO 14067 applies the widely used and proven international standards for life cycle assessment (LCA), ISO14040 and ISO14044.

- Green house gas absorption is relevant as a product can reduce the impact of climate change; for example, CO2 removal techniques, such as carbon capture and storage, or methane capture and utilization from an aerobic digestion.
- Applying the principles of LCA, the ISO standard describes processes for determining green house gas emissions and removals from the purchase of raw materials through the end of the product's lifecycle ,i.e. analysis from start to finish. Standard also describes how users can define partial CFP, end-to-end analysis, or CFP throughout the lifecycle of the product in use.

9.2.1.3. CF Calculation for Colleges/Universities as per ISO 14064

Normally the Carbon foot print is calculated with the most authentic and relevant emission factors and assessment methodology in line with the global framework and the ISO 14064 standards and the scope and operational boundary is given as follows:

Scope 1 Direct GHG emissions from:

i. Captive power generation activities including the renewable power and the power from the combustion of fossil fuels (HSD) in stationary source of electricity generators, LPG consumption in canteen & laboratories
ii. Combustion of fuels in mobile sources - College owned & controlled vehicles and the fuel used for the horticulture activities
iii. Fugitive emissions from Refrigeration/air-conditioning equipment installed and operated

Scope 2 Indirect emissions from:

i. Purchased electricity including renewable and non-renewable power

Scope 3 Other Indirect GHG emissions from:

i. Commuting of Teaching Staff, Non-Teaching Staff, Students and Sub-contractors.
ii. Business Air travel and associated hotel stay
iii. Material procurement, consumption and disposal.
iv. Waste management and disposal.
v. Upstream and downstream activities
vi. Considering the unavailability of accurate data in most of the above scopes, a simplified methodology has been formulated to get an overall understanding about the carbon foot print of the college.

Carbon emission	Carbon sequestration
Direct emissions (from own or controlled sources) -campus facilities, vehicles and equipment's	Biomass (biodiversity of the campus)
Indirect emissions (from activities) (including purchased energy) • electricity, water or fossil fuels (LPG etc.) • commuting, waste generation and procurement	Alternate energy resources – solar energy
DATA USED (2023-24 schedule)	
Electricity consumption in the college per year (in KWH) Water consumption per year (in KL)	Biomass estimation based on trees and grasses Solar energy generation (in KWH) per year

Table 9.1. Simplified carbon footprint matrix for academic institutions.

Calculating the carbon footprint of a college campus involves considering various factors such as energy consumption, water usage, waste generation, and biodiversity impact, as given in the above matrix. However, many of these data are deficient in the present audit. Since limited data only available, a simplified methodology is developed by TIES for estimating the Carbon foot Print of the college. Keep in mind that this approach provides a rough estimate, and for a more accurate calculation, additional data may be needed.

9.2.3. TIES' simplified calculator for the estimation of carbon Foot print of colleges/ universities

Carbon Foot print of the college is estimated through calculating component foot prints of based on available data:

9.2.3.1. Electricity Carbon Footprint:

Calculate the total electricity consumption in kilowatt-hours (kWh) per year. Use the carbon intensity factor for the region to convert electricity consumption to CO_2 emissions. As per Our World Data (2022), carbon intensity factor of electricity or grams of CO_2 equivalents per Kilowatt hour is 633g of CO_2, in India. (https://www.google.com/search?q=carbon+intensity+factor+of+electricity&oq=carbon+intensity+factor+of+electricity&aqs=chrome..69i57j33i160.9020j0j15&sourceid=chrome&ie=UTF-8)

Electricity Carbon Footprint (kg CO_2) = Electricity Consumption (kWh) × Carbon Intensity Factor (kg CO_2/kWh)

9.2.3.2. Water Carbon Footprint:

Calculate the total water consumption in cubic meters (m^3) per year. The water consumption carbon footprint factor, which is the average carbon footprint associated with water use, in India for potable water is estimated as 0.137 Kg. CO_2/m3. (https://wint.ai/blog/the-carbon-footprint-of-water/#:~:text=In%20fact%2C%2013%25%20of%20 electricity,10.6Kg)%20of%20carbon%20emissions).

Water Carbon Footprint (kg CO_2) = Water Consumption (m^3) × Water Carbon Footprint Factor (Kg CO_2/m^3)

9.2.3.3. Waste Carbon Footprint:

Estimate the annual waste generation in kilograms. Use the waste generation carbon footprint factor, representing the average carbon emissions associated with waste disposal in the region.
In India, the CO_2 equivalent of organic or food waste is estimated as 0.165g CO_2 per one Kg of organic waste (Ramachandra et al., 2015; https://www.researchgate.net/publication/275017534_Carbon_Footprint_of_the_Solid_Waste_Sector_in_Greater_Bangalore_India#read).

Disposable and packing plastic wastes are found to generate 3.50 Kg. of CO_2 per one KG. of such wastes. (TERRA. https://www.teorra.info/blog/what-is-the-carbon-footprint-of-packaging#: ~:text=Plastic%3A%203.50kg%20carbon%20emissions%20per%201kg%20of%20packaging).

E Wastes or electronic wastes generally responsible for emission of 1.44 Kg. CO_2 per one Kg of waste. (World Loop- https://worldloop.org/e-waste/bo2w-impact-on-co2-emissions/#:~:text=The%20results%20were%20astounding%3A%20For,CO_2%20emissions%20have%20been%20avoided).

Waste Carbon Footprint (kg CO_2) = Waste Generation (kg) × Waste Carbon Footprint Factor (kg CO_2/kg)

9.2.3.4. Total Carbon Footprint:

Sum up the carbon footprints from electricity, water, and waste, impact to get the total carbon footprint.

Total Carbon Footprint (kg CO_2) =
Electricity Carbon Footprint +
Water Carbon Footprint +
Waste Carbon Footprint

Special Note: This simplified formula provides a basic estimation of the carbon footprint. For more accurate results, it's recommended to obtain specific data, collaborate with environmental agencies, or hire a professional to conduct a comprehensive assessment.

9.3. RESULTS AND OBSERVATION

9.3.1. Electricity consumption

No.	Year	Annual consumption of electricity as per KSEB Bill (KwH)	Solar energy exported to the grid (KwH)/year
1	2021 (covid year)	16793	48954
2	2022	30627	38368
3	2023	37166	17663
	Average of three years	28195.33	34995
	Average of two years (2022, 23).	33896.50	28015.5
	Difference in average of 2 years (average electricity use-KwH)		5881

9.2. Electricity consumption (in kwH) from KSEB and solar per generation in the college

The average electricity usage is extremely low in 2021 due to the lockdown owing to covid restrictions. During the period the solar energy export is also at the peak (Table 9.1). Hence, the average of 2022 and 2023 only considered for the calculation of energy usage and energy production I n the college.

9.3.2. Manual calculation

The Carbon foot print calculated for St. Aloysius College, as per the methodology suggested in section 9.2.3 is as follows:

No.	Component	Total quantity /year	Equivalent to CO_2	Respective foot print(Kg of CO_2)
1	Electricity (kWh)	5881	0.633 Kg/kWh	3722.67
2	Water (m3)	3655.35	0.137 Kg/m3	500.78
3	Organic waste (Kg)	0*	0.000165 Kg/Kg	0.00
4	Plastic waste (Kg)	237.55	3.50 Kg/Kg	831.43
5	E waste & scraps (Kg)	405.57**	1.44 Kg/Kg .	584.02
			Total carbon Foot print (Kg. of Co_2) of the college	5638.90
			TOTAL	6.2 t CO_2eqv.

* A total of 226 Kg. of organic waste is produced in the college. But it is fully utilized for biogas generation in a nearby monastery.

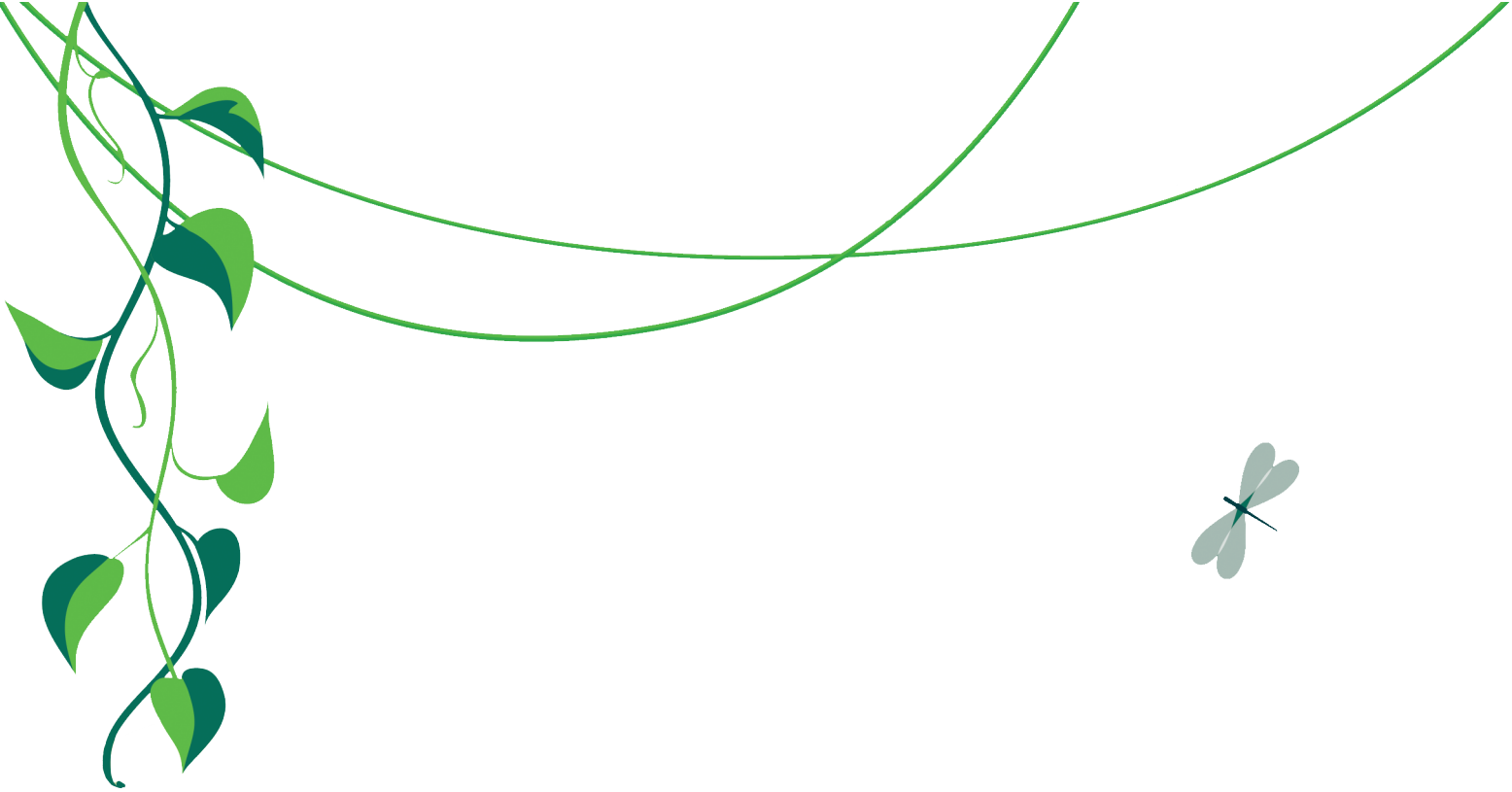
**** the exact quantity of e waste is not available. The quantity of paper and other wastes included here.**

9.3. Carbon foot print of St. Aloysius College, Elthuruth, Thrissur – manual calculation using simplified formula.

Carbon foot print of St. Aloysius college is extremely low compared to similar institutions in India. This is mainly because of the high energy production from the solar system and recycling of biowastes through bio methanation plant.

Chapter X

GENERAL CONCLUSION OF GREEN AUDIT & RECOMMENDATIONS



Never doubt that a small group of thoughtful,
committed citizens can change the world;
indeed, it is the only thing that ever has.

- Margret Mead

10 General Conclusions & Recommendations

10.1 CONCLUSION

- SDG 7 - Affordable and Clean Energy: The Energy Management Plan (EMP) focuses on transitioning to energy-efficient lighting, gradually replacing fluorescent lights and conventional fans with LEDs and BLDC fans. This shift supports the goal of ensuring access to affordable, reliable, and modern energy sources by reducing overall energy consumption. The 10 KVA solar power system complements this by promoting the use of renewable energy.
- SDG 12 - Responsible Consumption and Production: The College's emphasis on maintaining energy usage registers, reducing paper waste through digitalization, and managing e-waste more effectively supports responsible consumption and production practices. The partnership with a recycling company for plastic waste and the promotion of green protocols for events reflect sustainable waste management efforts.
- SDG 6 - Clean Water and Sanitation: The College has a well-established water collection, storage, and pumping system, with measures to conserve water, such as installing water-saving taps. While minimal water conservation measures are in place due to an abundance of water, awareness campaigns are recommended to prevent wastage. Regular testing of water quality and the existence of a well-recharge system ensure access to clean and safe water for all.
- SDG 13 - Climate Action: Through initiatives like carpooling, which reduces fossil fuel consumption, and plans for improved energy efficiency in equipment and lighting, the college is contributing to climate action by reducing its carbon footprint and promoting sustainable energy use.
- SDG 15 - Life on Land: The campus is rich in biodiversity, particularly with the presence of 58 freshwater fish species. However, plant diversity could be improved to attract more fauna, contributing to the conservation of biodiversity on campus. Students' involvement in creating a plant checklist and other conservation efforts aligns with this goal by preserving terrestrial ecosystems.
- SDG 3 - Good Health and Well-Being: The College promotes a healthy environment through its Occupational Health and Safety Management System, regular safety inspections, and enforcement of safety protocols in laboratories. Facilities like the gym and meditation programs further enhance physical and

mental well-being, and the canteen's FSSAI certification ensures food safety. Psychological counselling and support systems address emotional and gender-related issues, promoting overall well-being.

- SDG 11 - Sustainable Cities and Communities: The College's responsible infrastructure planning, such as pedestrian pathways, traffic control, and waste segregation systems, supports the development of sustainable communities. Its efforts to reduce waste, manage resources efficiently, and promote inclusive practices contribute to building resilient and sustainable campus communities.

By aligning its practices with these Sustainable Development Goals, the college is taking significant steps toward sustainability, resource conservation, and promoting a healthier, more inclusive environment for students and staff.

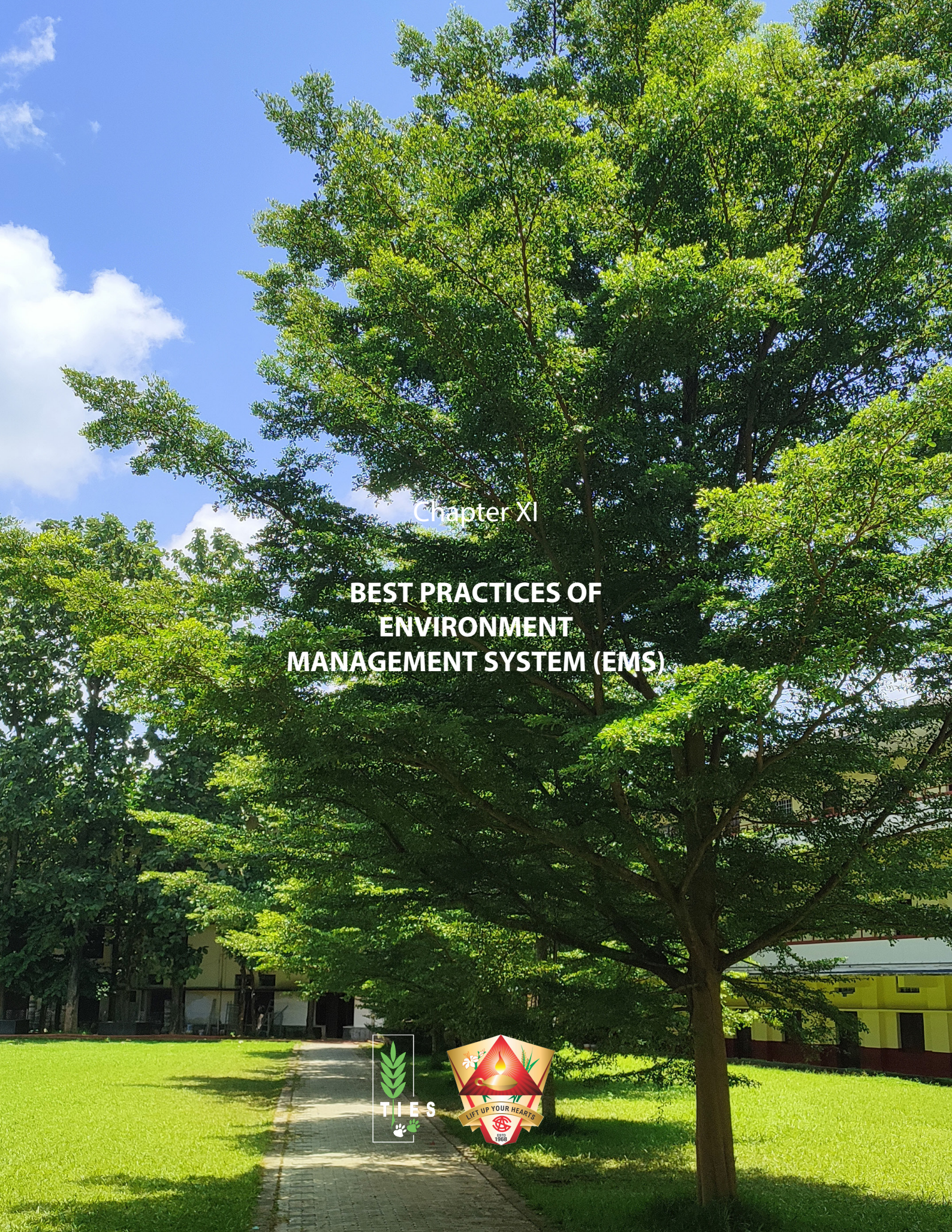
10.2 RECOMMENDATION

- The phased implementation of the Environmental Management Plan (EMP) should include energy conservation measures and promote energy-efficient equipment and devices. Regular internal and external audits should be conducted.
- Promoting alternative energy resources, as outlined in the plan, is crucial to achieving sustainable energy management goals.
- Information, Education, and Communication (IEC) programs involving all stakeholders, including parents and the local community, will lead to improved outcomes.
- Students can take the initiative to introduce innovative, low-cost technologies and mechanisms that save energy. These initiatives could be part of their internships, projects, or standalone efforts.
- Colleges should organize techno-fests in collaboration with other institutions, providing opportunities for students to share ideas and engage with diverse knowledge, promoting teamwork and innovation.
- With guidance from faculty, students can proactively bring forward low-cost, innovative technologies and mechanisms while focusing on energy conservation.
- A dedicated power management team should be established to monitor energy usage, assess progress, and document findings, allowing for adjustments in sustainable energy practices.
- An alternative energy-saving plan should be developed, with a focus on reducing LPG consumption. Installing a biogas plant is a recommended solution, with the power management team overseeing its progress.
- As an academic institution, students learn from the college's practices in all aspects of life, so water conservation programs should be regularly conducted on campus.
- Regular maintenance of water infrastructure is essential, and biannual water quality testing of sources is recommended.
- Awareness programs should be held for stakeholders to encourage water-friendly habits.
- Sustainable practices should be implemented on campus to demonstrate and teach students.
- Efforts should be organized to monitor and improve campus biodiversity.
- The campus community should be made aware of its rich biodiversity through regular IEC programs and participatory conservation projects.
- The farming area should serve as a model for organic farming practices.
- Trees and shrubs should be labeled with QR codes, and boards displaying photographs and names of common biodiversity species should be placed throughout the campus.
- Students, faculty, and staff should engage in citizen science projects to monitor biodiversity, such as bird-watching events, insect surveys, and plant identification activities.
- Nesting boxes and bird feeders should be installed across campus to support bird species, especially during nesting seasons and harsh weather.
- Community involvement in biodiversity conservation should be encouraged through outreach programs, volunteer opportunities, and educational workshops.
- Start an apiculture project on campus to enhance biodiversity and produce honey.
- Continue with current responsible waste management practices, adapting future plans as strengths and challenges evolve, while regularly reviewing the system for improvement.
- E-waste should be segregated monthly, and systematic records should be maintained to track volumes and ensure proper disposal or recycling.
- Ensure the efficient operation of the biogas plant to generate biomass for college use, with the possibility of utilizing the produced fertilizer for a campus vegetable garden.

- A streamlined waste segregation system should be introduced to manage all types of waste, ensuring proper disposal and recycling.
- Implement an efficient grey water management system to collect, treat, and recycle grey water from the canteen and laboratories, ensuring compliance with eco-friendly standards and routine maintenance.
- Install a soppit tank for safe grey water disposal, with regular checks and treatment processes to minimize environmental impact and promote campus sustainability.

I can't imagine anything more important than air, water, soil, energy and biodiversity. These are the things that keep us alive

- David Suzuki



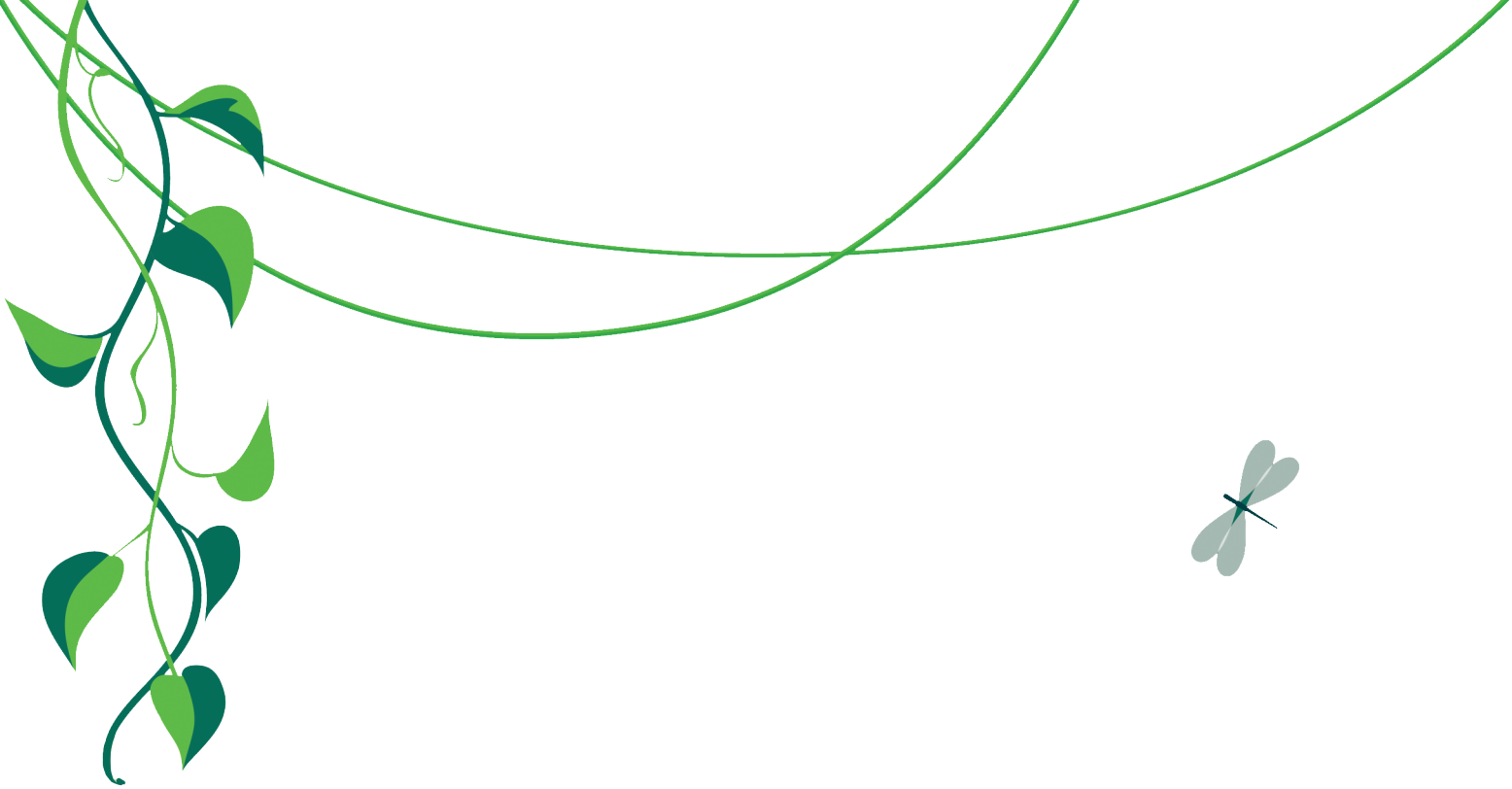
Chapter XI

BEST PRACTICES OF ENVIRONMENT MANAGEMENT SYSTEM (EMS)

TIES

LIFT UP YOUR HEARTS

ESTD 1968



Plans to protect air and water,
wilderness and wildlife
are infact plans to protect man

- Stewart Udall

11

Best practices of Environment Management System

11.1 INTRODUCTION

The College has an efficient environmental management system. In today's fast-changing world, incorporating sustainable development into college curricula is increasingly essential. As centre of higher learning, colleges play a pivotal role in equipping students with the knowledge and skills to tackle the challenges of a sustainable future. By adopting best practices that integrate sustainability into academics, colleges not only provide students with practical insights but also create a ripple effect that extends beyond the classroom, influencing their families and communities. This introduction highlights how colleges can act as catalysts for meaningful change, cultivating a generation ready to make significant contributions to society's well-being.

11.1.1 Alternative energy source- solar plant

As part of the Energy Management System, energy is a widely consumed resource, and its conservation presents a significant global challenge. To address this, the adoption of alternative energy sources has become crucial. In line with this objective, our educational institution has taken steps toward integrating alternative energy, particularly through the installation of solar panels. Currently, the college has a solar production capacity of 10 kVAh, which powers the main building and the self-financing department. Any surplus energy generated is redirected to the Kerala State Electricity Board (KSEB). This initiative not only reduces the institution's carbon footprint but also reflects our commitment to environmental sustainability. The solar installation, associated with meter number 1156788013343, operates through a three-phase net meter system. To date, it has produced a total of 38,368 units of electricity, with an average monthly production of 10 kVA kWh. Students are actively involved in monitoring the system's readings and documenting its progress, providing them with valuable hands-on experience in understanding the importance of alternative energy sources and their environmental impact.

11.1.2 Vehicle sharing practice

As part of the Energy Management System, faculty and staff have embraced vehicle sharing, leading to a significant reduction in individual travel across various categories. Notably, nearly 86% of four-wheeler travel is shared. Expanding this practice further optimizes transportation, lowers emissions, and promotes sustainability. While two-wheelers have a lower shared travel rate of 56.18%, they still offer considerable potential for increased sharing,

reducing the number of vehicles on the road and curbing fossil fuel consumption and carbon emissions. Faculty and staff lead by example in adopting this effective energy conservation practice.

11.1.3 Water usage monitoring system through water flow metering

As part of the Water Efficiency Management System, water resource management is a key element in promoting environmental conservation and sustainability within educational institutions. Acknowledging water as a finite resource is essential, especially given the scarcity of freshwater. This calls for proactive conservation efforts, which are achieved through systematic monitoring and efficient usage. To support these efforts, our college has installed three water flow meters for precise measurement. Guided by faculty, students from the internal audit team regularly monitor and record data, playing a vital role in maintaining effective water conservation initiatives.

11.1.4 Paddy Cultivation in Kole wetlands

One of the best practices in educational institutions aimed at fostering sustainability and community engagement is the implementation of a "Paddy Cultivation Drive" in Kole wetlands. This initiative not only serves as a hands-on learning experience for students but also helps in preserving traditional agricultural practices and revitalizing local ecosystems. By actively involving students and staff in paddy cultivation, the institution promotes awareness of sustainable farming methods, water conservation, and biodiversity preservation, as the Kole wetlands are a vital habitat for many species. Moreover, this drive strengthens ties with the local farming community, encouraging collaboration and the exchange of knowledge on environmentally friendly agricultural practices. Such initiatives not only contribute to food security and ecological balance but also instill a deeper understanding of environmental stewardship and sustainability among the students, preparing them to be future advocates for responsible resource management.

11.1.5 Sustainable Campus initiative

To promote sustainable practices and foster innovative solutions for a greener future, the Entrepreneurship Development Cell, Green Initiative Cell, and Institution's Innovation Council at our institution launched the "Haritham" program. A key environmental challenge addressed by this initiative was the rising issue of plastic waste, particularly in collaboration with Astrotech, which sought effective recycling solutions.

As part of the initiative, a plastic waste recycling machine was installed on campus, with the company providing training for its operation. This hands-on training empowered students to actively participate in the recycling process. Recycled plastic is converted into pellets, which are then used to manufacture eco-friendly items such as ID card frames. Students involved in the recycling process receive a small honorarium, fostering a culture of environmental stewardship.

Through this effort, the institution is taking significant steps towards responsible plastic waste management, demonstrating leadership in sustainability and encouraging students to engage in practices that benefit both the environment and the community.

11.1.6 Participatory audit for sustainability

As part of the Environment Management System, the college community actively engages in the green audit process, promoting sustainable environmental management within the institution. A team of 71 certified internal auditors at St. Aloysius College, Elthuruth, monitors and addresses any non-conformities. The college's goal is to foster a sustainable lifestyle among its members by incorporating eco-friendly practices, efficient resource management, and conservation efforts into campus life, curriculum, and operations, ensuring long-term sustainability and environmental responsibility.

11.1.7 Conclusion

The adoption of an Environment Management System (EMS) that includes solar power generation, vehicle sharing programs, medicinal plant and butterfly gardens, compost use in vegetable tower gardens, water flow monitoring systems, and participatory audit processes creates a robust framework for sustainability within the college. By implementing these practices, the college not only minimizes its environmental impact but also cultivates a culture of conservation, innovation, and community involvement. This well-rounded approach benefits the institution and serves as a model for others aiming for environmental stewardship and sustainability.

Chapter XII

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The Green Audit, conducted in accordance with ISO Standards 14001, 50001, 46001, 14046, and 14067/14064, 45001 is currently underway at St. Aloysius College. This comprehensive assessment evaluates key systems essential to environmental sustainability, including the Environmental Management System (EMS), Energy Management System (EnMS), Water Efficiency Management System (WEMS), Campus Biodiversity Register (CBR), Waste Management System (WMS), Occupational Health and Safety Management System, and Carbon Footprint (CF) assessment. An analysis of the campus's energy consumption patterns reveals that approximately 95% of the equipment, instruments, and appliances in use are outdated models lacking an Energy Star rating, leading to potentially high energy consumption. Despite this, the college's overall energy usage remains moderate, with an annual per capita consumption of 35 kWh of electrical energy. The college relies on two main power sources: the Kerala State Electricity Board (KSEB) supply and a 10 KVA solar power generation system. The Energy Management Plan (EMP) outlines the goal of achieving 100% energy-saving light fittings. Proactive measures, such as awareness programs, are also being implemented to promote energy conservation among the campus community. In terms of water efficiency management, the college has a total water storage capacity of 40,990 liters. However, pumping data shows that only 70% of this capacity is utilized. Based on this, the per capita daily water usage is estimated at 16 liters. A sampling study of the water meter data indicates a daily usage of just 13,488 liters, which brings the per capita daily usage down to 7 liters. While the water delivery infrastructure is functioning optimally, conventional taps are still predominantly used. It is recommended that these be replaced with more water-efficient taps, at least in the gents' toilets. The water quality is consistently good, as it undergoes regular mandatory testing. Water resources on campus are perennial, and no water scarcity has been reported, even during extreme summers. A well recharge system is installed in Well 2. Despite the abundance of water, there are currently no significant water conservation measures in place at the college.

The college campus is rich in biodiversity, particularly in the variety of species identified. Notably, the campus hosts a diverse range of fish, birds, and trees. A unique aspect of its biodiversity is the presence of 58 freshwater fish species, as the wetland is part of the campus. However, there is a lack of structured conservation efforts and initiatives to enhance the campus's biodiversity.

The college had basic waste management strategies in place, but the auditing process has led to the development of a more responsible and comprehensive waste management system. A total of 405.57 kg of paper is produced annually, with paper usage being significantly higher than that of plastic, bio-waste, and other waste types. While the college has facilities to manage plastic and food waste, there are lapses in the responsible management of other types of waste.

The college has implemented a well-maintained system and strategic approach to Occupational Health and Safety Management, focusing on infrastructure safety, mental and physical health, and inclusive facilities. However, there are shortcomings in effective functioning of biogas plant and lack in high-traffic areas and pedestrian pathways. The college's carbon footprint is notably low at 6.2 tonnes CO_2eqv., a testament to its eco-friendly initiatives, particularly the harnessing of solar energy and bio-waste recycling through bio-methanation, setting a benchmark for similar institutions in India. The audit recognizes the college's commendable quality of its Environmental Management System, while also identifying some non-conformities. Recommendations include enhancing infrastructure, improving internal communication mechanisms, and operationalizing non-functioning facilities to support regular program implementations and further strengthen sustainability initiatives.

St. Aloysius College, Elthuruth
Thrissur, Kerala, India. Pin. 680 611.
Phone: +91 94001 37800; E mail: sac@staloysiuselt.edu.in
Affiliated to the University of Calicut and Aided by the Govt. of Kerala