REPORT OF

GREEN AUDIT

St Teresa's College (Autonomous)

1447 St Teresas Convent,
BLDNO CCXXXVII/125-1
Park Avenue Road,
Ernakulam

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

TIES

ST. TERESA'S COLLEGE (AUTONOMOUS)
Affiliated to Mahatma Gandhi University, Kottayam

REPORT OF GREEN AUDIT

Based on International Standards

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

Auditee

St Teresa's College (Autonomous), Ernakulam

1447 St Teresas Convent, BLDNO CCXXXVII/125-1

Park Avenue Road, Ernakulam – 682011

Affiliated to Mahatma Gandhi University

Auditor

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

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October, 2025

Disclaimer

This report is meticulously crafted by the Environment Management Committee of St Teresa's College (Autonomous), Ernakulam, 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. College hostels and centenary block are not included in the study. Furthermore, the Report and Manual of Documented Information have undergone rigorous. Scrutiny by external auditors from TIES, ensuring alignment with ISO standards.

Published on 15th October 2025

St Teresa's College (Autonomous), Ernakulam.

TIES wish to acknowledge respective contributor's photographs and graphics are given in the pages 01, 23, 35, 115, 161, 195, 271, 273, 287, 289, 295 & 319.

Preface

We are pleased and excited to present the Green Audit Report of St Teresa's College (Autonomous), Ernakulam, 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 Teresa's College (Autonomous), 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 management, Principal, IQAC, 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 Teresa's College (Autonomous), Ernakulam Dist.
15.10.2025

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

\- John Muir -

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Chapter I

GREEN AUDIT AT ISO STANDARDS FOR COLLEGES & UNIVERSITIES

An Introduction

TIES

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM

ST. TERESA'S COLLEGE
(AUTONOMOUS)
ESTD 1925

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 TERESA'S COLLEGE (AUTONOMOUS), ERNAKULAM

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.

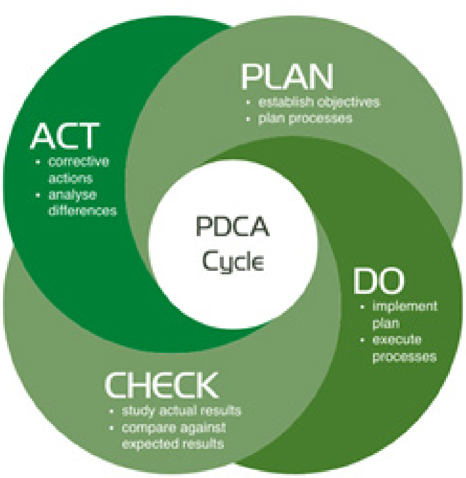


Fig.1.1. PDCA cycle of Green Audit

1.6.2. Green Audit at St Teresa's College (Autonomous)

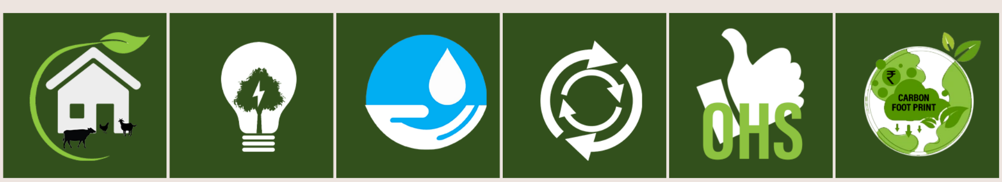
The IQAC coordinator and the Principal of the college requested Tropical Institute of Ecological Sciences (TIES) to conduct a green audit at the college on 18.02.2025. TIES initiated the formal proceedings of the audit by requesting the prerequisite data for green audit from the college, on 20.02.2025. The college has submitted required information on 22.02.2025. Subsequently, the MoU for green audit was signed between the Principal of the college and Secretary, TIES on 04.03.2025 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 04.03.2025. 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 19.09.2025.
The first surveillance audit is scheduled for October 2026.

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 2025

Chapter II

COLLEGE PROFILE
St. TERESA'S COLLEGE
ERNAKULAM
(AUTONOMOUS)

Sustainable development begins
with Education

- UNESCO -

2

College Profile
St.Teresa's College, Ernakulam (Autonomous)

2.1.HISTORY OF THE COLLEGE

St. Teresa's College Ernakulam is a Catholic institution of higher learning for women. It was established in 1925 by the Carmelite Sisters of St. Teresa under the leadership of Mother Teresa of St. Rose of Lima, the foundress of the congregation. Mother Foundress envisioned an educational institution that would be a home, inspiration and guiding force to mould, enlighten and empower generations of women. The college is proud of and faithful to the vision of its initiator and is committed to women empowerment through excellence in teaching, learning and research. The college is a minority institution, but, it has an all-India and all-denomination membership; and has students and teachers from various communities, different parts of India and even abroad. The "Fear of the Lord is the Beginning of Wisdom" is the motto of the college. St. Teresa's College is the first women's college in Cochin and the second in the state of Kerala. It holds the honour of being the first aided college for women in the state. St. Teresa's was first affiliated to Madras University, and later to Kerala University. With the establishment of Mahatma Gandhi University in 1983, it became one of its affiliated colleges. It was started in 1925 and the first Principal was Rev. Sr. Beatrice.

Between 1944 and 1976, the College underwent significant transformation, establishing itself as a respected academic institution and a prestigious destination for women's higher education. This evolution was driven by the remarkable vision and strategic foresight of the Principals and Managers, whose unwavering commitment and dedication greatly expanded the College's horizons. Under their leadership, the institution experienced substantial growth in both size and reputation. The high standards maintained by the college in terms of research have ensured regular funding from various agencies. The college has a prove track history of research excellence. In 2012, five science departments received recognition from the DST-FIST program. This commitment received additional support with a ₹77.92 lakh grant approved in 2024 through the DST-CURIE scheme. In 2017 five departments of the college were awarded financial support under the DBT Star College Scheme. St Teresa's college is a RUSA beneficiary institute under the Rashtriya Uchchatar Shiksha Abhiyan (RUSA), a Centrally Sponsored Scheme (CSS), launched in 2013 which aims at providing strategic funding to eligible state higher educational institutions. Our college has been allocated Rs 2 crore under this plan by RUSA for the future development needs in term of the Master Plan of the College.

St. Teresa's College has the distinction of securing awards and honours for its outstanding performance consistently.

VIT Award (2013)	Best arts and science college in South India.
National award (2014)	For the e-Jalakam project of the Economics department.
Paristhithimithra Award by CEERD (2016 & 2021)	For their contributions in environmental protection and sustainability.
Suchitwa Haritha Award (2015-2016)	Cleanliness, waste management, and sustainable environmental practices.
Kerala State Renewable Energy Award (2022-2023)	Adoption of renewable energy technologies, Promotion and awareness of sustainable energy practices
Higher Education Minister's Excellence Award (2022-2023)	Outstanding performance and quality enhancement in Education
Best College Excellence Award	Exceptional contributions to education and student development.
International Green Gown Awards by UNEP (2023)	For the Teresian Karshakashree project
Kerala State Energy Conservation Award (2018)	Excellence in energy efficiency and conservation practices
Kerala State Renewable Energy Award (2018)	For the initiatives towards popularisation of renewable energy.
National Energy Conservation Award (2019)	For all the energy conservation initiatives under I CONNECT.
Best Club award (2017)	For the Green activities of the Bhoomitra Sena Club (BMC) including Green Protocol
Best Environment Project Award (2019)	World Malayalee Council
Kerala State e- Governance awards 2011-13	For e- Jaalakam project for spreading awareness on e governance among the community
Chief Minister's special jury award	for Innovations in Public Service 2012-13. - For e- Jaalakam project for spreading awareness on e governance among the community

Table No. 2.1. Awards received by the college during the recent years

St. Teresa's College has reigned as champions in the Mahatma Gandhi University Youth Festival for 7 consecutive years. The college has emerged victorious 24 times in the history of the Mahatma Gandhi University youth festival, including 2023, when the college won the Overall Championship.

Today the college is home to nearly 4000 students, 220 faculty members and 74 non-teaching staff. Teresa's College has been at the forefront of women's education in Kerala for one hundred years now, nurturing young minds and shaping future leaders. As it gracefully approaches its centenary milestone in 2025, we celebrate the visionary legacy of our foundress, Mother Teresa of St. Rose of Lima. Her profound vision to empower women through education has not only endured but has evolved into a trailblazing force in the realm of women's empowerment. Our commitment extends beyond academic excellence, encompassing vibrant research initiatives, co-curricular achievements, and impactful community outreach programmes. Through a series of events, programs and initiatives, we aspire to celebrate our achievements, honour and heritage in the centenary year. From academic symposiums and cultural festivals to community service projects and alumni reunions, our centenary year will be a testament to the enduring spirit of St. Teresa's College and the countless lives it has touched and transformed over the past century. Guided by our vision and mission, we pledge to continue our quest for knowledge, truth and social justice, ensuring that St. Teresa's College remains a vibrant hub of learning and transformation for generations to come.

2.2.VISION

St. Teresa's College, as envisaged by our Foundress, Servant of God Mother Teresa of St. Rose of Lima promotes a life-oriented education that empowers women through a humanizing and liberative process towards the creation of a civilization of love.

2.3.MISSION

Our Mission is to Empower Women to Transform Society.

2.4.GOAL

St. Teresa's, a premier Catholic Institution of higher education for women, provides university education in a Christian atmosphere. The College aims at the integral formation of "Intellectually creative, emotionally mature, morally responsible, spiritually enlightened, socially committed and Truly liberated" young women who will reposition themselves as self-reliant and responsible individuals, who will transform society. The mutual trust and cordial relationship of the college community contributes to the effective realisation of our goal, "an empowered woman" who would fearlessly chart the journey of her life.

2.5.ACADEMIC PROGRAM OFFERED

With two campuses in the heart of Cochin city: the Arts Block in the main campus on Park Avenue Road and the Science Block on TD. Road; St. Teresa's College, offers 25 undergraduate programmes, which include three vocational courses and 23 postgraduate programmes, which include a master's programme in vocational courses. It also offers 5 UG Diploma programmes, 3 PG Diploma programmes, 1 Integrated M.A. programme, 3 Diploma and 8 Post Graduate departments of the institution are recognised research centres of the Mahatma Gandhi University, and they offer Ph.D programmes in the respective disciplines. The college also has the following centres functioning under it, which add to its strength: Women's Study Centre, Continuing Education Centre of the Government of Kerala, and IGNOU Study Centre.

2.6 COLLEGE GOVERNING BODY

Name	Designation
Rev. Sr. Nilima CSST	Chairperson
Dr. Anu Joseph	Principal
Prof. H. A. Ranganath	Visiting Prof. Centre of Human Genetics, Banglore
Prof. Dr. Sabu Thomas	Former VC, M. G. University
Prof. Dr. G. Gopa Kumar	Former VC, Central University
Dr. Anitha C. Kumar	School of Chemical Science, MG University
Dr. Sajimol Augustine M	Senior Administrator
Dr. Lebia Gladis N. P. (Sr. Dr. Suchita CSST) Prof. Thushara George	Teacher representatives
Mr.Joshy P.G	Administrative Staff of the College
Mrs. Sushama Srikandath	Managing Director, AVT Mac Cormick Ingredients Pvt Ltd.
Dr. Anu Joseph Principal	Member Secretary

Table No. 2.2. College Governing Body of the institution

2.7.ACADEMIC COUNCIL

Chairman:
Dr. Anu Joseph, Principal

1. University Nominees to the Governing council
1. Prof. Cyriac Joseph Professor, School of Pure and Applied Physics, MG University
2. Prof. Sudharsana Kumar C., Senior Professor, School of Pure and Applied Physics, MG University
3. Prof. A. Minikutty, Professor, School of Pedagogical Sciences, MG University

2. Experts/academicians nominees from outside the College:
1. Dr. Chenraj Roychand, Chancellor, Jain University
2. Prof. Anu Gopinath, Professor and Head, Department of Aquatic Environment Management, KUFOS, Panangad
3. Mr. Balagopal Chandrasekhar (IAS), Trustee, Anaha Trust
4. Adv. Sherry J Thomas, Advocate, High Court, Ernakulam

Members:

3. All the Heads of Departments in the Autonomous College

4. Teacher nominees of the Autonomous College
1. Dr. Priya K. Nair
2. Dr. Jency Treesa
3. Dr. Sajitha J. Kurup
4. Dr. Lekha Srinivas

The Controller of Examination: Dr. Ursala Paul, Controller of Examinations
Member Secretary: Dr. Shilpa Jose

2.8.COLLEGE ADMINISTRATIVE BODY

Name	Designation
Rev. Sr. Tessa CSST	Directoe - Arts Block
Rev. Sr. Francis Ann , CSST	Director - Science Block
Dr. Anu Joseph	Principal
Dr. Sajimol Augustine M.	Senior Administrator & Co-Ordinator-Centenary Celebrations
Dr. Sajitha J. Kurup	IQAC Co-Ordinator
Dr. Susan Mathew Panakkal Dr. Pearly Antony O.	IQAC JOINT CO-ORDINATORS
Dr. Usha Nair	Director Of Examinations
Dr. Ursala Paul	Controller Of Examinations
Dr. Reema Kuriakose	Deputy Controller
Dr. Kala M.S.	Dean Of Self Financed Stream
Dr. Nirmala Padmanabhan	Dean Of Extension & Incubation
Dr. Beena Job	Dean Of Spiritual & Religious Life
Dr. Soja Louis Dr. Vinitha Tharakan Ms. Ria V.R.	Deans of student affairs
	Academic Deans
Dr. Thushara George	Arts Stream
Dr. Priya Parvathy Ameena Jose	Science Stream
Ms. Elizabeth Rini C. K	Commerce Stream
Ms. Nair Supriya Damodaran	Self-Financed Stream

Table No. 2.3. The college administrative body of the institution

2.9. COLLEGE ORGANOGRAM

2.9.1. Administrative Organogram

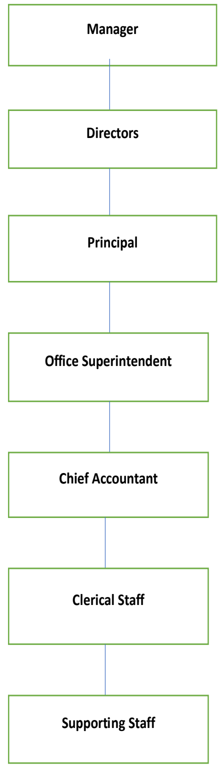


Fig 2.1 Administrative organogram of the college

2.9.2. Acadamic Organogram

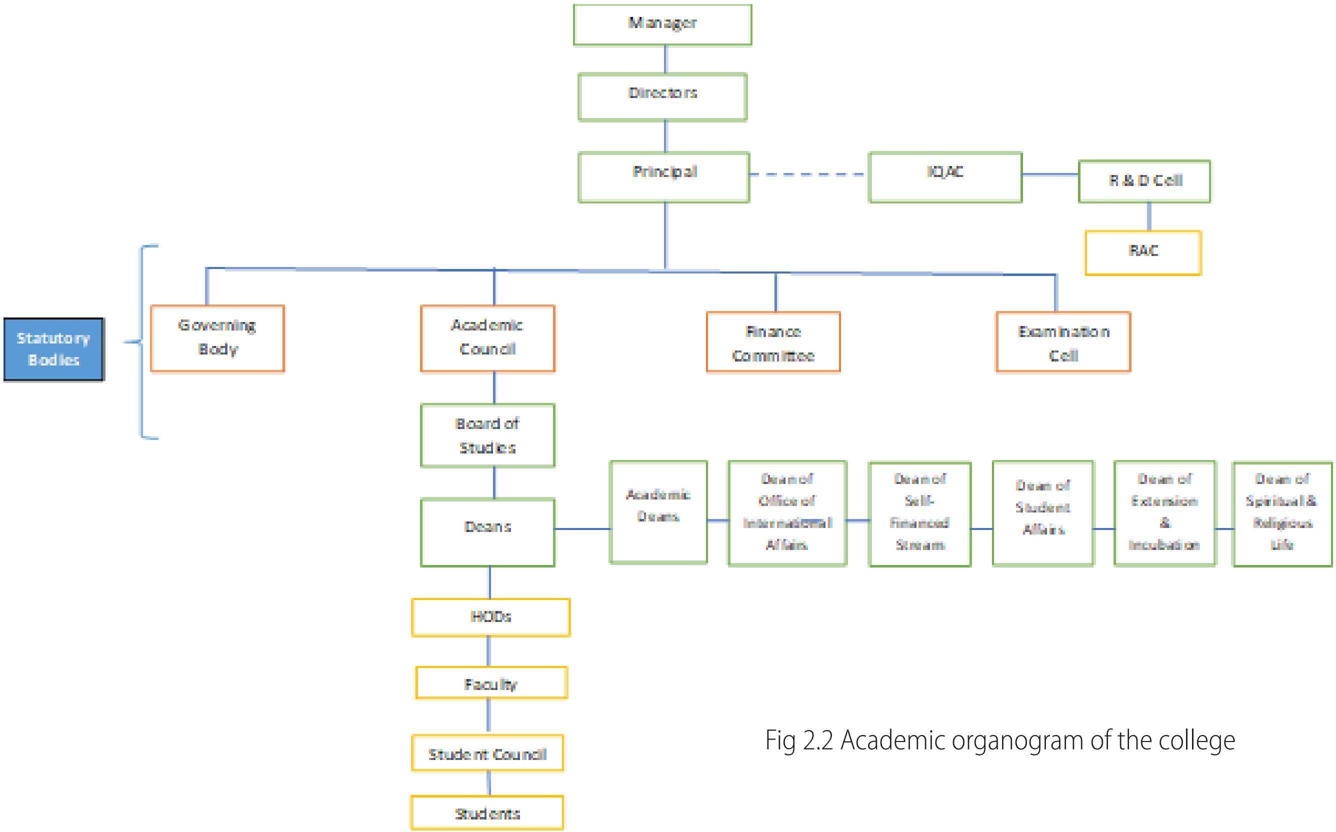


Fig 2.2 Academic organogram of the college

2.10.STRENGTH OF THE COLLEGE

2.10.1.Students

Strength of the college					
Sl No	Department	Program	Boys	Girls	Total
1	BCA (Cyber Security & Applied Computing)	BCA	0	106	106
2	Bharatanatyam	BA, MA	0	71	71
3	Botany	BSc, MSc	0	98	98
4	Chemistry	BSc, MSc	0	62	62
5	Commerce Regular	B.Com, M.Com	0	242	242
6	Commerce SF	B.Com, M.Com	0	354	354
7	Communicative English	BA, MA	0	117	117
8	Computer Applications & B.Voc Software Development	B.Sc, B.Voc	0	206	206
9	Economics	BA, MA, Integrated	0	315	315
10	English	BA, MA	0	228	228
11	French	BA,MTTM	0	61	61
12	Hindi	Language	0	0	0
13	History	BA, MA	0	142	142
14	Home Science	BSc, MSc	0	146	146
15	Malayalam	Language	0	6	6
16	Management Studies	BMS,PGDM	0	122	122
17	Mathematics & Statistics	BSc, MSc	0	277	277
18	Physical Education	NIL	0	0	0
19	Physics	BSc, MSc	0	108	108
20	Psychology	BSc, MSc	0	150	150
21	Sociology	BA, MA	0	223	223
22	FPT	B.Voc, M.Voc	0	92	92
23	Zoology	BSc, MSc	0	114	114
24	Fashion Designing	BSc, MSc	0	37	37
25	CND	B.Sc, MSc	0	229	229
			TOTAL	3506	3506

Table No. 2.3. Department wise student strength

2.10.2.Faculty

Strength of the Faculty							
Sl No	Department	Program	Men	Women	Contract	Permanent	Total
1	BCA (Cyber Security & Applied Computing)	BCA	0	5	5	0	5
2	Bharathanatyam	BA, MA	2	5	7	0	7
3	Botany	BSc, MSc	1	7	4	4	8
4	Chemistry	BSc, MSc	2	7	2	7	9
5	Commerce Regular	B.Com, M.Com	1	8	5	4	9
6	Commerce SF	B.Com, M.Com	0	13	13	0	13
7	Communicative English	BA, MA	0	14	14	0	14
8	Computer Applications & B.Voc Software Development	B.Sc, B.Voc	0	13	13	0	13
9	Economics	BA, MA, Integrated	0	16	10	6	16
10	English	BA, MA	0	13	3	10	13
11	French	BA,MTTM	0	10	10	0	10
12	Hindi	Language	0	3	2	1	3
13	History	BA, MA	0	6	4	2	6
14	Home Science	BSc, MSc	0	12	3	9	12
15	Malayalam	Language	0	7	5	2	7
16	Management Studies	BMS,PGDM	0	7	0	7	7
17	Mathematics & Statistics	BSc, MSc	0	10	6	4	10
18	Physical Education	NIL	2	1	1	2	3
19	Physics	BSc, MSc	0	9	2	7	9
20	Psychology	BSc, MSc	0	7	7	0	7
21	Sociology	BA, MA	0	7	0	7	7
22	FPT	B.Voc, M.Voc	0	7	0	7	7
23	Zoology	BSc, MSc	0	8	5	3	8
24	Fashion Designing	BSc, MSc	0	12	12	0	12
25	CND	B.Sc, MSc	0	8	8	0	8
		TOTAL	8	215	141	82	223

Table No. 2.4. Department wise faculty strength

Strength of the Non-Teaching Staff				
Sl No	Category	Permanent	Contract	Total
1	Non-teaching staffs	24	61	85
2	Clerk	5	10	15
3	Accountant	1	1	2
4	College takes carer (Gardner/security	1	2	3
5	Library Staffs	1	5	6
6	Canteen/ cafeteria/stationary supply source staffs	0	0	0
7	Infrastructure management staffs	7	15	22
8	Housekeeping staffs	1	14	15
9	Office staffs	7	14	21
10	Superintendent	1		1
	Total	48	122	170

Table No. 2.5. Department wise Non-teaching staff strength

2.10.3.Total strength of the college community

Total strength of college community		
Sl No	Inmates' category	Total no
1	Students	3724
2	Teaching Staffs	238
3	Non-Teaching Staffs	170
	Total	4132

Table No. 2.6. Total strength of the college

2.11.DETAILS OF PROGRAM OF THE COLLEGE

2.11.1.Aided Programs

Aided stream		
Sl No	Department	Program
1	Economics	B.A. Economics, B.A. (Hons) Economics
2	English	B.A. English Language & Literature , B.A. (Hons) English Language & Literature
3	History	B.A. History ,B.A. (Hons)History
4	Sociology	B.A. Sociology , B.A. (Hons)Sociology
5	Commerce Regular	B.Com. Finance & Taxation , B.Com. (Hons) Finance & Taxation
6	Botany	B.Sc. Botany ,B.Sc. (Hons) Botany
7	Chemistry	B.Sc. Chemistry ,B.Sc. (Hons)Chemistry
8	Home Science	B.Sc. Home Science , B.Sc. (Hons)Home Science
9	Mathematics & Statistics	B.Sc. Mathematics ,B.Sc. (Hons) Mathematics
10	Physics	B.Sc. Physics ,B.Sc. (Hons)Physics
11	Zoology	B.Sc. Zoology ,B.Sc. (Hons)Zoology
12	Economics	Integrated M.A. in Social Sciences - Economics
13	English Language & Literature	M.A. English
14	Economics	M.A. Economics
15	Sociology	M.A. Sociology
16	Botany	M.Sc. Botany
17	Chemistry	M.Sc. Chemistry
18	Physics	M.Sc. Physics
19	Home Science	M.Sc. (Home Science) Branch A - Child Development
20	Home Science	M.Sc. (Home Science) Branch B - Resource Management & Interior Space Designing
21	Home Science	M.Sc. (Home Science) Branch C - Food Science & Nutrition
22	Commerce Regular	Master of Commerce and Management

Table No. 2.7. Aided Programs of the college

2.11.2.Self- financing program

Self- financing program		
Sl No	Department	Program
1	Bharatanatyam	B.A. Bharatanatyam , B.A.(Hons) Bharatanatyam
2	Communicative English	B.A. English Literature & Communication Studies ,B.A. (Hons) English Literature & Communication Studies
3	French	B.A. French Language & Literature ,B.A. French Language & Literature
4	Women Study Centre -Department of Fashion Designing	B.Sc. Apparel & Fashion Design , B.Sc. (Hons) Apparel & Fashion Design
5	Department of Computer Applications	B.Sc. Computer Applications (Triple Main: Mathematics, Statistics, Computer Applications) , B.Sc. (Hons.)Computer Applications ,BVOC Software Development
6	Management Studies	Bachelor of Management Studies , Bachelor of Management Studies (Hons) International Business
7	Psychology	B.Sc. Psychology
8	Cyber Security & Applied Computing	BCA (Cyber Security & Applied Computing) , BCA (Hons) Cloud Technology and Information Security Management
9	Commerce SF	B.Com. (Finance & Taxation) , B.Com. (HonS)Finance & Taxation with ACCA
10	Commerce SF	B.Com. Capital Market , B.Com.(Hons) Capital Market with CISI
11	Women Study Centre -Department of Clinical Nutrition and Dietetics	B.Sc. Clinical Nutrition and Dietetics
12	Food Processing Technology	B.Voc. Food Processing Technology
13	Communicative English	B.Voc. Applied Media Studies
14	Bharatanatyam	M.A. Bharatanatyam
15	History	M.A. History
16	Malayalam	M.A. Malayalam
17	Communicative English	M.A. Journalism & Mass Communication
18	Commerce SF	M.Com. Finance
19	Zoology	M.Sc. Zoology
20	French	MTTM (Master of Tourism & Travel Management)
21	Mathematics & Statistics	M.Sc. Mathematics
22	Mathematics & Statistics	M.Sc. Applied Statistics & Data Analytics
23	Psychology	M.Sc. Psychology
24	Women Study Centre -Department of Fashion Designing	Master's Programme in Fashion Designing
25	Women Study Centre -Department of Clinical Nutrition and Dietetics	Master's Programme in Clinical Nutrition & Dietetics
26	Food Processing Technology	M.Voc. Food Processing Technology
27	Community College	Diploma in Healthcare Assistance
28	Community College	Diploma in Wellness Craft Baker

29	Community College	Diploma in Interior & Exterior Space Design
30	Community College	Diploma in Digital Marketing
31	Community College	Diploma in Garment Making
32	Women Study Centre -Department of Clinical Nutrition and Dietetics	PG Diploma in Clinical Nutrition & Dietetics
33	Women Study Centre -Department of Fashion Designing	PG Diploma in Fashion Designing
34	Management Studies	PG Diploma in Management in Business Analytics
35	Community College	Diploma in Business Administration
36	Community College	Diploma in Professional Accounting and Taxation

Table No. 2.8. Self-financing of the college

2.11.3.Research Departments- Ph.D Programs

Sl No	Department	Program
1	Botany	Ph.D
2	Chemistry	Ph.D
3	Economics	Ph.D
4	English	Ph.D
5	Home Science	Ph.D
6	Physics	Ph.D
7	Sociology	Ph.D
8	Maths	Ph.D

Table No. 2.9. Research Departments of the college

2.12.CAMPUS LAYOUT

2.12.1.College campus and Location

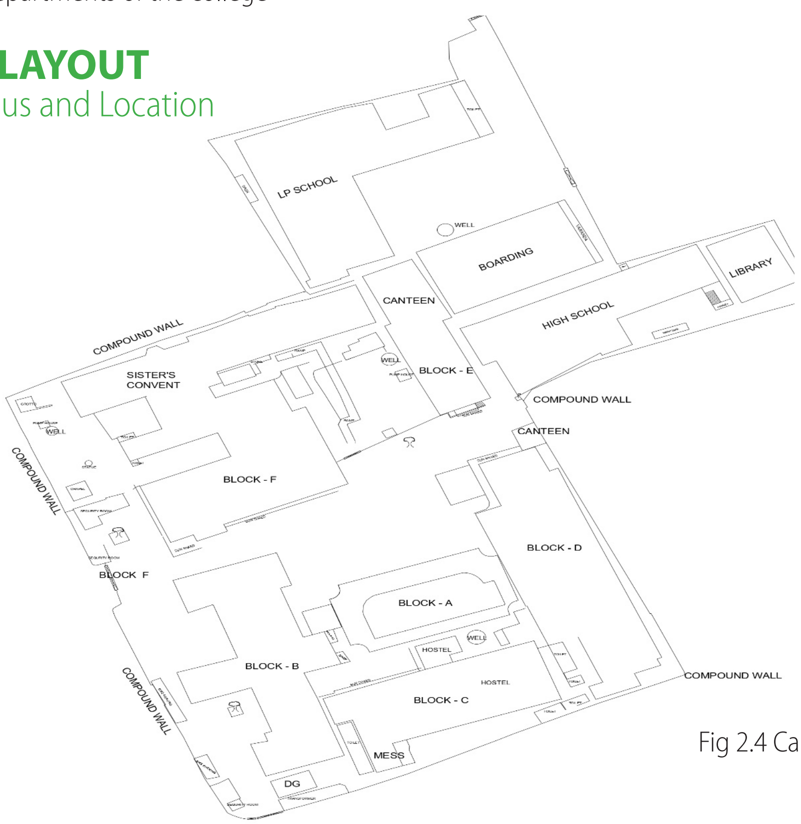


Fig 2.4 Campus Layout

2.12.2. Diagramatic sketch of the buildings

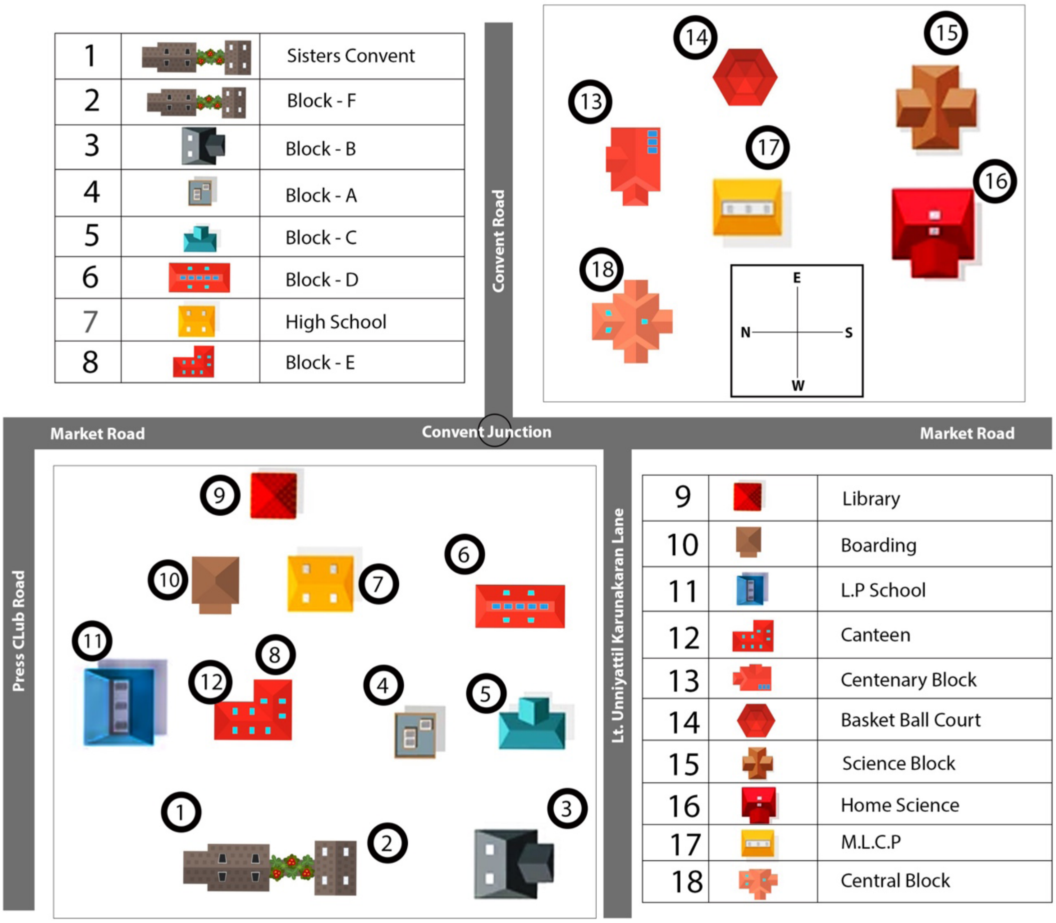


Fig 2.6. Diagramatic sketch of the buildings

Fig 2.5 College campus and Location

2.13.FACILITIES OF THE COLLEGE

Facilities of the College			
Sl No	Facilities	Count	Location/Campus name.
1	Total number of Classrooms and Seminar halls	147	All Blocks
2	Total number of computers on campus for academic purposes	448	All Blocks
3	Classroom LCD facilities	138	All Blocks
4	Smart board classrooms	13	All Blocks
5	Seminar halls	9	All Blocks
6	Auditoriums (More than thousand seating capacity in Arts block)	3	All Blocks
7	Audio-Visual Rooms	4	Arts Block, Science Block
8	Video-conferencing facility	7	All Blocks
9	Multi-media Lab	1	Arts Block
10	E -learning Centre and Business Centre	1	Arts Block
11	Computers	448	All Blocks
12	Xerox machines	9	All Blocks
13	Printers	72	All Blocks
14	Internet speed	500 Mbps	
	Other facilities		
15	Indoor multi-purpose sports facility	2	Arts and Science Block
16	Multi Gym station	1	Arts Block
17	Training equipment		Arts Block
18	Treadmills	3	Arts Block
19	Elliptical trainer	2	Arts Block
20	Yoga floor	1	Arts Block
21	Fitness centre	1	Arts Block
22	Wellness centre	0	Arts Block
23	Diet clinic	1	Arts Block
24	Whole-body analyser	1	Arts Block
25	Modernized canteens	1	Arts Block
26	Cafeterias	2	Arts, Science

Table No. 2.10. Facilities of the college

Chapter III

ENVIRONMENT MANAGEMENT SYSTEM (EMS) : AUDIT REPORT

TIES

ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM

ENVIRONMENT MANAGEMENT COMMITTEE (EMS 2025)

Dr. Anu Joseph
Principal

Dr. Pearly Antony O.
Dr. Priya Parvathy Ameena Jose
Dr. Arya P. Mohan
Mr. Linto Anto
Dr. Sreehari S. Nair
Ms. Rishika P.S.
Assistant Professors

3 Environment Management System

3.1. INTRODUCTION

An environmental management system (EMS) offers organizations a systematic framework for the identification, management, monitoring, and resolution of their environmental challenges in a thorough manner. ISO 14001, recognized as a premier international standard for EMS, is designed to be compatible with other ISO standards such as ISO 9001 for quality management and ISO 45001 for occupational health and safety, all of which follow a High-Level Structure. This alignment facilitates the seamless integration of ISO 14001 into pre-existing management systems. Applicable to organizations of various types and sizes, including private, governmental, and non-profit entities, ISO 14001 promotes the consideration of all environmental factors pertinent to operations. These factors encompass air quality, water and sewage management, waste minimization, soil contamination, climate change mitigation and adaptation, as well as the efficient use of resources. By complying with this standard, organizations can effectively diminish their ecological impact, fulfil legal obligations, and attain their environmental objectives.

The framework emphasizes the importance of resource efficiency, effective waste management, environmental monitoring, and active stakeholder participation in sustainability efforts. In a time marked by increased environmental consciousness and urgent global issues like climate change, biodiversity decline, and resource scarcity, higher education and various sectors play a crucial role in promoting sustainable practices. ISO 14001 provides organizations with a means to tackle these significant challenges by committing to regulatory compliance and ongoing environmental enhancement. Implementing ISO 14001 can yield substantial advantages, including waste reduction, energy conservation, cost savings, and improved organizational reputation. It highlights the organization's duty to sustainable development and encourages the cultivation of environmentally conscious citizens. As a symbol of environmental responsibility, ISO 14001 demonstrates a commitment to building a sustainable future while enhancing organizational resilience and success.

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

Environment Policy of St Teresa's College

3.2.1 Statement of Commitment

St. Teresa's College (Autonomous), Ernakulam, demonstrates a strong dedication to sustainability and ecological responsibility. Guided by its Environmental Management System (EMS) Policy, the college embeds environmentally conscious practices across campus operations, academic programs, and community initiatives. This policy acts as a strategic framework for minimizing ecological impact, encouraging resource conservation, and fostering a culture of environmental awareness among all stakeholders. It focuses on five core areas Energy, Water, Waste, Occupational Health & Safety, and Biodiversity supported by targeted actions that align with both national and global environmental objectives.

3.2.2.Goal

To lead in environmental responsibility and promote holistic wellbeing by actively reducing ecological footprints through significant cuts in waste generation, water usage, and energy consumption; enriching campus biodiversity; and fostering a culture rooted in safety, health, and sustainability across the college community—driven by continuous education, awareness initiatives, and innovative practices.

3.2.3.Objectives

- Promote resource efficiency and conservation across campus operations by significantly reducing waste

generation, water consumption, and energy usage. This initiative will ensure equitable access and incorporate environmental considerations into developmental strategies in alignment with sustainable development goals.
- Foster a strong, campus-wide culture of environmental responsibility, safety awareness, and holistic wellbeing through targeted education, active engagement, and awareness campaigns.
- Ensure a safe, healthy, and secure campus by proactively managing risks, complying with relevant regulations, encouraging preventive measures, and providing comprehensive support services.
- Establish and continually enhance sustainable systems through enabling clean and affordable energy, optimum utilization of resources, and reducing waste generation and infrastructure, such as waste management, water reuse, biodiversity initiatives integrating life on land, and renewable energy solutions to drive long-term environmental progress.
- Embed sustainability, ecological responsibility, and occupational health and safety into the heart of academic programs, research efforts, and community outreach activities.
- Ensure initiative for carbon offsetting practice through implementing strategies to switch to alternative sources of energy, reduce the dependency on fossil fuel usage trends, water resource conservation, and strengthen biodiversity initiatives, and enable the practice of climate resilience through a decline in carbon footprint

3.2.4.Resource Management

3.2.4.1.Energy Management: The college has implemented an Energy Management System (EnMS) designed to enhance energy efficiency throughout the institution, in line with its commitment to the sustainable use of clean and affordable energy. Key objectives of the EnMS include promoting sustainable energy practices among all stakeholders, integrating clean energy solutions such as solar power, reducing energy waste through automation and infrastructure improvements, and incorporating energy literacy into academic curricula. Additionally, the institution ensures compliance with national regulatory frameworks, including the standards established by the Bureau of Energy Efficiency (BEE).

The college has undertaken a series of resource management initiatives, including the phased installation of LED lighting, the automation of lighting and HVAC systems using motion sensors and timers, and enhanced electrical safety through the use of MCCBs and regular inspections. Energy-efficient appliances certified by the Bureau of Energy Efficiency (BEE) are standard across all departments, while solar energy systems are operational in four campus blocks.

3.2.4.2.Water efficiency management: the institution emphasizes conservation, reuse, and awareness. Rainwater harvesting and greywater recycling via bioremediation have been implemented to reduce reliance on external water sources. The campus is equipped with water-saving fixtures such as low-flow taps and dual-flush toilets. Leak detection systems and a structured maintenance protocol help minimize water loss. Through the TROP initiative, awareness campaigns promote water literacy among students and the broader community. These efforts reflect the college's commitment to Sustainable Development Goal 6 (Clean Water and Sanitation), reinforcing its dedication to responsible water use and environmental sustainability.

3.2.4.3.Biodiversity Management: The institution places strong emphasis on conserving urban biodiversity. The institution faces spatial constraints for preserving the campus greenery due to its proximity to the city center. Enhancing and conserving biodiversity within this limited space requires the effective utilization of available areas through strategic investment in green initiatives. To maintain the ecological richness and aesthetic appeal of the campus, we have established butterfly gardens, native tree clusters, and herbal plantations that serve both environmental and educational purposes.

Student learning is augmented by the use of QR-coded plant tags and biodiversity registers, facilitating species identification and documentation. Before any infrastructure development, comprehensive biodiversity audits are conducted to mitigate habitat disruption. Conservation principles are integrated into the academic curricula, allowing undergraduate and postgraduate students to engage in field surveys, community seed banks, and ecological restoration projects. These initiatives are aligned with the Biological Diversity Act and contribute to Sustainable Development Goal 15 (Life on Land).

3.2.4.5.Waste Management: The college's waste resource management system is implemented through a structured approach that begins with classifying waste such as non-biodegradable (including paper, plastic, glass, and metal), biodegradable (organic), hazardous, and electronic materials. This systematic process is designed to foster a culture of responsible usage and management practices. Currently, the college has initiated efforts to reduce plastic usage through a dedicated team known as Bomithrasena. This team is focused on limiting the amount of plastic on campus and promoting the use of alternative materials. In the first phase of this initiative, the college distributed stainless steel bottles to faculty members and offered cloth bags to students at an affordable price during the academic year. An initiative called "Steps," which aims to recycle textile waste into lifestyle products. To facilitate effective waste segregation and disposal, the college will install labelled bins across designated campus locations, supported by a central waste collection centre. Clear signage and CCTV surveillance will be implemented to ensure compliance with waste management practices.

3.2.4.6.Occupational health and management: The college management holds responsibility for ensuring a safe and healthy campus environment by formulating, implementing, evaluating, and updating comprehensive health and safety policies, structured protocols, and regular drills. This includes compliance with specific regulations such as the Noise Pollution Policy, which is upheld through monitoring, designated quiet zones, and awareness programs. Accessibility for individuals with disabilities is prioritized through infrastructure features like ramps, handrails, and clear signage. The administration also allocates resources for safety training, including fire drills and first aid sessions, monitored through internal audits. Support is extended to wellness initiatives led by groups like the Women's Cell, as well as staff and student outings, all aimed at promoting mental wellbeing and a positive campus atmosphere. The principal communicates safety-related updates and general announcements via official channels and serves as the escalation point for unresolved safety issues.

3.2.5.Curriculum integration

The institution's policy advocates for the comprehensive integration of environmental themes such as energy, water, biodiversity, waste management, and sustainable development into the academic curriculum. This includes offering additional courses and internship programs, primarily as part of the First-Year Undergraduate Program (FYUGP). Students and faculty are encouraged to focus their thesis topics and project papers on these themes, promoting meaningful academic contributions. These subjects are interwoven across disciplines, with a notable emphasis on interdisciplinary courses in biodiversity, ecology, and environmental conservation. Furthermore, a mandatory intensive program is in place to enhance student engagement and deepen their understanding of these critical issues.

Water management is addressed through specialized coursework covering rainwater harvesting, water quality analysis, scientific treatment methods, and automated budgeting systems. Waste management education includes studies on decomposition, green protocols, recycling techniques, economic impacts, and civic regulations, with students encouraged to explore additional subjects related to technological and commercial innovations in sustainability.

Although energy conservation is not a formal part of every curriculum, it is actively promoted through awareness campaigns and department-specific sessions that focus on practical strategies for reducing consumption. To ensure effective delivery of these integrated themes, faculty development programs will be implemented, reinforcing the institution's commitment to fostering a campus-wide culture of sustainability.

3.2.6.Green initiative

The college is dedicated to cultivating a sustainable campus through a multifaceted green initiative. This includes improving energy efficiency by upgrading infrastructure, encouraging shared transportation, and embedding energy conservation into academic research, curriculum, and awareness efforts. Water sustainability will be promoted through expanded use of Rain Gardens, Water-Sensitive Landscaping, xeriscaping techniques, and the development of greywater recycling systems. Biodiversity enhancement will be achieved by nurturing diverse green zones such as native flora and butterfly gardens alongside regular tree planting campaigns, Water Literacy initiatives, comprehensive biodiversity assessments, and behavior-focused ecological education supported by technology.

waste management strategy will be implemented, incorporating campus clean-up drives, thrift-based recycling initiatives, and a transition to paperless workflows and digital documentation. The strategy will prioritize the optimal use of resources and the reduction of plastic through volunteer initiatives by Boomithra Sena, aligning with the principle of "Reduce." Additionally, widespread recycling and innovative material reuse will be promoted through the "STEP" initiative, alongside efforts to foster responsible waste practices via outreach programs, awareness campaigns, and active participation from student-led clubs.

3.2.7.Research and innovation

The institution places a strong emphasis on advancing research and innovation within critical environmental sectors. It encompasses various research departments, including Botany, Chemistry, Economics, English, Home Science, Physics, and Sociology. The college aims to integrate sustainable development topics, with a particular emphasis on environmental conservation, into the PhD programs offered by its research departments. Both theoretical studies and community-focused research initiatives are proposed, with priority areas including energy conservation and the investigation of innovative waste-to-energy technologies. In the realm of water management, research efforts will focus on enhancing conservation techniques, developing greywater reuse systems, and conducting regular assessments of pollutants in nearby water bodies. Biodiversity-related studies will be supported through research projects and academic dissertations that explore campus ecosystems, conservation strategies, and sustainable practices. Waste management research will similarly spotlight sustainable technologies and reinforce the pursuit of innovative waste-to-energy solutions.

These diverse research initiatives will be backed by comprehensive institutional support, including access to research grants and scholarships, well-equipped infrastructure featuring workshops and field-based learning, and the development of interdisciplinary and external collaborations. The institution will also actively promote the dissemination of research outcomes through peer-reviewed publications and participation in academic conferences.

3.2.8.Community Engagement

The institution is committed to fostering collaborative partnerships with local communities and organisations across various sustainability sectors. In the energy domain, our initiatives include promoting conservation through knowledge sharing, conducting LED lamp assembly workshops, facilitating community education sessions, and launching student-led awareness campaigns. In the area of water management, the college collaborates with local agencies to provide training in rainwater harvesting and perform well water quality assessments, thereby offering practical solutions for residents. Biodiversity initiatives prioritise community-based conservation, featuring educational outreach through workshops, guided nature walks, public exhibitions, and the establishment of butterfly gardens in adopted villages to enhance local ecosystems. Waste management efforts are bolstered through collaborative initiatives with municipal bodies and private partners, including organised cleanup drives. Through a Memorandum of Understanding with the leading hospital in Kerala, Aster Medcity, we conduct annual workshops and training sessions to equip students and staff with basic medical assistance skills for emergencies. To further extend our impact, the institution actively engages with local governments and industries to promote sustainable practices and livelihood initiatives through diverse waste reduction strategies. Society of Teresians for Environmental Protection (STEP), established in April 2016 with contributions from the Departments of Economics and Commerce, Bhoomitra Sena, and the Entrepreneurship Development Club, has organised campaigns including the "Save Every Drop" initiative and blue-ribbon awareness drives, as well as workshops on home-based water conservation. These programs effectively engage schools, Anganwadis, and Kudumbashree units across the Ernakulam district. In December 2017, partnered with Cochin Shipyard Limited and TIECON Kochi to establish the Teresian Innovation and Entrepreneurship Development Cell (IECD). Subsequently, a Startup Yatra was jointly organised by the Kerala Startup Mission, Startup India, Invest India, and TIBIC on November 15, 2018, at the college. In December 2018, we also launched the Teresian Innovation and Business Incubation Centre (TIBIC) on campus to advance entrepreneurship among women and girls. Our initiatives encompass organic farming, training programs for reusing textile materials (such as

Prakriti Bags and Bhoomithram Sanchis), village adoption for community development, and beautification projects. These programs provide students with valuable hands-on experience in implementing technological solutions that promote environmental sustainability and social advancement. As a Participating Institute of Unnat Bharat Abhiyan (UBA) since 2018, the college is committed to uplifting and empowering rural communities in neighbouring areas. The UBA activities reflect our dedication to social responsibility, with a focus on enhancing education, awareness programs, and skill development in rural settings. Collaborations among the Botany and Zoology departments involve organising field visits to wetlands, conducting biodiversity assessments of water bodies, and leading awareness classes on aquatic ecosystems and sustainable water usage. They also coordinate eco-trails and "Know Your River" days for local school students. As part of our Ente Haritha Bhavanam Extension (Water Edition) initiative, students are encouraged to document and improve water conservation at home, focusing on leak detection, the promotion of water-saving taps, and implementing greywater reuse practices. Furthermore, in partnership with local self-government institutions, our students facilitate eco-workshops that educate community members on traditional water preservation methods, household rainwater harvesting, and kitchen greywater reuse models in selected panchayats.

3.2.9.Purchasing and Procurement

The College's Purchase and Procurement Policy adopts a comprehensive sustainability framework, embedding environmental and health considerations into all purchasing decisions. It emphasizes the selection of energy-efficient systems and equipment, guided by the expertise of the energy management team to reduce overall consumption. Water conservation measures include installing low-flow taps and dual-flush toilets, sourcing drought-tolerant native plants, and procuring materials that support rainwater harvesting and greywater recycling, monitored through regular audits.

Waste reduction is addressed through pre-purchase optimization assessments led by the Waste Management Committee, which advocates for minimizing plastic and hazardous materials, promoting reusable items such as steel utensils and cloth bags, and enforcing a Green Protocol for campus events. Sanitary waste is managed responsibly through incineration, while biodiversity is supported through eco-conscious landscaping with native species.

This integrated approach is guided by sustainable procurement standards that favour environmentally responsible products from ethical and local vendors. It also incorporates lifecycle assessment principles, with input from committees such as EnMS, WEMS, WMS, and OHS, ensuring minimal environmental impact and promoting responsible consumption throughout the campus.

3.2.10.Monitoring and Reporting

The institution will establish a system for tracking and reporting environmental performance across key areas such as energy, water, biodiversity, and waste using clearly defined Key Performance Indicators (KPIs) aligned with policy objectives and auditor guidance. Energy usage will be monitored through internal audits of meter readings, utility bills, and departmental inventories, with findings compiled by internal auditors and summarised in an annual energy performance report prepared by the energy audit team.

Water consumption will be assessed through designated representatives, flow meter data, and infrastructure evaluations, with progress toward reduction targets reviewed periodically. Energy assessment to identify the low-performance infrastructure, and conduct electricity meter reading to evaluate the energy usage trend. Waste management will be overseen through monthly audits conducted by the Waste Management Committee, routine inspections by housekeeping staff and internal auditors, and CCTV monitoring. An annual waste report will highlight key initiatives and outcomes. Biodiversity will also be systematically measured and documented. The effectiveness of these environmental practices will be evaluated through regular internal assessments and audits. Each year, a comprehensive environmental report will be published in college communications, detailing KPIs, consumption metrics, waste statistics, and biodiversity data. This transparent approach will actively involve stakeholders, including students, faculty, and staff, through feedback tools such as annual surveys, fostering a culture of continuous improvement.

3.2.11.Compliance and Review

The College is firmly committed to maintaining full compliance with all relevant environmental laws and regulations, local, state, national, and international, with focused attention on energy efficiency, water conservation, waste management (including hazardous waste), biodiversity protection, and health and safety standards. Institutional policies in these areas will be thoroughly reviewed at least once every three years, or more frequently when needed, to incorporate technological innovations, updated regulations, best practices, audit findings, and strategic priorities.

This review process will be inclusive, engaging students, faculty, staff, and community stakeholders to ensure a participatory approach to environmental governance. Internal audits and dedicated committees will oversee compliance, identify gaps, and implement corrective measures where necessary. To reinforce adherence, the College will provide clear operational guidelines, protocols, educational signage, awareness campaigns, and enforceable actions for non-compliance, especially in areas such as waste segregation and disposal.

3.2.12.Leadership and Accountability

The Environmental Management Committee, comprising students, faculty, staff, and administrators, oversees the implementation and continuous evaluation of environmental policies. Their work is supported by a qualified Sustainability Coordinator who reports to senior leadership (such as the Upper Body EMS). This coordinator is responsible for managing all environmental initiatives, tracking progress toward defined goals, and offering specialised technical guidance.

Dedicated teams are assigned to specific resource areas: an Energy Management Team, a Waste Management Team (both inclusive of faculty, staff, and students), and a water efficiency team appointed by the head of the institution. Each team is tasked with executing and monitoring their respective sustainability policies.

Roles and responsibilities for audits, reporting, and awareness programs will be clearly outlined across departments. Institutional leadership will ensure accountability by requiring all departments and individuals to meet targets related to energy conservation, water efficiency, biodiversity enhancement, and waste reduction. These efforts will be reinforced through regular performance reviews and progress assessments to ensure the achievement of environmental goals.

3.2.13.Conclusion

St. Teresa's College is committed to fostering a culture of sustainability and environmental responsibility throughout its community. By implementing its environmental management policy, the institution aims to minimise ecological impact, enhance environmental awareness, and promote responsible practices among students, faculty, and staff. Through collective action and continuous improvement, the college reinforces its dedication to sustainability, with a strong focus on education and community involvement. Its overarching goal is to build a healthier, more sustainable future for upcoming generations and contribute meaningfully to the global movement toward environmental consciousness and accountability.

3.3.ENVIRONMENT MANAGEMENT PLAN

3.3.1.Establish an Environment Management Team

Form a central Environment Management System (EMS) comprising of IQAC, SQAC, Principal, administrative staff, students, and technical staff. Sub-committees consist of selected internal auditors to administrate and monitor the system.

Energy Management Team– Develop a sustainable energy management system that adheres to ISO 46001 and Bureau of Energy standards, in alignment with Sustainable Development Goal 12 (SDG 12) for clean and affordable energy. This initiative will emphasise optimal utilisation, efficiency practices, and the adoption of renewable energy sources. Additionally, innovative curricular initiatives will be implemented to promote a sustainable future and effective resource management.

Biodiversity Management Committee (BMC) – Enhance campus biodiversity in alignment with SDG 15 (Life on Land) by creating a comprehensive data repository of local fauna and flora. This committee will oversee conservation efforts, improve green cover, coordinate campus greening activities, and cultivate a community committed to biodiversity conservation and the promotion of ecological benefits.

Water Conservation Team – Establish an efficient water management system that complies with ISO 46001 and ISO 14046 standards, in alignment with SDG 6 (Clean Water and Sanitation). The team will emphasise annual water audits, optimise water resource utilisation, promote water conservation initiatives, and integrate related academic efforts.

Waste Management Team– Develop and implement a system for sustainable waste management practices in accordance with ISO 14001 and aligned with SDG 12 for responsible consumption and production within the college. This initiative will incorporate academic opportunities and foster a responsible community dedicated to waste reduction and management.

Occupational Health & Safety (OHS) Committee – Ensure compliance with safety standards and health practices as per ISO 45001 in academic institutions. The committee will continuously evaluate and enhance the established health and safety management system to promote a safe and healthy campus environment.

3.3.2.Formulate a Comprehensive Strategy

- Upgrading infrastructure and implementing alternative energy management strategies with expert consulting and audit assessment results. Emphasise resource management and the integration of alternative energy sources, alongside the principles of Energy-Efficient Eco-Design to reduce overall consumption.
- Enrich campus biodiversity with native species and establish green zones. Incorporate conservation principles into academic curricula and develop a comprehensive biodiversity data bank to support Biodiversity-Conscious Construction practices, admitting the challenge in space-constrained investment for a green environment in college by identifying the species applicable for a limited area and contribute to act as a buffer zone and addressing carbon footprint
- Implement water conservation initiatives, including the treatment and recycling of greywater. Launch community sensitisation awareness campaigns aimed at promoting resource conservation while simultaneously enhancing academic initiatives.
- Advocate for source segregation of waste and reinforce compliance with established rules and regulations. Ensure safe transportation of waste to designated locations, implement a zero-plastic policy, and promote the composting of organic waste to minimise environmental impact.
- Strict compliance with ISO 45001 standards while enhancing emergency management systems. Conduct annual risk assessments, strengthen mental health support initiatives, and create a safer, more secure environment.

3.3.3.Implement strategies to accomplish the objectives

Each subcommittee is responsible for monitoring the performance through documentation and maintaining a register, and based on the evaluation, identify the potential risk and submit to the administrative body through a detailed discussion between auditors and the administrative wing, and mitigate with the expert's suggestion

- Energy: Introduce real-time energy monitoring, automate HVAC systems, and conduct regular energy audits to ensure the standards are met.
- Biodiversity: Organise plantation drives, maintain biodiversity registers, and conduct eco-literacy workshops based on the schedule of the biodiversity audit team
- Water: water resource management, maintain leak-proof plumbing, promote water-saving devices, and create water recharge pits
- Waste: Install segregated bins, segregation from source, establish composting pits and plan to generate energy from biomass, partner with recycling agencies
- OHS: Display safety signage, upgrade first-aid kits, conduct emergency response system, and establish reporting protocols.

3.3.4.Establish Communication Channels and Governing Body

- Utilise a multi-channel communication strategy, including notice boards, email, WhatsApp, social media, newsletters, and community radio, to disseminate updates. The Environment Management Committee (EMC) will provide regular reports to the Internal Quality Assurance Cell (IQAC) and the principal, thereby ensuring transparency and accountability.
- Assign specific responsibilities to the coordinator of each sub-committee for the preparation of annual reports to governing bodies.

3.3.5.Set Long-Term and Short-Term Goals

Short-Term (1–2 years):

- Conduct baseline biodiversity and water audits.
- Strengthening the focused on the principle to

reduce the waste generation through the initiatives of Bumithre sena

- Transition to 100% LED lighting.
- Replace expired first-aid supplies.
- Plant native trees and indoor greenery.
- Launch waste segregation and composting drives. Long-Term (3–5 years):
- Establish zero-energy/green buildings.
- Transforming the initiate of "steps" into comprehensive discipline through integrating energy, water, biodiversity, health $ safety and waste management system
- Maintain conservation zones and a mini forest.
- Achieve organic input use across campus.
- Full-fledged rainwater harvesting and greywater reuse.
- Zero-major-incident OHS policy.

3.3.6.Continuously Monitor and Enhance the System

- Conduct annual biodiversity, water, energy, and waste management audits by internal auditors and after three years by external auditors.
- Review of registers and documentation of each initiative is conducted bi-monthly to ensure the transparency and critical evaluation of the performance
- Use digital tracking to record the trend in energy and water usage patterns
- Collect student and faculty feedback to refine practices.
- Adaptive management approach to renew and update policies as per monitoring outcomes.

3.3.7.Conclude and Follow Up

- The STEP and TROP systems are currently among the most active initiatives within the institution, having been integrated into auditing processes to align with ISO standards and meet sustainable development goals. These initiatives involve selected students and staff members and originated with the establishment of the Society of Teresians for Environmental Protection (STEP) in April 2016. This initiative was created through the collaborative efforts of the Departments of Economics and Commerce, Bhoomitra Sena, and the Entrepreneurship Development Club, which was founded in 2010. Since then, STEP has strengthened its impact through partnerships with external agencies and local governing bodies, eventually evolving into the Teresian Innovation and Business Incubation Centre. Each academic year, students are enrolled in the club to ensure the continuity of the program, and faculty members are encouraged to pass on their expertise and services to new instructors.
- Annual reports will be compiled by the EMS, submitted to the Principal and IQAC, and publicly shared for transparency. Gaps identified will be addressed through corrective action, awareness, and policy revision, making the campus a model for sustainable higher education.

St. Teresa's College is committed to a holistic approach to environmental sustainability. By integrating waste reduction, energy efficiency, biodiversity enhancement, water conservation, and occupational health and safety, the institution ensures a resilient, eco-friendly, and safe campus.

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 IV

ENERGY MANAGEMENT SYSTEM (En MS): AUDIT REPORT

ENERGY MANAGEMENT SYSTEM COMMITTEE (EnMS 2025)

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4 Energy Management System: Audit Report

4.1.INTRODUCTION

Energy is essential to our everyday existence, addressing a core human requirement. We rely on it for nearly all facets of our daily activities, and the planet offers a variety of energy resources, each possessing unique attributes. Nonetheless, every energy source has an environmental impact, with ecological effects stemming from various origins. This article explores energy resources and their environmental ramifications. The relationship between energy and environmental issues is profoundly intertwined. The processes of producing, transporting, and utilizing energy inevitably result in considerable environmental consequences. Immediate effects of energy consumption include air pollution, climate change, water pollution, thermal pollution, and solid waste disposal. Notably, the burning of fossil fuels significantly contributes to urban air pollution and is the primary source of greenhouse gas emissions. Furthermore, energy-related operations frequently lead to challenges associated with water pollution.

Electrical systems consist of intricate networks of wiring and safety mechanisms that supply power to diverse loads, including heating, ventilation, and air conditioning (HVAC) systems, fans, pumps, computers, lighting, blowers, compressors, and various heavy machinery. Nevertheless, their effectiveness and efficiency may decline due to several factors, such as aging components, dust build up, humidity, and obsolete technology. These challenges lead to energy losses, as electricity is transformed into heat, which diminishes efficiency and raises power consumption. Employing energy auditing techniques can help mitigate these inefficiencies by evaluating the overall performance of the electrical system.

ISO 50001 empowers organizations to systematically enhance energy performance across all processes by identifying measures to manage energy consumption effectively while communicating energy management efforts to an increasingly environmentally conscious public. Energy auditing, in accordance with ISO standards and aligned with sustainable development goals, involves a comprehensive assessment of energy use in a specific area or building, aimed at identifying inefficiencies and improving energy performance. Insights from the audit are utilized to develop effective energy management strategies, with the primary goal of reducing energy consumption while maintaining operational efficiency, comfort, and performance. Factors such as occupant behaviour, building age, and climate conditions are carefully considered throughout the auditing process to ensure accurate and actionable outcomes.

4.1.1.What is an energy Audit?

Energy auditing is an essential tool for identifying opportunities and strategies to enhance energy efficiency. It is instrumental in revealing potential measures for efficiency and assessing their economic viability across different operational levels. The process starts with a preliminary evaluation that includes site inspections and general energy assessments, which help identify low-cost savings options. As the audits advance to more detailed stages, they explore energy expenses, consumption trends, and system characteristics more thoroughly, utilizing on-site measurements to identify capital-intensive efficiency improvements that align with tailored financial strategies for the site. The prerequisites for conducting an energy audit include:

- A comprehensive assessment of the energy infrastructure at the college or university is essential.
- An in-depth analysis of the energy consumption patterns across various utility points, highlighting areas of energy loss or inefficiency.
- To identify potential energy-saving opportunities, which may involve behavioural changes, upgrades to energy-efficient infrastructure and equipment, as well as the integration of alternative energy sources.

Conducting such thorough energy audits not only lays the groundwork for establishing Energy Management System (EnMS) within educational institutions but also enhances the overall management of energy demand.

4.1.2.Needs for Energy Audit

The increasing emphasis on sustainability in our everyday activities, there is a heightened and ongoing interest in professional energy management systems. This trend is fuelled by the understanding that conserving energy and minimizing CO_2 emissions can significantly benefit our climate and environment. Recently, there has been a marked change in energy consumption patterns. In addition to the desire to lower electricity costs, many organizations are now utilizing advanced machinery and equipment that are engineered for reduced energy use. The necessity for an efficient infrastructure has become increasingly apparent.

The functions of the energy audit are:

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

Customizing energy audits to align with effective energy management systems can significantly reduce energy expenses, enhancing your financial flexibility. As a result, you acquire a more comprehensive insight into operational processes and consumption trends, which aids in the rapid and sustainable execution of enhancement strategies.

4.1.3.Benefits of adopting energy management system

An energy management system, ISO 50001, can provide Organisations have several benefits. These include:

- Helping to achieve energy use reduction and carbon emissions in a systematic way
- Creating a clear picture of the 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 the 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 POLICY

4.2.1.Statement of Commitment

St. Teresa's College reiterates its dedication to responsible energy management and sustainability by implementing measures that lower energy usage, incorporate renewable energy sources, and align with the Sustainable Development Goals set by the United Nations. This policy embodies the principles of environmental stewardship and institutional ethics, following India's Energy Conservation Act of 2001, the National Action Plan on Climate Change (NAPCC), and the UN Sustainable Development Goals (SDG 7 and SDG 13).

4.2.2.Goals

institutionalization of an energy management system in alignment with energy standards, to provide accessible, clean energy, and subsequently enhance sustainable energy conservation.

4.2.3.Objectives

- To promote sustainable and responsible energy use across campus.
- To minimize energy wastage and enhance energy efficiency in all infrastructure.
- To integrate solar and other renewable energy sources into operations.
- To foster awareness, education, and research on energy conservation.
- To align with national and international energy policies and climate action frameworks.

4.2.4.Resource Management

- The college is at the juncture of enhancing its lighting system by transitioning to energy-efficient LED technology. Given budget limitations, a full campus implementation of LED lighting cannot be achieved at this moment. Consequently, the focus will be on upgrading to LED lights in areas that are most in need and in spots where current fixtures are old or have garnered complaints.
- The capacity of college infrastructure is increasing significantly each year. Fundamentally, it is approaching a critical point where a transition from manual methods to automated technology is necessary, hence implementing automation (like motion sensors and timers) to manage lighting and HVAC systems
- Conduct yearly inspections of earth pits to verify adherence to safety regulations, minimize the likelihood of electrical incidents, and enhance the dependability of electrical systems throughout the institution.
- A well-maintained earth pit will be established on campus with the support of a professional electrical contractor to guarantee equipment protection, voltage stabilization, and reduce ground resistance. This is crucial for safeguarding both the equipment and the college community, as it aids in preventing electric shocks, fires, and damage to devices by offering a secure way for surplus current to disperse.
- At present, the college utilizes Switch Fuse Units (SFUs) to protect electrical circuits from harm caused by overloads or short circuits. However, given the recent expansion in infrastructure capacity, depending exclusively on SFUs is inadequate for maintaining safety. Ensure all appliances and electronics meet Bureau of Energy Efficiency (BEE) standards. The college is transitioning to moulded case circuit breakers (MCCBs) to better handle overloads and improve electrical safety.
- The use of alternative energy sources, specifically solar energy, from the past….. college has employed as a supplementary resource. The college relies on solar energy, utilizing four blocks: two connected to the grid and two off-grid for solar protection.

4.2.5.Curriculum Integration

- Alongside the mandated academic curriculum, the institution draws attention to the importance of supplementary and online courses in various fields. Each add-on course acts as a focused enhancement within its given area. The curriculum further incorporates themes of energy conservation at both undergraduate and postgraduate levels, covering subjects like sustainable energy conservation and advanced energy management, among others.

- Encourage internship and observation visits to Energy Education Centres and Energy Research Institutes, to promote insightful knowledge and skills associated with the discipline, additionally strengthening the career possibilities and future sustainable practices
- The Department of Physics and the Centre of Research open wide opportunities for research scholars, students, and faculty to engage in research papers& publication, PhD thesis, internal, national, and state-level research proposals for innovative projects in the field of sustainable energy conservation

4.2.6.Green Initiatives

- The college received an honour award for its efforts and social intervention activities aimed at promoting renewable energy sources during the period from 2019 to 2021. The institution actively supports and implements green energy protocols by establishing a 150kW solar power plant and has successfully commissioned 90kW over the years. In addition, the college incorporates value-added certificate courses in Solar Photovoltaics into its curriculum. It improved upon the commendation award it earned in the same category in 2018. The college has demonstrated its commitment to promoting renewable energy resources and energy conservation by winning the National Energy Conservation Award in 2019 and the Kerala State Energy Conservation Award in 2018.
- "I connect" initiatives for the conservation of nature and energy. In association with the program, organise events to sensitize school students to promoting the advantages of renewable energy and LED technologies. Whereby showcase hands-on applications of solar energy and LED products practically engaging through this inspiring practice, nurturing scholarly advancement to explore science and technology through interactive demonstrations and exhibits.
- The project named "Glowing Blooms" is based on the concept of "RRR," which involves reusing LED lights to create decorative objects. Students from the physics department are leading the effort to develop decorative items such as flower decorations for home decor, which are utilized within the institution to improve aesthetic appeal and promote sustainable disposal of the products.
- To restrict vehicle access and conserve fuel, thus lowering the carbon footprint, the institution encourages vehicle sharing among college stakeholders. This initiative results in a savings of 2827.5 litters of fuel from two-wheelers and 3240 litters from four-wheelers.
- Annual energy audit of the institution with the consultation of an external agency to identify the major and minor conformity and to improve an effective energy management system in adherence with Bureau of Energy Efficiency (BEE) standards.

Purchasing and Procurement

- Prioritize the importance of selecting energy-efficient equipment with the consultation of the electrical maintenance contractor and the college electrician. Select products that align with national energy efficiency guidelines.
- incorporate the suggestions report from EnMS auditors prior to the construction of new buildings to ensure safer electrical system, encouraging energy efficient practices
- Support and purchase from vendors who supply and promote ethical and environmentally responsible practices.

4.2.7.Research and Innovation

- Physics department and centre of research support faculty and student-led research on renewable energy and low-carbon technologies, and encourage the feasibility for publication
- Encourage opportunities for student and faculty involvement in internal and national conferences, as well as student exchanges that improve skills and academic understanding. Additionally, incorporating suggestions and models from experts can increase student interest and foster innovation.

4.2.8.Community Engagement

- Collaborate with government agencies, the colleges introduce outreach initiatives named TROP. Through this program, in collaboration with Teresian Outreach Initiatives, the college has adopted the village of Ayappankkavu and the Government High School in Fort Kochi to implement the IES program, which aims to raise awareness about the significance of energy conservation and the importance of practical education on sustainable technologies. With the rising energy demands and environmental issues, it is crucial to inform students about the value of conserving energy and embracing energy-efficient technologies such as LED lighting. Through hands-on training in assembling LED bulbs, this activity sought to equip students with practical skills, helping them grasp how energy-efficient technologies function and how they can be utilized in daily life. Additionally, this initiative encouraged students to engage actively with science and technology, nurturing an interest in sustainable practices for a more environmentally friendly future.
- Organize awareness campaigns, workshops, and seminars on climate action and energy conservation in collaboration with external agencies as part with these resource persons from reputed institutions present sessions on various topics connecting with energy conservation, alternative energy, and sustainability Development initiatives.

4.2.9.Monitoring and Reporting

- Conduct periodic internal energy assessments to pinpoint areas for enhancement and monitor advancement through the maintenance log and documentation for infrastructure repairs, laboratory records, meter reading logs, and recorded minutes to ensure uniformity and optimal management of the system.
- Publish and release the yearly report on energy use and sustainability that details performance, accomplishments, and objectives to environmental management committees for their evaluation and endorsement by the college governing body.
- Plan and discuss to formulate future endeavours that guarantee access to affordable, reliable, sustainable, and modern energy

4.2.10.Compliance and Review

- Ensure ongoing compliance with local, state, and national energy laws and frameworks through periodic assessment studies
- Align actions with the NMEEE (National Mission on Enhanced Energy Efficiency) to effectuate a novel approach in the energy management system.
- Review and update the energy policy every two years to incorporate technological and integrate further requirements aligned with the outcomes of the assessment
- Consider feedback and suggestions from internal and external stakeholders during each review cycle.

4.2.11.Leadership and Accountability

- Form an Energy Management Committee to oversee and regulate the operation through assessment, internal audit meetings to ensure transparency, internal, external communications, and active involvement of auditors
- Manage the allocation of institutional resources to support energy conservation programs.
- Define roles and responsibilities for faculty, administration, and students in upholding the policy.
- Encourage a campus-wide culture of sustainability and energy consciousness.

4.2.12.Conclusion

Through this comprehensive Environmental Management System Policy, St. Teresa's College (Autonomous), Ernakulam, demonstrates its unwavering commitment to environmental responsibility and sustainable development. By weaving environmental stewardship into the fabric of campus life through academics, infrastructure, and community outreach, the college aspires to be a national model for green educational institutions, promoting resilience and climate-conscious growth.

4.3.METHODOLOGY

The energy audit systematically analysed the institution's energy usage according to a structured program. The 12 member of internal audit team, comprising 10 students and 1 faculty, collected data under faculty supervision.

4.3.1 Internal audit training

Green audit training fosters institutional ownership and engagement through comprehensive, participatory approaches. To prepare the college for this, the established Energy Management System (EnMS) selects students and faculty for internal audit training. This one-day program certifies them as internal auditors, qualifying them to conduct a energy audit. The internal energy audit process includes key stages: assessment, risk analysis, data collection, policy generation, and documenting registers and programs for energy conservation and resource management.

4.3.2. Power quality analysis

This assessment will evaluate the integrity of the facility's electrical system. A power quality analyser will be used to measure the power supplied by KESB, focusing on voltage variations, power levels, and harmonic distortion. Concurrently, a thermal imaging of single phase and three phase performed to check for thermal anomalies and verify load balancing across each phase, serving as a basis for preventive maintenance. The evaluation will conclude with an assessment of the equipment's accessibility for service and the clear identification of the emergency shutdown controls within the specified area.

4.3.3. Registers and documents

The team initiated the energy audit by consolidating 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 received the task of mapping the campus and marking electrical appliances. To monitor usage, the team maintained various registers tracking energy meter readings, monthly utility bills, solar production, motor pump operations, and appliance logs. They also kept a maintenance register to assess appliance performance (effective/ineffective) and log daily/weekly operating hours. The process specifically focused on collecting weekend data and separate meter readings for each block.

4.3.4. Energy infrastructure documentation

Detailed documentation of the college's energy infrastructure (covering lighting, audio-visual equipment, lab instruments, computers, and appliances) was prepared. Subsequently, the total annual energy consumption was calculated in KWH using the power specifications of these items and their average yearly usage duration.

4.3.5. Usage pattern assessment through energy meter sampling data

Power consumption for each block was calculated by consolidating data collected centrally over three weeks, ensuring accuracy through daily and weekly cross-checks. This process involved multiple methods: energy meter readings taken three times daily during a nine-day period (covering weekends and a weekday), observational visits by team members to detail equipment, lighting, appliances, power capacities, and usage patterns, and interviews with the system manager and relevant faculty for operational context.

4.3.6 Analysis of KSEB meter reading

Power consumption data from the Kerala State Electricity Board (KSEB) were obtained from regular meter bills for the specified periods (2022-2023, and 2023-2024).

4.3.7 Identification of energy saving options and scope of alternate energy resources

The team identified and documented potential alternative energy sources and proposed a corresponding action plan. To assess the college's carbon footprint, they analysed the campus's energy resources including KSEB supply and alternatives along with their annual usage patterns across various locations like laboratories, offices, and kitchens.

4.3.8 External Audit

External auditors visit the college to evaluate conformity with energy management audit requirements and identify any non-conformities. If only minor non-conformities are found, the external auditor may then approve the institution for certification against relevant ISO standards.

4.3.9. Assumption

An effective Energy Management System (EnMS), when aligned with an organization's business strategy, provides crucial visibility into energy usage and highlights areas for performance improvement. It achieves this by establishing structured policies, processes, procedures, and action plans specifically designed to identify and implement energy-saving opportunities, fostering a culture of continuous improvement in energy management.

The primary benefit of an EnMS is tangible cost reduction. Energy savings identified through the system directly translate into lower energy bills, significantly reducing overhead. Many organizations implementing ISO 50001 report first-year savings that meet or exceed the initial investment, demonstrating a strong link between reduced energy consumption and improved financial performance. Furthermore, an EnMS deepens the understanding of where, when, and how energy is consumed, enabling ongoing identification of efficiency improvements.

ISO 50001:2018, utilizing the Annex SL high-level structure, facilitates integration with other management systems like ISO 9001 (Quality) and ISO 14001 (Environmental). This allows for streamlined processes like document control, internal audits, and corrective actions, avoiding duplicated effort. A cornerstone of ISO 50001 is the comprehensive energy review, which forms the basis for determining Significant Energy Uses (SEUs) and identifying key efficiency opportunities.

Successful implementation hinges on management involvement. The standard requires setting clear energy objectives and measurable targets, considering SEUs and improvement opportunities. These must be monitored using tools like Energy Performance Indicators (EnPIs) compared against an Energy Baseline (EnB), then communicated and updated. Prescriptive data collection requirements ensure relevant information is gathered. Critically, ISO 50001 extends to the design and procurement of new or renovated energy-using installations, equipment, systems, or processes, embedding energy performance improvement throughout their lifecycle. Any significant deviations from expected energy performance must be investigated.

4.3.10.Stages of Energy audit

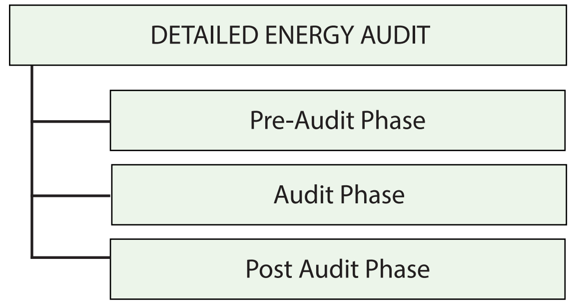


Fig. No. An energy audit has three phases: pre-audit, audit, and post-audit.

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

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).

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.

4.3.11.Steps of Energy Audit

1. Site assessment

Collection of contour maps and campus diagrams

- Preparing an 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)

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

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.

4.3.12. Workplan and schedule of energy audit

Date to date	Work Plan
15/03/2025-22/03/2025	• A meeting took place to review the policies and finalize the action plan. • Each team member has been instructed to review the manual and create checklists for implementing the action plan. • The college campus map was gathered. • Meter locations for readings were identified. • The internal audit team has been split into … groups. • The campus is segmented into three blocks, with each group designated a block for conducting the survey.
24/03/2025-31/03/2025	• Each group is tasked with locating the meters within their designated area. • A map has been provided to each group, highlighting specific locations for collecting meter reading data. • Each group needs to identify and sketch the electrical appliances and instruments in their block using simple diagrams and line drawings. • Data sheets have been distributed, and each group will commence data collection starting next week.
02/06/2025-09/06/2025	• Each group is responsible for placing registers in the designated areas to facilitate effective data collection. • Each team is tasked with assessing the operational status of the appliances and instruments inspected. • Devices will be categorized as either efficient or inefficient. • A meeting will be convened to evaluate the progress of the energy audit and review the findings.
10/06/2025-17/06/2025	• Preparing and uploading registers and documents, which include documenting programs and activities as well as recording meeting minutes
18/06/2025-25/06/2025	• Each group will be responsible for tracking the operational hours of each appliance individually for both daily and weekly usage, including data for weekends.
26/06/2025-03/07/2025	• The power meter readings for every block must be recorded at the same time.
04/07/2025-11/11/2025	• This week is designated for calculating and documenting the daily and weekly power consumption for each block using data gathered in the fourth week.
12/07/2025-19/07/2025	• Power consumption data from all blocks must be collected and cross-verified against the power meter readings to identify any inconsistencies.

Table 4.1. Schedule of energy management audit

Energy Meter reading (for every meter in the college)	9 days; 3 times a day	Three Sundays; 20/07/2025,27/07/2025,03/07/2025 Three Semi holidays (Saturday) 26/07/2025 ,02/08/2025,09/08/2025 Three working days21/07/2025,28/07/2025,04/07/2025	Entry in the given format
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 9lab, office, kitchen etc.)	Enter in the given format

Table 4.2. Work plan of energy management audit

4.4.RESULT AND DICUSSION

4.4.1 Energy Infrastructure Assessment

Equipment	Count	Watt	Hour	days of working	Kilowatt	Yearly consumption in kWh
Printer	13	250	8	5	0.25	400
Personal Computer	159	460	8	5	0.46	736
AC	11	1500	8	5	1.5	2400
Tube Light	77	40	8	5	0.04	64
Fan	144	60	8	5	0.06	96
Speaker	23	50	8	5	0.05	80
CCTV	10	15	8	5	0.015	24
XEROX	1	1800	8	5	1.8	2880
Cooler	1	300	8	5	0.3	480
Electric stove	1	2000	8	5	2	3200
Wi-Fi router	4	15	8	5	0.015	24
Monitor	23	25	8	5	0.025	40
AC	17	310	8	5	0.31	496
AC	8	210	8	5	0.21	336
AC	10	110	8	5	0.11	176
AC	1	1500	8	5	1.5	2400
Sound system	1	4000	8	5	4	6400
Sound system	3	1000	8	5	1	1600
Sound system	2	250	8	5	0.25	400
Sound system	1	300	8	5	0.3	480
Sound system	1	5000	8	5	5	8000
Lift	3	1500	8	5	1.5	2400
UPS	3	8000	8	5	8	12800
UPS	2	4000	8	5	4	6400
UPS	1	4800	8	5	4.8	7680
UPS	1	6400	8	5	6.4	10240
UPS	1	2400	8	5	2.4	3840
LED Tube light	149	12	8	5	0.012	19.2
LED bulb	173	9	8	5	0.009	14.4
LED SQ	92	20	8	5	0.02	32
CFL	20	25	8	5	0.025	40
TOTAL						74177.6

Table 4.3 The infrastructure strength of Arts block

Equipment	Count	Watt	Hour	days of working	Kilowatt	Yearly consumption in kWh
Printer	2	250	2	5	0.25	100
Personal computer	101	460	3	5	0.46	276
Lift	1	1500	8	5	1.5	2400
Tube Light	81	40	5	5	0.04	40
Fan	29	60	5	5	0.06	60
Speaker	31	50	1	5	0.05	10
Projector	4	800	3	5	0.8	480
LED Bulb	44	9	3	5	0.009	5.4
LED tube	280	20	3	5	0.02	12
Hot air oven	2	1500	0.5	5	1.5	150
Hot plate	1	1000	0.5	5	1	100
Centrifuge	1	120	1	5	0.12	24
Deionizer	1	100	0.5	5	0.1	10
Conductivity Meter	2	5	0.5	5	0.005	0.5
Rotary shaker	2	220	1	5	0.22	44
Voltas mini freezer	1	500	5	5	0.5	44
Water bath	1	750	0.5	5	0.75	500
AC	5	3517	5	5	3.517	75
AC	1	5275.50	5	5	5.2755	3517
UPS	2	4000	8	5	4	5275.5
UPS	3	2400	8	5	2.4	6400
LED SQ	11	20	3	5	0.02	3840
CFL	8	25	3	5	0.025	12
TOTAL						23375.4

Table 4.4 The infrastructure strength of Science block

Equipment	Count	Watt	Hour	days of working	Kilowatt	Yearly consumption in kWh
Fan	145	60	5	5	0.06	60
Table fan	6	40	3	5	0.04	24
LED tube	277	20	3	5	0.02	12
LED Bulb	148	9	3	5	0.009	5.4
Smart Board	5	200	3	5	0.2	120
Projector	12	800	3	5	0.8	480
Speaker	20	50	3	5	0.05	30
Printer	5	250	2	5	0.25	100
Personal Computer	27	460	2	5	0.46	184
Exhaust fan	24	40	3	5	0.04	24
Fridge	2	500	24	5	0.5	2400
Mixer	2	300	3	5	0.3	180
Oven	1	2000	2	5	2	800
Filter	5	40	24	5	0.04	192
Laptop	12	70	2	5	0.07	28
LIFT	3	1500	8	5	1.5	2400
AC	1	7034	2	5	7.034	2813.6
AC	5	10551.00	2	5	10.551	4220.4
LED SQ	10	20	3	5	0.02	12
TOTAL						14085.4

Table 4.5 The infrastructure strength of central block

Fig 4.1. Infrastructure maping

The infrastructure assessment of St. Teresa's College shows that the Arts Block registers the highest electrical load on campus due to its dense concentration of equipment and infrastructure. This includes two major auditoriums, radio stations, and elevators, all of which demand substantial energy. The block is equipped with a wide array of appliances such as air conditioners, sound systems, lighting fixtures, fans, and personal computers, making it the most power-intensive zone. A total of 414 LED lights, comprising tubes, squares, and bulbs, are currently installed, while 20 CFL lights remain in use. This indicates that more than half of the CFLs have yet to be replaced, presenting a clear opportunity for energy-efficient upgrades.

The block contains over 40 air conditioners and leads in the number of lights, fans, and computers. However, the highest energy consumption is attributed to UPS systems of varying capacities, followed by sound systems. Despite their large numbers, lights and fans consume relatively less energy compared to air conditioners and printers. The Arts block is noted as a high-demand energy environment, with significant potential for optimisation through targeted upgrades and load management.

The Science Block is estimated as the second most heavily equipped facility in terms of electrical appliances, primarily due to its array of laboratory instruments and computing infrastructure. While it hosts a substantial number of air conditioners, personal computers, and UPS systems, the number of ceiling fans installed is relatively low compared to other blocks. Energy consumption in this block is notably influenced by the operational patterns of its laboratory equipment, which are typically used only during designated working hours. This limited usage contributes to a comparatively lower overall energy demand from lab instruments. Among all appliances, high-voltage UPS systems emerge as the dominant energy consumers, surpassing even air conditioners and computers in their load impact. These systems are critical for maintaining an uninterrupted power supply to sensitive lab equipment and computing stations, but their continuous operation significantly elevates the block's energy footprint.

The Central Block exhibits a relatively modest electrical footprint, with minimal deployment of high-wattage equipment. Aside from a limited number of air conditioners and a single oven, the block lacks energy-intensive appliances commonly found in other campus zones. This restrained setup is largely attributed to the smaller scale and fewer buildings within the block. Despite its limited infrastructure, the Central Block features a higher count of fans and LED lights compared to the Science Block, suggesting a focus on basic ventilation and efficient lighting. However, it records the lowest number of personal computers and CFL lights across all blocks, reinforcing its role as a low-tech, low-consumption area.

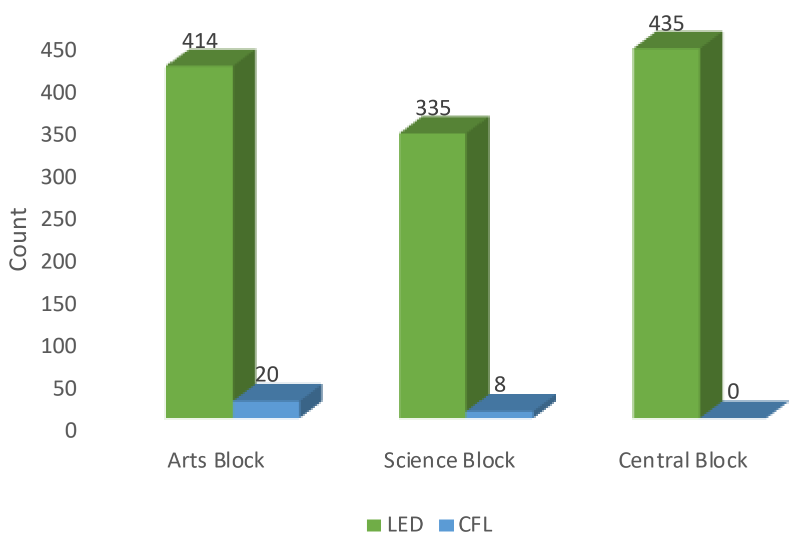


Fig 4.2. Total LED Strength of the campus

The college currently utilises a total of 1,184 LED lights and 629 CFLs. Notably, the central block features a higher concentration of LEDs, as it is a new building, in contrast to the older structures on campus. The assessment hasn't identified the presence of BLDC fans. The proposed policy and plan within the Energy Management System (EnMS) aim to convert the remaining lighting to LED technology and to incorporate BLDC fans in a phased approach.

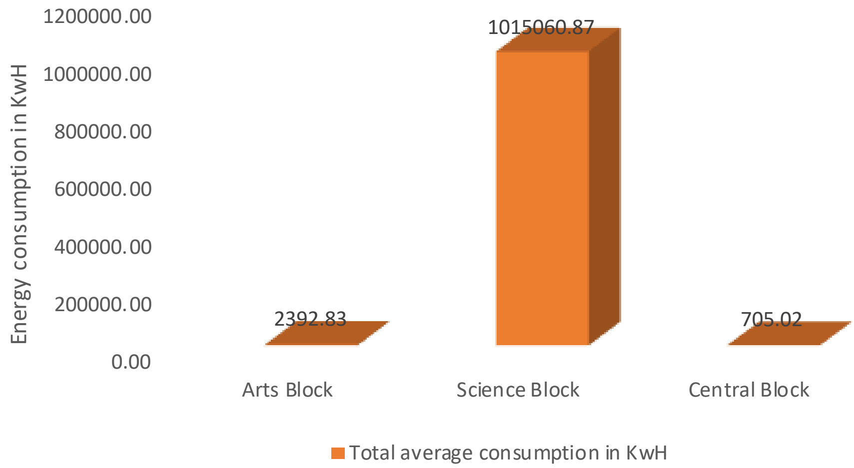


Fig 4.3. Total average consumption in kWh per year

The energy consumption of each block shows a decreasing trend where the highest is noted in the Arts block followed by science block and Central block. This is clearly due to the increased infrastructure facilities present in Arts block while comparing with the other blocks.

4.4.1. Mandatory energy audit

4.4.1.1 Annual Energy Import and Export

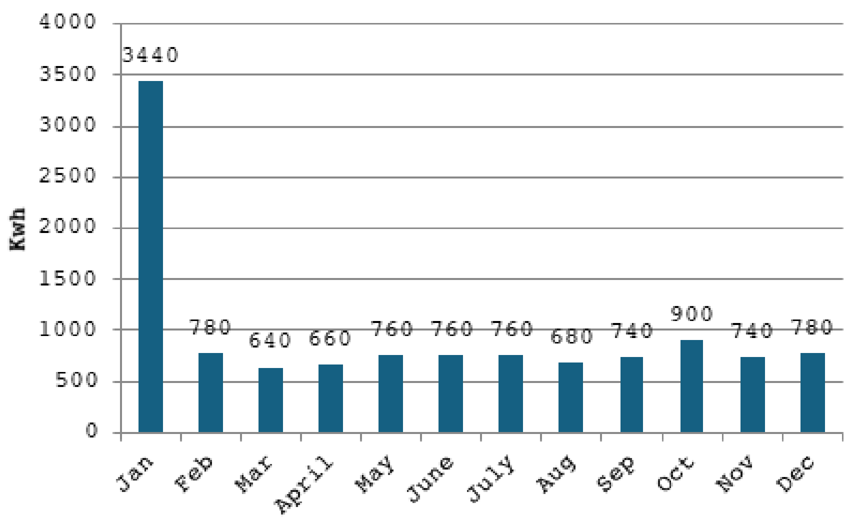


Fig 4.4. Annual energy import

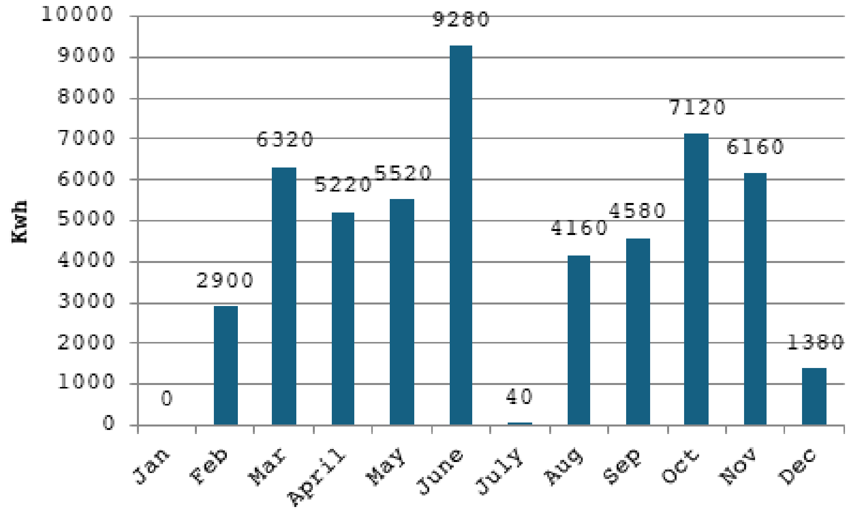


Fig 4.5. Annual energy export

4.4.1.2 Critical Areas

1. Panel Room :

One door of an outgoing switch is seen as burn, it is a serious issue. Urgent action needed for rectifying it.

2. Earth Pits:

Earth pits are not identifyable, yearly maintrenance and value recording is unable, so it is urgent to find out the earth pits, for perioidic maintenance and safety of the installation.

3. Relays and RCCBs:

We noticed that most of RCCBs porovided are not working propely, all relays must be tested and fitted.

4. General comments:

There is no responsible and qualified person for operating the electrical system is not present in the campus. There is no relevant documents or drawings regarding the electrical system are not present in the campus. There is no preventive maintenance registers or records are present. It is recommended that a person with qualification to operate in electrical system may appointed to the campus. It may also recommended that the management take necessary actions for preapring the electrical schematic of the entire campus(As-built), preparing preventive maintrenace records, preparing electrical load registers and identifying the defects and rework on it.

4.4.1.3 Key strengths & good safety practices

1. Insulated rubber mats conforming to IS 15652 standards are provided in the electrical room to ensure operator safety against electrical shock hazards during maintenance and operation.
2. The DOL starter is housed within an enclosure rated IP56, providing adequate protection against dust ingress and strong water jets, ensuring safety and durability in harsh environments.
3. Two-point earthing has been provided for the motors, ensuring effective fault current dissipation and enhancing operational safety in compliance with standard electrical safety practices.

4.4.1.4 Safety Audit Check List

a. ARTS BLOCK

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
1	Earthing pits with identification.	Pit number, test date, due date, and earthing resistance test value should be displayed	The locations of the earth pits could not be identified.
2	Check Nut-Bolts	• Should be free from rust. • Should be applied a layer of Grease or Petroleum Jelly.	The locations of the earth pits could not be identified.
3	Earth Pit location at dealership	Should match with earth pit layout diagram.	The earth pit layout diagram is currently unavailable.
4	Check Earth Pit Inspection Chamber	Inspection Chamber of earth pit should be provided with lid	The locations of the earth pits could not be identified.
5	Check for any signs of rust, corrosion or damage on the panel enclosure.	Visual check	The meter panels are heavily covered with dust, exhibit minor rusting, and some panels have missing glass covers.
6	Check all covers and doors are intact, properly secured and lockable.	Visual check	Out of the five panels, one was found to be missing a lockable mechanism.
7	Check meter sealing	Should be intact	YES
8	Check earthing provision	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
DG Set-1 Sl. No.: 542			
9	SOP for DG Set Start & Stop	Should be displayed / made available near to DG Set in English / Local language	NOT AVAILABLE
10	Check Neutral and Body earthing of the DG Set.	• DG Set Neutral and Body should be connected to two separate earth pits. • There should be 02 nos. of earth pit required for Body earthing, and 02 nos. of earth pit required for neutral earthing.	The earth pits could not be located during the inspection.
11	Segregation of earth pits	Mutual Segregation between the DG Set Neutral & Body Earth Pit shall not less than 6M.	The earth pits could not be located during the inspection.
12	Check DG Set breaker	4-Pole breaker should be available for DG Set	AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
13	Check cleanliness inside the DG Set	Should be free from dust / cobwebs / oil leakage etc.	Dust and cobwebs were observed inside the DG set during the inspection.
14	Check DG battery terminal caps	Should be intact	Battery terminal caps are not available.
15	Check whether Dielectric Grease or Petroleum Jelly is applied on the Battery Terminals	To prevent corrosion and enhance conductivity	Neither petroleum jelly nor dielectric grease has been applied to the terminals.
16	Check working of emergency stop push button provided on the enclosure	DG should stop by pressing the emergency push button provided on the enclosure	The emergency push button on the DG set could not be tested, as the DG became overloaded and shut down during the procedure.
17	Check the illumination light inside the DG set	Should be working condition	YES
18	• Check whether all the wall openings and cable duct entries in the electrical room are sealed. • Also check for the water seepage, if any.	• All the openings in walls (such as cable trench entry/ bus duct entry) should be sealed. • No signs of rainwater seepage should be available in walls / cable trench.	The wall openings made for cable entry are not properly sealed.
19	Check earthing provision in electrical room equipment if any.	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
20	List of authorized person's need to be displayed	Name & designation of Electrical Engineer / Electrician / Contractor need to be displayed	NOT DISPLAYED
21	Emergency Telephone numbers need to be displayed in the electrical room	Emergency Telephone numbers of Police, Fire Office and Ambulance should be displayed in electrical room.	NOT DISPLAYED
22	Check proper ventilation in the electrical room	Cooling mechanisms such as exhaust fans / AC should available	Natural cooling is provided in the electrical room through passive ventilation
23	Check for availability of Insulated Electrical Hand Gloves	Insulated Electrical hand gloves suitable for 11kV and 415V should be available	NOT AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
23	Check that electrical room is NOT used as storage area	Storage of scraps, oil drums, clothes, spares & carton / wooden boxes etc. not allowed	Broken plastic chairs, cardboard boxes, and scraps of old SFUs are being stored in the electrical room.
24	Check whether 'AUTHORIZED PERSONNEL ONLY' board is displayed in a conspicuous manner in the Electrical Room.	Visual check only	NOT DISPLAYED
25	Check the Identifications (Incomer & Outgoing Feeders)	Should be labeled with Feeder Name, Breaker Type and Rating	Multiple panels were found without proper identification labels indicating their names and ratings.
26	In case of two incomers check correct interlock is provided for safe operation.	Suitable electrical or mechanical interlock	AVAILABLE
27	Check ELR (Earth Leakage Relay) for its healthiness	Incomer Breaker should trip, when the TEST push button is pressed	Earth Leakage Relay (ELR) is not available.
28	Check meters like MFM (Multifunction meter), Voltmeter and Ammeter	• Inspect the meters exterior for damage (such as cracks or broken parts) not acceptable. • Check the integrity of display screens & buttons / knobs.	All meters were found to be in proper working condition.
29	Indication Lamps should be healthy (Phase / ON / OFF / Trip indication)	Indication Lamps provide visual feedback on the status of various components or circuits	Indication lamps were found to be non-functional on multiple panels.
30	Check PDB enclosure for rusting	PDB enclosure should be free from severe rusting	Minor rusting was observed on multiple panels.
31	Check the implementation of Lock Out Tag Out (LOTO)	• Visual check for LOTO provision for Incomer and Feeders • Observe the Lockout/ Tagout in action LOTO usage during service work (if applicable).	Lockout-Tagout (LOTO) systems have not been implemented, posing a potential safety risk during maintenance or servicing activities. The absence of proper isolation and tagging procedures increases the likelihood of accidental energization and exposure to electrical hazards.
32	Check isolation provision for control circuit.	MCB or Fuse cutout should be available	AVAILABLE
33	Check Panel door Locking	Door Locking mechanism should be available	AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
34	Check for any unwanted holes / any cutout open	Unused cable entry open holes / any other openings should be closed to ensure ingress protection	NONE
35	Check for the cable gland condition	SS gland for armored cable, PVC gland for flexible cable and Duct seal for incoming wire should be available	• Duct sealing for incoming cables was found to be absent at multiple cable entry points, which may lead to safety, dust ingress, and rodent intrusion concerns. • The armored cable connected to Panel - VDB-3 (Economics Block) was found to be damaged and rusted, potentially compromising its mechanical protection and electrical safety.
36	Check Earthing of panel as per earth pit layout diagram	Double earthing with two separate earth pits or grid	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
37	Check Grouting/ mounting of the panel	Firm Mounting should be firm	The panel mounting is firm and secure.
38	Check the Panel Board location	Should be away from corrosive fumes/ fluids, easy to access, max 2m from ground level.	YES
39	Check for the phase barriers	Phase barrier between each phase of MCCB, ACB & Changeover Switch for <25mm phase-to-phase air clearance.	YES
40	Check effective shrouding to all live parts	Shrouding should be provided to all live parts on all cable termination.	Shrouding was found to be absent on the KSEB incomer panel, posing a potential risk of accidental contact with live parts.
41	Check cleanliness inside the panel	Should be free from dusts / cobwebs etc.	Multiple panels were found to have heavy accumulation of dust and cobwebs, indicating a lack of regular maintenance and housekeeping.
42	Check Busbar & Terminal connection	Should be no signs of overheating, such as discoloration, melting insulation, or burning odors.	Discoloration due to overheating and the presence of burn marks were observed in multiple panels, indicating possible thermal stress or previous electrical faults.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
43	Check insulating rubber mats conforming IS 15652 are provided in front of the electrical panels to save the operating personnel of electrical shock.	The insulating rubber mats should conform IS 15652	Available
44	Check that 30mA ELCB / RCCB / RCBO is connected in Lighting and Socket circuit	• The rating should be not more than 30mA • ELCB / RCCB / RCBO should trip, when the TEST push button is pressed	In multiple panels, the RCCB was found to be either non-functional or bypassed, thereby compromising the system's electrical safety and protection against leakage currents.
45	Check for spare MCB cutouts.	Should be closed with MCB Dummy Blank Plate	Spare MCB cutouts are available in multiple panels; however, dummy blanking plates are missing, leaving open slots that pose a safety hazard.
46	Check for circuit identification.	The nameplates / labeling identification should match with SLD	Most of the LDB panels lack proper identification labels, making it difficult to trace circuits and potentially hindering maintenance and troubleshooting efforts.
47	Check for any unwanted holes / any cutout open	Unused cable entry open holes / any other openings should be closed to ensure ingress protection	Unwanted cut-outs were observed on multiple panels (e.g., LDB-18), which may pose safety and ingress concerns.
48	Check cleanliness inside the panel	Should be free from dusts / cobwebs etc.	Minor dust accumulation was observed during the inspection.
49	Check earthing provision at LDB	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
50	Check insulating rubber mats conforming IS 15652 are provided in front of the electrical panels to save the operating personnel of electrical shock.	The insulating rubber mats should conform IS 15652	NOT AVAILABLE
51	Check for the type of wires / cables used on random basis	Prefer FRLS / LSZH as and when the existing wires / cable are replaced	YES

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
52	Check electrical wiring / cables	The wiring / cable should be in good condition with no exposed wiring / cables	Exposed cables were observed in multiple areas, notably within unclosed switchboards in computer labs, main UPS rooms, the stairway on the 5th floor, and several other locations. This poses potential electrical safety and fire hazards.
53	Check cable dressing	• Cables should be neatly organized, bundled and adequately secured • Cable sharp bends should be avoided. • Cable ties, clips or clamps should be used. • Cable should not cross over metal sharp edges. • No cables hanging • No insulation damage or cuts in cables	Not proper
54	Visual check for improper / unsafe cable / wire jointing	• Cable / Wire joints should be done with good engineering practice • Jointing should be free from any hint of overheating / burning marks	Evidence of overheating was observed at multiple cable joints, indicating potential issues with connection integrity or load handling
55	Check cable trays	Cable trays and conduits should not be overloaded.	NOT OVERLOADED
56	Check cable identification	Cables identification should be done using Tags / Labels	NOT AVAILABLE
57	Check cable route marking	Underground cables should have route markers with voltage level.	No markings
58	Check cable conduit opening sealing (if visible)	Cable conduit opening should be sealed by suitable to prevent moisture, dust, pests, oil leakages.	Open cable conduits were observed in several areas, which may lead to physical damage to the cables and pose potential safety and maintenance concerns.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
59	Check cable entry sealing in panel / junction box	Sealing of all cable entry should be available. • Suitable Cable Gland for individual cables. • Rubber Grommets for smaller conduits.	Cable entry seals were found to be missing in certain areas, potentially allowing dust, moisture, and pests to enter the enclosures.
60	Check cable terminals for proper use of Lugs	Cable Lugs should be available at all cable termination	AVAILABLE
61	Check any unused/ unwanted cables	Unused/ unwanted cables should be removed	Several areas were found to have unused or unnecessary cables that had not been removed, leading to congestion and potential safety concerns.
62	Check cable entry glands in Terminal Box	• One gland one cable • Proper size gland	YES
63	Check external electrical connections	Weatherproof enclosures should be available for external electrical connections	YES
64	Check fuses or circuit breakers (CBs)	• The rating of the fuses or CBs should match with SLD. • Fuses or CBs should NOT be bypassed.	Almost all SFUs were found to be bypassed, and several RCCBs were either non-functional or bypassed, significantly compromising electrical protection and safety compliance.
65	Check ventilation provision for area.	Natural / mechanical ventilation required	Natural ventilation is available.
66	Check earthing provision in pump room equipment.	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
67	Check motor terminal box for empty holes	Motor terminal box should not have any empty holes	YES
68	Check whether electrical panel / Direct Online (DOL) Starter / Electrical Light Fittings are used .	Electrical Panel / DOL Starters / Electrical Light Fittings should be suitable for IP56 protection.	YES

UPS-1 Sl. No.: CR03003023	
UPS-2 Sl. No.: 2101201788221C101226	
UPS-3 SL NO: CR02403023	
UPS-4 SL NO: CR02403023	
UPS-5 SL NO: NOT LABELLED	
UPS-6 SL NO: NOT LABELLED	

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
69	Check provision of standby UPS with adequate capacity.	Ensure redundancy	YES
70	Check whether the network cables and power cables are laid in separate conduits	The following separation distances should be maintained between the conduits carrying the network cables and power cables. • 2" for power cable below 2 kVA. • 6" for power cables between 2 kVA to 5 kVA. • 12" for power cables above 5 kVA.	YES
71	Check battery condition.	No Bulge, No Damage	YES
72	Check for isolation at Battery end.	Isolation at the battery end should be available or Integrated Protection (CB or Fuse) should be available in UPS.	AVAILABLE
73	Check battery terminal caps	Should be intact	While a few batteries had terminal caps in place, the majority were found without them, increasing the risk of electrical hazards and accidental contact.
74	Check terminal for rusting or corrosive deposits.	Battery terminals should be clean (free from rusting or corrosive deposits)	Corrosive deposits and rusting were observed on the battery terminals of the batteries located in the main UPS room on the ground floor.
75	Check dielectric Grease or Petroleum Jelly should apply on Battery Terminals	Battery terminals to prevent corrosion and enhance conductivity	Neither dielectric grease nor petroleum jelly is applied.
76	Check provision for battery rack earthing.	It should be properly earthed	The metal racks were found to lack proper two-point earthing, which is essential for ensuring electrical safety and fault current dissipation.
77	Check Eye Washer wherever lead acid Batteries are Installed.	• Should be available for Lead Acid Batteries. • NOT required for Ni-Cd Batteries / Maintenance free Batteries.	NOT AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
78	Check the provision of separate earth pit.	2 nos. of dedicated earth pits should be available for LA.	AVAILABLE
79	Check down conductor separation from the structure.	Down Conductor should be fixed on insulators, and NOT directly on the structure.	YES
80	Check Fire Detection and Alarm system.	Fire Detection and Alarm system should be available in the following areas: • Electrical Room.	NOT AVAILABLE
81	Check whether the Uninterrupted power supply is provided to the Fire Detection and Alarm system	The power supply for the Fire Detection and Alarm system should be through UPS.	
82	Check Fire Sand Buckets are available near electrical equipment (Transformer, DG Set, Electrical Room, LDB)	• The sand should be free flowing. • Canopy should be provided when Fire Sand Buckets are placed in open area (for avoiding rainwater ingress).	NOT AVAILABLE
83	Check whether portable fire extinguishers are available.	• Fire extinguishers should be mounted about 1 Meter above the ground / floor. • CO_2 Type for electrical installations. • DCP Type (ABC) for all other areas.	A fire extinguisher was available; however, its inspection due date has expired, indicating the need for immediate servicing or replacement.
84	Check escape route marking and exit signs	Escape routes and exit signs should be marked in a conspicuous manner	NOT AVAILABLE
85	Check the availability of LOTO Equipment	Lockout Devices, Tagout Devices, Unique Keys should be available.	NOT AVAILABLE
86	Check that, electrical panels are not exposed to rainwater	• Opening / rainwater exposure not allowed. • Canopy needs to be provided for outdoor electrical panel.	YES

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
87	Check for display of Resuscitation (Artificial Respiration) Chart near PDB and LDB	Resuscitation (Artificial Respiration) Chart should be displayed in English or Local language.	NOT AVAILABLE
88	Check provision of emergency lights	UPS / Invertor supply based critical emergency lighting should be available in critical areas like Electrical Room, D G Area, Security cabin, Entrance etc.	NOT AVAILABLE
89	Check electrical sockets for overloading	The electrical sockets should not be overloaded with multiple loads.	NOT OVERLOADED
90	Check that every connection is provided with one exclusive terminal connector	Visual inspection	No
91	Check Terminal box for easy access	Terminal box should be provided at a height not more than 3M from the floor level.	NA
92	Check whether the Terminal box is mounted firmly	Min. 4 fasteners should be used	NA
93	Check for presence of Rodents and Termites in the premises	• The premises should be kept clean and free from the traces of the leftover foods. • Repellents may be used to keep the biological agents away from electrical installation.	Evidence of rodent presence was observed inside the DG set, indicating a need for pest control measures and improved housekeeping.
94	Check whether the material used for false ceiling, flooring and wall furnishing (if any) is highly flammable	Use of highly flammable materials in the construction of false ceiling, flooring and wall furnishing should be avoided.	NONE
95	Check Single Line Diagram	Updated	NOT UPDATED
96	Check that as built drawing are available	Approved	

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
97	Check earth pit layout diagram	Updated	NOT AVAILABLE
98	Check earth pit test records	Earthing Electrode & Grid resistance should be measured at least once in a year in a dry period as per IS 3043	NOT AVAILABLE
99	LOTO Policy Documentation	• Written LOTO Procedure including Electrical Isolation Procedure should be available. • LOTO register should be maintained.	NOT AVAILABLE
100	Check Electrical Competency Licenses	Electrical competency certificates (electrical supervisor / Contractor / Wiremen License) regulated by the respective state regulatory state authority	AVAILABLE
101	Check preventive maintenance schedule	The schedule should at least include the following equipment / installations. • DG Set • PDB • LDB • UPS and Batteries	AVAILABLE
102	Check preventive maintenance check lists and records for last 3 years	With respect to schedule	

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
103	Check for measuring instrument calibration test certificates	Calibration certificates from NABL approved laboratory should be available for the following instruments • Digital Multimeter. • Digital Clamp meter. • Insulation Tester. • Earth Pit Tester. The calibration should be carried out at least once in a year.	NOT CALIBRATED
104	Check for electrical accident/incident records and investigation reports	With corrective action	NOT AVAILABLE
105	Check for cable and equipment Insulation Resistance (IR) test reports for last 3 years	The IR test should be carried out at least once in a year.	NOT TESTED
106	Check for valid AMC for major electrical equipment	The valid AMC should be in place for the following equipment / installations. • DG Set • UPS and Batteries	AVAILABLE
107	Check for Electrical Safety Awareness Training records for last 3 years.	The Electrical Safety Awareness Training should be imparted to all the employees at least once a year.	AVAILABLE
108	Check for the compliance status of the reports of annual inspection of electrical installations by local authorities	Check for last 3 years	AVAILABLE
109	Test certificates for insulating rubber gloves (for electrical purpose) check for last 3 years	The insulating rubber gloves should be tested at least once in 6 months as per IS 4770	NOT AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
110	Check for Fire Extinguisher inspection records for last 3 years	Fire Extinguisher should be checked at least once in 3 months	NOT AVAILABLE
111	Check for Fire Detection and Alarm System for last 3 years	Inspection maintenance and testing should be carried out at least once in 3 months	NOT AVAILABLE
112	Fire NOC	Check availability, validity and compliance with conditions mentioned therein	AVAILABLE

Table 4.6 Detailed assessment of external energy audit of Arts block

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
1	Earthing pits with identification.	Pit number, test date, due date, and earthing resistance test value should be displayed	The locations of the earth pits could not be identified.
2	Check Nut-Bolts	• Should be free from rust. • Should be applied a layer of Grease or Petroleum Jelly.	The locations of the earth pits could not be identified.
3	Earth Pit location at dealership	Should match with earth pit layout diagram.	The earth pit layout diagram is currently unavailable.
4	Check Earth Pit Inspection Chamber	An Inspection Chamber of earth pit should be provided with lid	The locations of the earth pits could not be identified
5	Check for any signs of rust, corrosion or damage on the panel enclosure.	Visual check	The meter panels were found to be heavily covered in dust and showed signs of minor rusting. Glass panels were missing in multiple locations, and KSEB bills were improperly stored inside the panels.
6	Check all covers and doors are intact, properly secured and lockable.	Visual check	Some panels were found to be missing locks, posing a potential safety and security concern.
7	Check meter sealing	Should be intact	YES
8	Check the earthing provision	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
9	• Check whether all the wall openings and cable duct entries in the electrical room are sealed. • Also check for the water seepage, if any.	• All the openings in walls (such as cable trench entry/bus duct entry) should be sealed. • No signs of rainwater seepage should be available in walls / cable trench.	YES
10	Check earthing provision in electrical room equipment if any.	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
11	List of authorized person's need to be displayed	Name & designation of Electrical Engineer / Electrician / Contractor need to be displayed	NOT DISPLAYED
12	Emergency Telephone numbers need to be displayed in the electrical room	Emergency Telephone numbers of Police, Fire Office and Ambulance should be displayed in electrical room.	NOT DISPLAYED
13	Check proper ventilation in the electrical room	Cooling mechanisms such as exhaust fans / AC should available	Natural cooling is provided in the electrical room through passive ventilation
14	Check for availability of Insulated Electrical Hand Gloves	Insulated Electrical hand gloves suitable for 11kV and 415V should be available	NOT AVAILABLE
15	Check that electrical room is NOT used as storage area	Storage of scraps, oil drums, clothes, spares & carton / wooden boxes etc. not allowed	The electrical room is not being used as a storage area, in compliance with safety standards.
16	Check whether 'AUTHORIZED PERSONNEL ONLY' board is displayed in a conspicuous manner in the Electrical Room.	Visual check only	NOT DISPLAYED
17	Check the Identifications (Incomer & Outgoing Feeders)	Should be labeled with Feeder Name, Breaker Type and Rating	Multiple panels were found without proper identification labels indicating their names and ratings.
18	In case of two incomers check correct interlock is provided for safe operation.	Suitable electrical or mechanical interlock	AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
19	Check ELR (Earth Leakage Relay) for its healthiness	Incomer Breaker should trip, when the TEST push button is pressed	Earth Leakage Relay (ELR) is not available.
20	Check meters like MFM (Multifunction meter), Voltmeter and Ammeter	• Inspect the meters exterior for damage (such as cracks or broken parts) not acceptable. • Check the integrity of display screens & buttons / knobs.	All meters were found to be in proper working condition.
21	Indication Lamps should be healthy (Phase / ON / OFF / Trip indication)	Indication Lamps provide visual feedback on the status of various components or circuits	Indication lamps were found to be non-functional on multiple panels.
22	Check PDB enclosure for rusting	PDB enclosure should be free from severe rusting	Rusting was observed on multiple panels, indicating exposure to moisture and lack of adequate maintenance.
23	Check the implementation of Lock Out Tag Out (LOTO)	• Visual check for LOTO provision for Incomer and Feeders • Observe the Lockout/ Tagout in action LOTO usage during service work (if applicable).	Lockout-Tagout (LOTO) systems have not been implemented, posing a potential safety risk during maintenance or servicing activities. The absence of proper isolation and tagging procedures increases the likelihood of accidental energization and exposure to electrical hazards.
24	Check isolation provision for control circuit.	MCB or Fuse cutout should be available	AVAILABLE
25	Check Panel door Locking	Door Locking mechanism should be available	AVAILABLE
26	Check for any unwanted holes / any cutout open	Unused cable entry open holes / any other openings should be closed to ensure ingress protection	NONE
27	Check for the cable gland condition	SS gland for armored cable, PVC gland for flexible cable and Duct seal for incoming wire should be available	AVAILABLE
28	Check Earthing of panel as per earth pit layout diagram	Double earthing with two separate earth pits or grid	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
29	Check Grouting/ mounting of the panel	Firm Mounting should be firm	The panel mounting is firm and secure.
30	Check the Panel Board location	Should be away from corrosive fumes/ fluids, easy to access, max 2m from ground level.	YES
31	Check for the phase barriers	Phase barrier between each phase of MCCB, ACB & Changeover Switch for <25mm phase-to-phase air clearance.	YES
32	Check effective shrouding to all live parts	Shrouding should be provided to all live parts on all cable termination.	YES
33	Check cleanliness inside the panel	Should be free from dusts / cobwebs etc.	Severe dust accumulation and cobwebs were observed inside multiple panels, indicating inadequate housekeeping and maintenance.
34	Check Busbar & Terminal connection	Should be no signs of overheating, such as discoloration, melting insulation, or burning odors.	Discoloration due to overheating and the presence of burn marks were observed in multiple panels, indicating possible thermal stress or previous electrical faults.
35	Check insulating rubber mats conforming IS 15652 are provided in front of the electrical panels to save the operating personnel of electrical shock.	The insulating rubber mats should conform IS 15652	Insulating rubber mats are available; however, they were found to be torn, compromising their effectiveness and safety compliance.
36	Check that 30mA ELCB / RCCB / RCBO is connected in Lighting and Socket circuit	• The rating should be not more than 30mA • ELCB / RCCB / RCBO should trip, when the TEST push button is pressed	In multiple panels, the RCCB was found to be either non-functional or bypassed, thereby compromising the system's electrical safety and protection against leakage currents.
37	Check for spare MCB cutouts.	Should be closed with MCB Dummy Blank Plate	Spare MCB cutouts are available in multiple panels; however, dummy blanking plates are missing, leaving open slots that pose a safety hazard.
38	Check for circuit identification.	The nameplates / labeling identification should match with SLD	Most of the LDB panels lack proper identification labels, making it difficult to trace circuits and potentially hindering maintenance and troubleshooting efforts.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
39	Check for any unwanted holes / any cutout open	Unused cable entry open holes / any other openings should be closed to ensure ingress protection	NONE
40	Check cleanliness inside the panel	Should be free from dusts / cobwebs etc.	Minor dust accumulation and cobwebs were observed during the inspection.
41	Check earthing provision at LDB	Two-point earthing with two separate earth pits or grid.	Two-point earthing has been provided; however, the earth pits could not be located during the inspection.
42	Check insulating rubber mats conforming IS 15652 are provided in front of the electrical panels to save the operating personnel of electrical shock.	The insulating rubber mats should conform IS 15652	NOT AVAILABLE
43	Check for the type of wires / cables used on random basis	Prefer FRLS / LSZH as and when the existing wires / cable are replaced	YES
44	Check electrical wiring / cables	The wiring / cable should be in good condition with no exposed wiring / cables	Exposed cables were observed in multiple areas, specifically at the Direct-On-Line (DOL) starter connections near the DG area, posing electrical safety risks.
45	Check cable dressing	• Cables should be neatly organized, bundled and adequately secured • Cable sharp bends should be avoided. • Cable ties, clips or clamps should be used. • Cable should not cross over metal sharp edges. • No cables hanging • No insulation damage or cuts in cables	Cables were found hanging loosely in multiple areas, indicating poor cable management and potential safety hazards.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
46	Visual check for improper / unsafe cable / wire jointing	• Cable / Wire joints should be done with good engineering practice • Jointing should be free from any hint of overheating / burning marks	Evidence of overheating was observed at multiple cable joints, indicating potential issues with connection integrity or load handling.
47	Check cable trays	Cable trays and conduits should not be overloaded.	NOT OVERLOADED
48	Check cable identification	Cables identification should be done using Tags / Labels	NOT AVAILABLE
49	Check cable route marking	Underground cables should have route markers with voltage level.	
50	Check cable conduit opening sealing (if visible)	Cable conduit opening should be sealed by suitable to prevent moisture, dust, pests, oil leakages.	Open cable conduits were observed in several areas, which may lead to physical damage to the cables and pose potential safety and maintenance concerns.
51	Check cable entry sealing in panel / junction box	Sealing of all cable entry should be available. • Suitable Cable Gland for individual cables. • Rubber Grommets for smaller conduits.	AVAILABLE
52	Check cable terminals for proper use of Lugs	Cable Lugs should be available at all cable termination	AVAILABLE
53	Check any unused/ unwanted cables	Unused/ unwanted cables should be removed	YES
54	Check cable entry glands in Terminal Box	• One gland one cable • Proper size gland	YES
55	Check external electrical connections	Weatherproof enclosures should be available for external electrical connections	Weatherproof enclosures were not provided for the electrical connections of the DOL starter, exposing the components to environmental hazards and potential safety risks.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
56	Check fuses or circuit breakers (CBs)	• The rating of the fuses or CBs should match with SLD. • Fuses or CBs should NOT be bypassed.	Almost all SFUs were found to be bypassed, and several RCCBs were either non-functional or bypassed, significantly compromising electrical protection and safety compliance.
57	Check whether electrical panel / Direct Online (DOL) Starter / Electrical Light Fittings are used .	Electrical Panel / DOL Starters / Electrical Light Fittings should be suitable for IP56 protection.	The DOL starter is equipped with suitable IP56 protection, ensuring adequate safeguarding against dust and water ingress.
UPS-1 Sl. No.: 91092015034			
UPS-2 Sl. No.: PRIMAP2200/ HQJ000367			
UPS-3 SL NO.:900012110090177			
58	Check provision of standby UPS with adequate capacity.	Ensure redundancy	YES
59	Check whether the network cables and power cables are laid in separate conduits	The following separation distances should be maintained between the conduits carrying the network cables and power cables. • 2" for power cable below 2 kVA. • 6" for power cables between 2 kVA to 5 kVA. • 12" for power cables above 5 kVA.	YES
60	Check battery condition.	No Bulge, No Damage	YES
61	Check for isolation at Battery end.	Isolation at the battery end should be available or Integrated Protection (CB or Fuse) should be available in UPS.	AVAILABLE
62	Check battery terminal caps	Should be intact	Battery terminal caps are not available, posing a risk of accidental contact and short circuits.

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
63	Check terminal for rusting or corrosive deposits.	Battery terminals should be clean (free from rusting or corrosive deposits)	Corrosive deposits were observed on a few battery terminals, indicating potential maintenance issues and the need for cleaning and inspection.
64	Check dielectric Grease or Petroleum Jelly should apply on Battery Terminals	Battery terminals to prevent corrosion and enhance conductivity	Neither dielectric grease nor petroleum jelly is applied.
65	Check provision for battery rack earthing.	It should be properly earthed	Batteries are placed on wooden stands and racks, which may not meet recommended safety and fire resistance standards.
66	Check Eye Washer wherever lead acid Batteries are Installed.	• Should be available for Lead Acid Batteries. • NOT required for Ni-Cd Batteries / Maintenance free Batteries.	NOT AVAILABLE
67	Check the provision of separate earth pit.	2 nos. of dedicated earth pits should be available for LA.	AVAILABLE
68	Check down conductor separation from the structure.	Down Conductor should be fixed on insulators, and NOT directly on the structure.	YES
69	Check Fire Detection and Alarm system.	Fire Detection and Alarm system should be available in the following areas: • Electrical Room.	NOT AVAILABLE
70	Check whether the Uninterrupted power supply is provided to the Fire Detection and Alarm system	The power supply for the Fire Detection and Alarm system should be through UPS.	
71	Check Fire Sand Buckets are available near electrical equipment (Transformer, DG Set, Electrical Room, LDB)	• The sand should be free flowing. • Canopy should be provided when Fire Sand Buckets are placed in open area (for avoiding rainwater ingress).	NOT AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
72	Check whether portable fire extinguishers are available.	• Fire extinguishers should be mounted about 1 Meter above the ground / floor. • CO_2 Type for electrical installations. • DCP Type (ABC) for all other areas.	NOT AVAILABLE
73	Check escape route marking and exit signs	Escape routes and exit signs should be marked in a conspicuous manner	NOT AVAILABLE
74	Check the availability of LOTO Equipment	Lockout Devices, Tagout Devices, Unique Keys should be available.	NOT AVAILABLE
75	Check that, electrical panels are not exposed to rainwater	• Opening / rainwater exposure not allowed. • Canopy needs to be provided for outdoor electrical panel.	YES
76	Check for display of Resuscitation (Artificial Respiration) Chart near PDB and LDB	Resuscitation (Artificial Respiration) Chart should be displayed in English or Local language.	NOT AVAILABLE
77	Check provision of emergency lights	UPS / Invertor supply based critical emergency lighting should be available in critical areas like Electrical Room, D G Area, Security cabin, Entrance etc.	NOT AVAILABLE
78	Check electrical sockets for overloading	The electrical sockets should not be overloaded with multiple loads.	NOT OVERLOADED
79	Check unused industrial sockets covers	Unused industrial sockets should be closed with covers.	NA
80	Check that every connection is provided with one exclusive terminal connector	Visual inspection	No
81	Check Terminal box for easy access	Terminal box should be provided at a height not more than 3M from the floor level.	NA

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
82	Check whether the Terminal box is mounted firmly	Min. 4 fasteners should be used	NA
83	Check for presence of Rodents and Termites in the premises	• The premises should be kept clean and free from the traces of the leftover foods. • Repellents may be used to keep the biological agents away from electrical installation.	Evidence of rodent presence was observed inside the DG set, indicating a need for pest control measures and improved housekeeping.
84	Check whether the material used for false ceiling, flooring and wall furnishing (if any) is highly flammable	Use of highly flammable materials in the construction of false ceiling, flooring and wall furnishing should be avoided.	NONE
85	Check Single Line Diagram	Updated	NOT UPDATED
86	Check that as built drawing are available	Approved	
87	Check earth pit layout diagram	Updated	NOT AVAILABLE
88	Check earth pit test records	Earthing Electrode & Grid resistance should be measured at least once in a year in a dry period as per IS 3043	NOT AVAILABLE
89	LOTO Policy Documentation	• Written LOTO Procedure including Electrical Isolation Procedure should be available. • LOTO register should be maintained.	NOT AVAILABLE
90	Check Electrical Competency Licenses	Electrical competency certificates (electrical supervisor / Contractor / Wiremen License) regulated by the respective state regulatory state authority	AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
91	Check preventive maintenance schedule	The schedule should at least include the following equipment / installations. • Transformer • DG Set • PDB • LDB • UPS and Batteries	AVAILABLE
92	Check preventive maintenance check lists and records for last 3 years	With respect to schedule	NOT AVAILABLE
93	Check for measuring instrument calibration test certificates	Calibration certificates from NABL approved laboratory should be available for the following instruments • Digital Multimeter. • Digital Clamp meter. • Insulation Tester. • Earth Pit Tester. The calibration should be carried out at least once in a year.	NOT CALIBRATED
94	Check for electrical accident / incident records and investigation reports	With corrective action	NOT AVAILABLE
95	Check for cable and equipment Insulation Resistance (IR) test reports for last 3 years	The IR test should be carried out at least once in a year.	NOT AVAILABLE

Sl. No.	Activity Description	Requirement	Observation and Recommendation (If any)
96	Check for valid AMC for major electrical equipment	The valid AMC should be in place for the following equipment / installations. • DG Set • UPS and Batteries	AVAILABLE
97	Check for Electrical Safety Awareness Training records for last 3 years.	The Electrical Safety Awareness Training should be imparted to all the employees at least once a year.	AVAILABLE
98	Check for the compliance status of the reports of annual inspection of electrical installations by local authorities	Check for last 3 years	AVAILABLE
99	Test certificates for insulating rubber gloves (for electrical purpose) check for last 3 years	The insulating rubber gloves should be tested at least once in 6 months as per IS 4770	NOT AVAILABLE
100	Check for Fire Extinguisher inspection records for last 3 years	Fire Extinguisher should be checked at least once in 3 months	NOT AVAILABLE
102	Check for Fire Detection and Alarm System for last 3 years	Inspection maintenance and testing should be carried out at least once in 3 months	NOT AVAILABLE
103	Fire NOC	Check availability, validity and compliance with conditions mentioned therein	AVAILABLE

Table 4.7 Detailed assessment of external energy audit of Arts block

4.4.1.5 Additional opportunities for further improvement

1. Earth pits were not traceable in both the Arts Block and Science Block. It is recommended to clearly mark, document, and ensure accessible identification of all earthing points as part of compliance and maintenance protocol.
2. All meter panels exhibited severe dust accumulation, and some panels were found missing glass covers. Regular cleaning and replacement of missing covers are recommended to ensure safety and proper visibility of meters.
3. Multiple electrical panels were found with visible rusting, indicating prolonged exposure to moisture or lack of maintenance. This can compromise panel integrity and electrical safety, and hence should be addressed promptly through cleaning, repainting, or replacement.
4. Damage and rusting were observed on the armoured cable entering the changeover panel (to VDB4 – Economics Block). It is recommended to repair or replace the affected section and ensure proper sealing and corrosion protection to prevent further deterioration.
5. Several panels were found without proper labelling of names and ratings. Clear and durable labelling should be provided to ensure easy identification, enhance operational safety, and assist in maintenance activities.
6. Multiple SFUs were found bypassed in both the Arts Block and Science Block. It is recommended to restore proper fuse protection to ensure circuit safety and fault isolation.
7. Discoloration of cable terminals due to overheating and overcurrent was observed in multiple panels. This indicates potential loose connections or overload conditions, and corrective action should be taken to prevent equipment damage or fire hazards.
8. Fire extinguisher was not available in the Science Block electrical room, and the extinguisher in the Arts Block electrical room was found to be past its expiry date. Immediate replacement and proper maintenance are recommended to ensure fire safety compliance.
9. Neither sand buckets nor fire extinguishers were available near the DG area. Provision of basic fire-fighting equipment is essential and should be ensured to enhance emergency preparedness.
10. Insulated hand gloves were not available in both Science Block and Arts Block. These are essential for electrical safety and should be provided in all electrical rooms.
11. Earth Leakage Relays (ELRs) were not available in both the Science Block and Arts Block. Installing ELRs is recommended to enhance personnel safety and provide protection against earth leakage faults.
12. Lockout-Tagout (LOTO) systems are not implemented in the college. Introducing LOTO procedures will significantly improve electrical safety during maintenance and servicing activities by preventing accidental energization.
13. Multiple panels were found with severe dust accumulation and cobwebs. Regular cleaning and maintenance schedules should be implemented to ensure panel hygiene and reduce fire hazards.
14. Multiple RCCBs were found either non-functional or bypassed. It is recommended to replace faulty RCCBs and ensure all protective devices are operational to maintain electrical safety standards.
15. In the Maths Department of the Science Block, the LDB panel shows a ground-to-neutral voltage of 43.8 V, indicating a possible insulation or grounding issue. Additionally, the RCCB in this panel is non-functional. It is recommended to investigate the fault, rectify the insulation or grounding issue, and replace or repair the RCCB to ensure personnel and equipment safety.
16. Several hanging wires were observed in multiple areas, particularly in the Physics Department UPS room, posing a potential safety hazard and requiring proper cable management.
17. Multiple conduits were found left open with exposed cables, indicating the need for proper sealing to ensure safety and protection from environmental factors.
18. Two-point earthing has not been provided for the UPS battery rack, which is a deviation from standard electrical safety practices.
19. In the main UPS room of the Arts Block, out of two exhaust fans, one was found not working, indicating inadequate ventilation.
20. The neutral wire connected to the 400A 4P COS-5 of the Solar Utility Panel in the Arts Block was found

burnt, indicating a potential issue of overloading, loose termination, or imbalance that requires immediate rectification.

21. Foreign objects such as KSEB bills and damaged SFUs were found placed inside the electrical panels, posing a serious safety and fire hazard. Immediate removal and strict housekeeping protocols are recommended.
22. Indication lamps were found non-functional in multiple panels, which can hinder quick visual identification of panel status. Replacing faulty lamps is recommended to ensure proper monitoring and safety.
23. Porcelain fuses were found bypassed in both the Arts Block and Science Block. This compromises circuit protection and poses significant safety risks. Immediate corrective action is recommended to restore proper fuse protection.
24. Eyewash station is not available in the main UPS room of the Arts Block. It is recommended to install an eyewash facility to enhance safety in case of accidental exposure to harmful substances or battery acid.
25. Neither fire detection systems nor fire alarm systems are available in the electrical rooms of both the Arts Block and Science Block. It is recommended to install appropriate fire detection and alarm systems to ensure early warning and improved safety during fire-related emergencies.

4.4.1.6.Load balance check

Sl. No.	Area	Equipment	Current (in A)		
			L1	L2	L3
1	ARTS BLOCK MSB PANEL	INCOMER	31.50	33.83	27.33
2		TO VDB-4 ECONOMICS FLOOR	16.24	8.66	21.36
3	SSB-1	TO COS-1	31.01	33.8	42.4
4	SOLAR UTILITY PANEL	TO 400A 4P COS-5	50.5	79.6	53.6
5	A-BLOCK (NOT LABELLED)	INCOMER	76.2	49.8	54.2
6	SSB-2	INCOMER	49.5	34.32	31.16
7	VDB FOR LIFT(NOT LABELLED)	INCOMER	19.00	18.08	20.50
8	DG PANEL(NOT LABELLED)	INCOMER	64.6	81.3	64.4
9	SCIENCE BLOCK MSB PANEL	INCOMER	24.55	38.27	15.03
10		HOME SCIENCE	2.03	5.73	4.18
11		SCIENCE BLOCK	37.17	45.9	32.16
12		LIFT	10.98	1.19	6.95
13	SOLAR SUBPANEL	PANEL-2(NOT LKABELLED)	14.38	4.93	11.34

Table 4.8 Load balance checking of each block

SL NO	L1 (R Phase)	L2 (Y Phase)	L3 (B Phase)
1	1.98	9.52	11.52
2	5.32	43.84	38.51
3	13.23	5.43	18.64
4	17.52	29.99	12.47
5	26.85	17.10	9.78
6	29.15	10.46	18.71
7	0.99	5.78	6.83
8	7.85	15.98	8.13
9	5.39	47.47	42.07
10	48.99	43.97	5.03
11	3.23	19.50	16.27
12	72.36	81.32	9.10
13	40.70	51.76	10.96

Table 4.9 Load balance phase reading

Finding:

The recorded percentage current unbalance across phases is consistently high, with multiple instances crossing 40% and a peak nearing 81%. This indicates improper load distribution and potential overloading of individual phases, posing a risk to equipment and system efficiency.

Recommendation:

Immediate corrective action is required. Redistribute loads across phases to reduce unbalance. Conduct a detailed phase-wise load study and implement routine monitoring to ensure balance is maintained and risks to equipment are minimized.

Note: Load imbalance should not be more than 10%.

4.4.1.7.Photographs

4.4.1.7.1.Good safety practices:

Fig 4.6. Insulated rubber mats conforming to IS 15652 are installed in front of electrical panels in the electrical room, ensuring protection against electric shock during operation or maintenance.

Fig 4.7. Each three-phase motor is equipped with dual earthing points in accordance with standard grounding requirements to enhance safety and fault clearance reliability.

Fig 4.8. An emergency stop push-button is provided for the Diesel Generator (DG) system, facilitating immediate shutdown in case of operational hazards or emergency conditions.

4.4.1.7.2. Opportunities for further improvement:
Arts Block

Fig 4.9. The electrical room entrance lacks a visible 'Authorized Personnel Only' signage, which is essential for restricting unauthorized access and ensuring compliance with safety

Fig 4.10. All Switch Fuse Units (SFUs) in the DG panels were found electrically bypassed, rendering the overcurrent protection mechanism inoperative and posing a

Fig 4.11. Multiple electrical panels were found without proper identification labels indicating their name and rating, which is not in accordance with standard electrical labeling practices.

Fig 4.12. Plastic chairs, cardboard boxes, and scrap materials such as old SFUs were found stored inside the electrical room, which is a violation of standard housekeeping and safety practices.

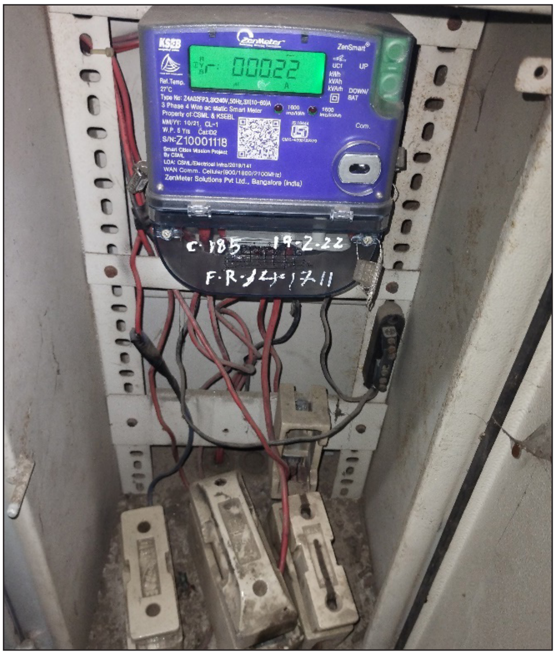


Fig 4.13. Multiple meter panels were found with heavy dust accumulation, indicating inadequate maintenance and posing potential operational and safety risks.

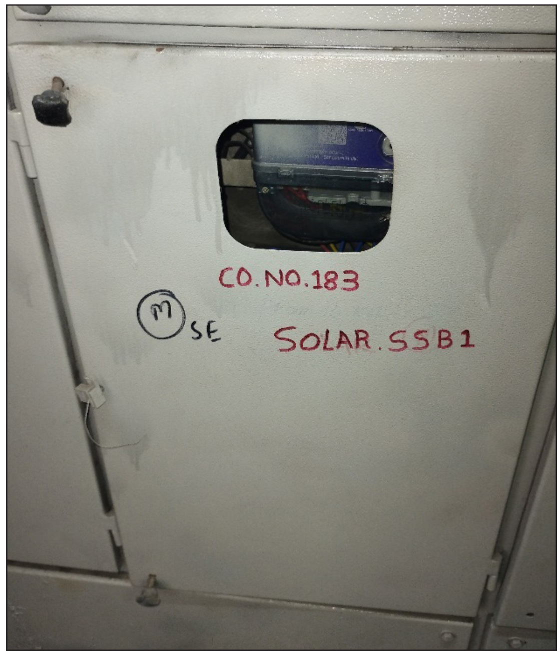


Fig 4.14. Multiple meter panels were found without glass covers, which compromises equipment protection and poses a safety hazard.

Fig 4.15. Multiple SFUs were found bypassed, indicating a critical lapse in circuit protection and non-compliance with standard electrical safety practices.

Fig 4.16. Burn marks caused by blown SFUs were observed in multiple panels, indicating past fault incidents and insufficient maintenance or timely replacement.

Fig 4.17. Multiple panels were found without rubber door seals, compromising protection against dust, moisture, and ingress, and reducing the effectiveness of the panel's IP rating.

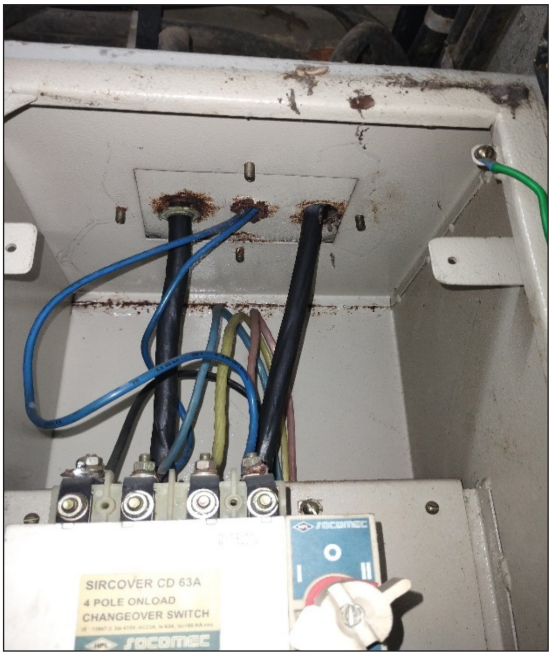


Fig 4.18. Multiple cables were found entering the TO VDB-4 panel (Economics Block) without proper cable glands or sealing arrangements, resulting in potential damage to the cables due to sharp

Fig 4.19. Damage to the armored cable due to rusting and signs of overheating was observed inside the TO VDB-3 panel (IGNOU Block), indicating prolonged exposure to moisture and thermal stress.

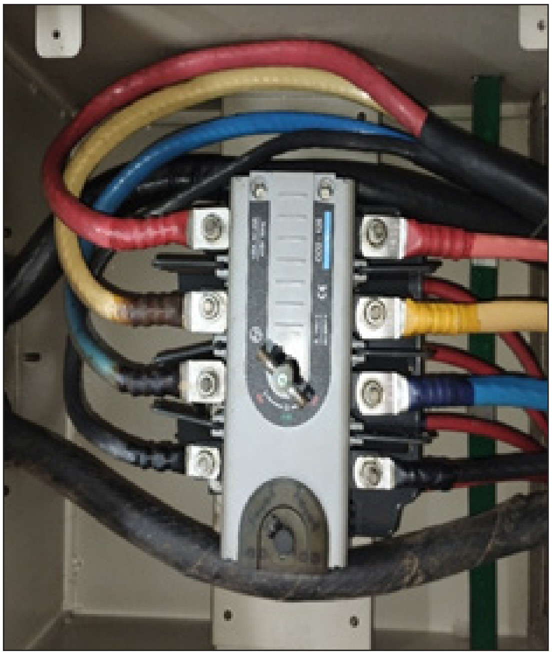


Fig 4.20. Discoloration due to overheating was observed at the cable terminals in multiple panels, indicating possible loose connections or overloading.

4.4.1.8 Thermography

4.4.1.8.1 Thermographic Assessment

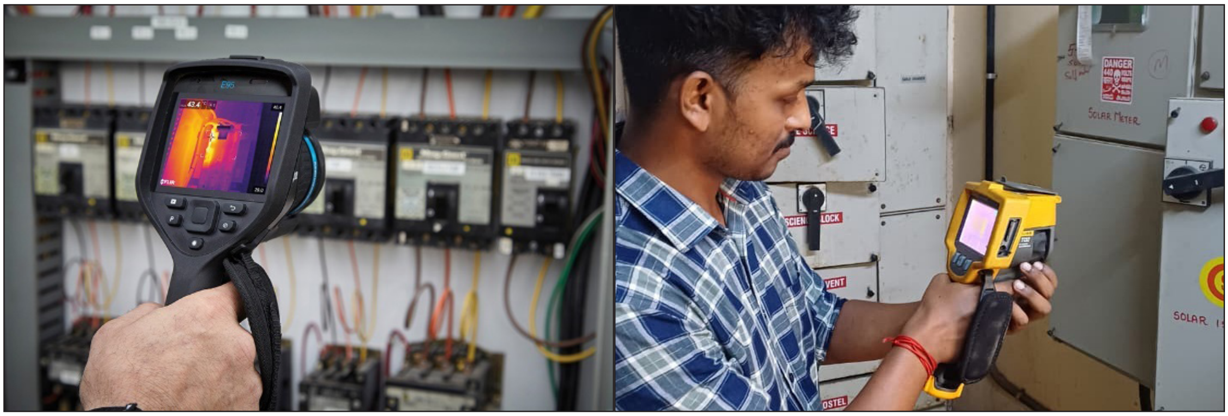


Fig 4.21. Thermal imaging

Thermal images are an easy way to identify apparent temperature differences in industrial three-phase electrical circuits, compared to their normal operating conditions. By inspecting the thermal gradients of all three phases side-by-side, can quickly spot performance anomalies on individual legs due to unbalance or overloading.

Equal load should equate to equal temperatures. In an unbalanced load situation, the more heavily loaded phase(s) will appear warmer than others due to the heat generated by resistance. However, an unbalanced load, an overload, a bad connection, and a harmonic imbalance can all create a similar pattern. Measuring the electrical load is required to diagnose the problem.

The measured temperature with respect to the ambient temperature is compared to detect the abnormal heating of components.

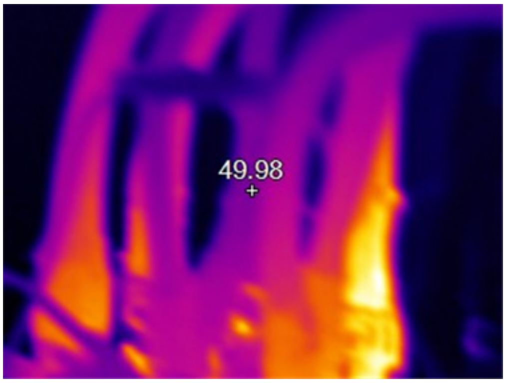
Temperature Rise above Ambient	Severity	Recommended Action
1^{0}C to 10^{0}C	Normal	No Action Required
11^{0}C to 35^{0}C	Minor	Monitor, analyse load condition, schedule for repairs.
36^{0}C to 75^{0}C	High	Repair in one or two days, reduce load until repairs are complete.
Over 76^{0}C	Critical	Repair immediately, reduce or control load till repairs are complete.

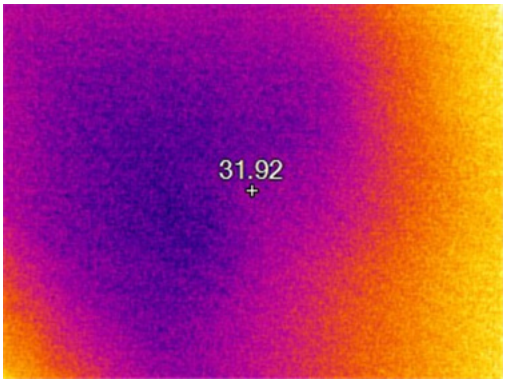
Table 4.10 Thermal imaging temperature measure

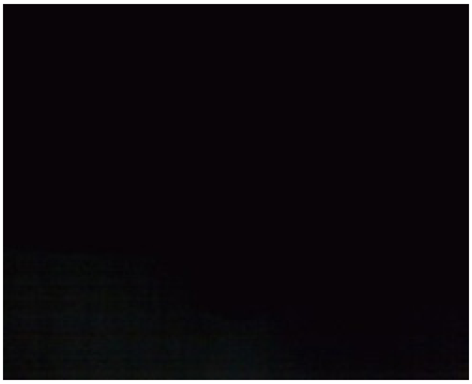
The thermal assessment conducted panel-wise is detailed in the following section.

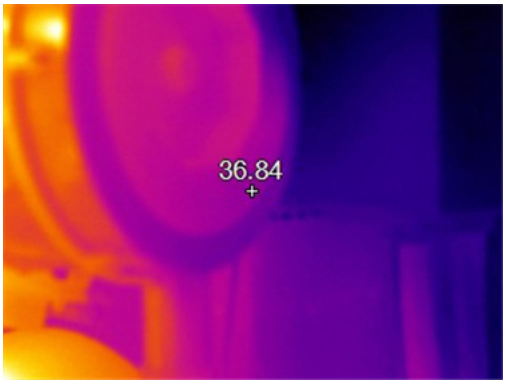
Thermal image

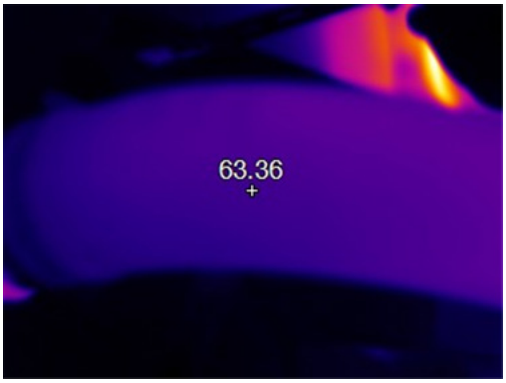
Real image



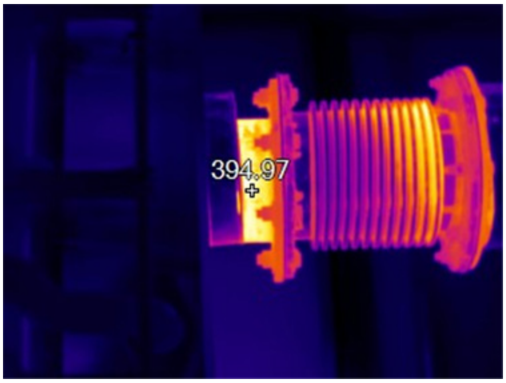


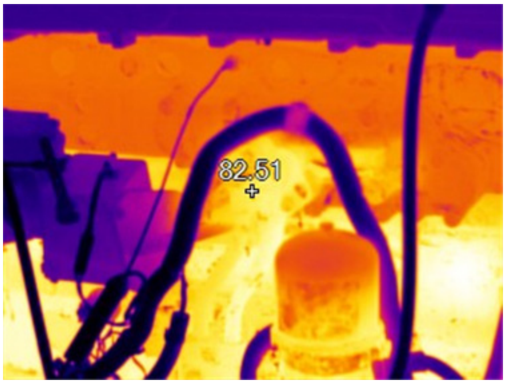


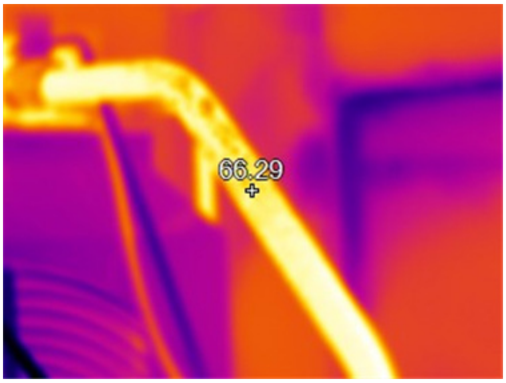




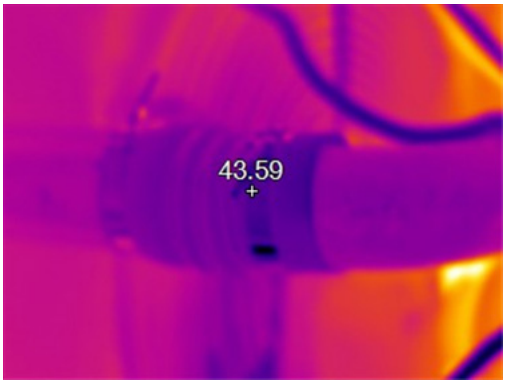
Thermal image | Real image

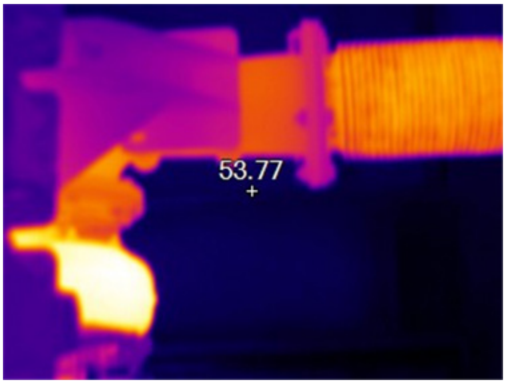


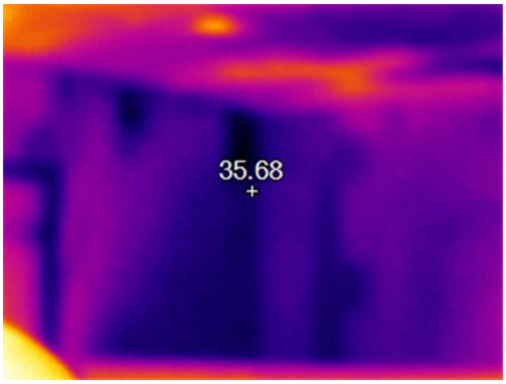


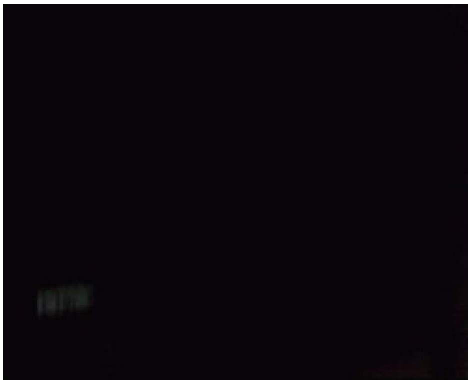


Thermal image	Real image

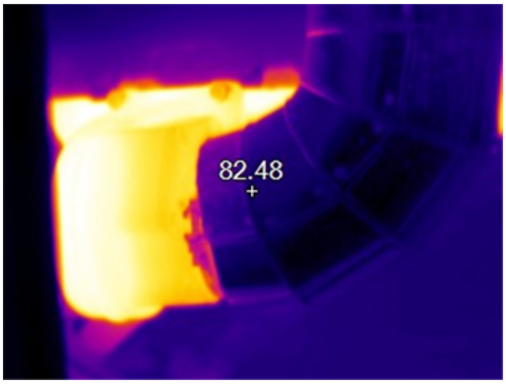


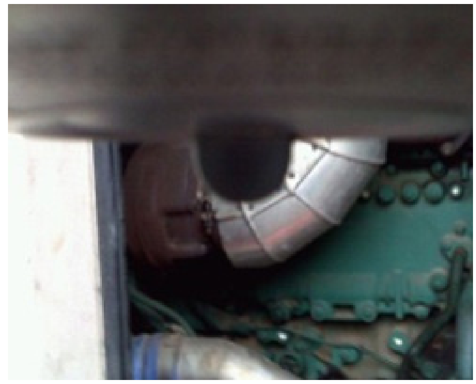



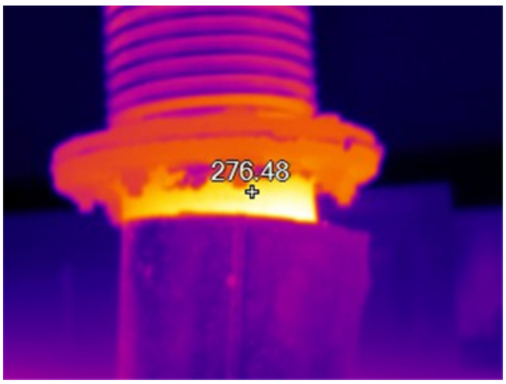



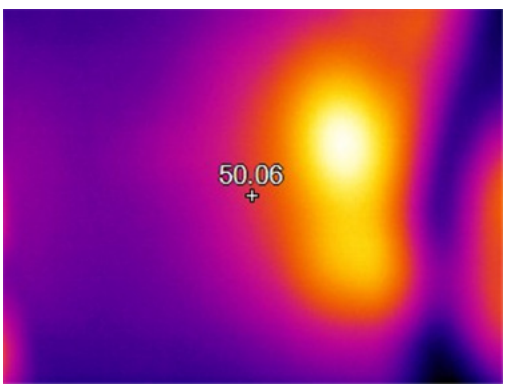


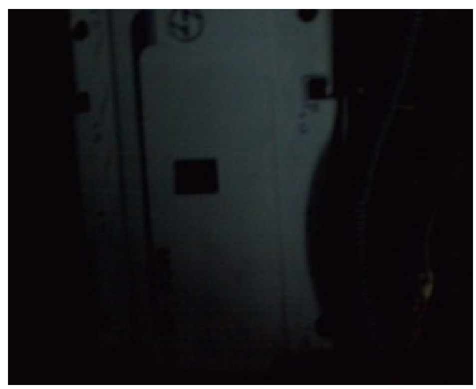

Thermal image | Real image

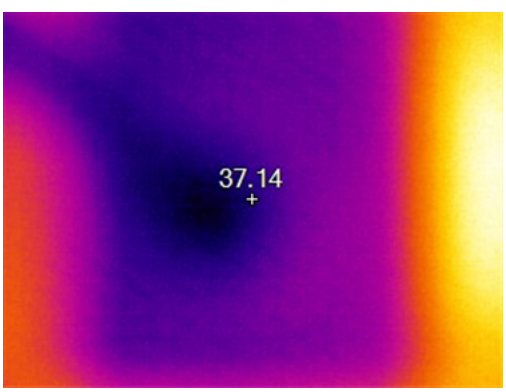












Thermal image

Real image

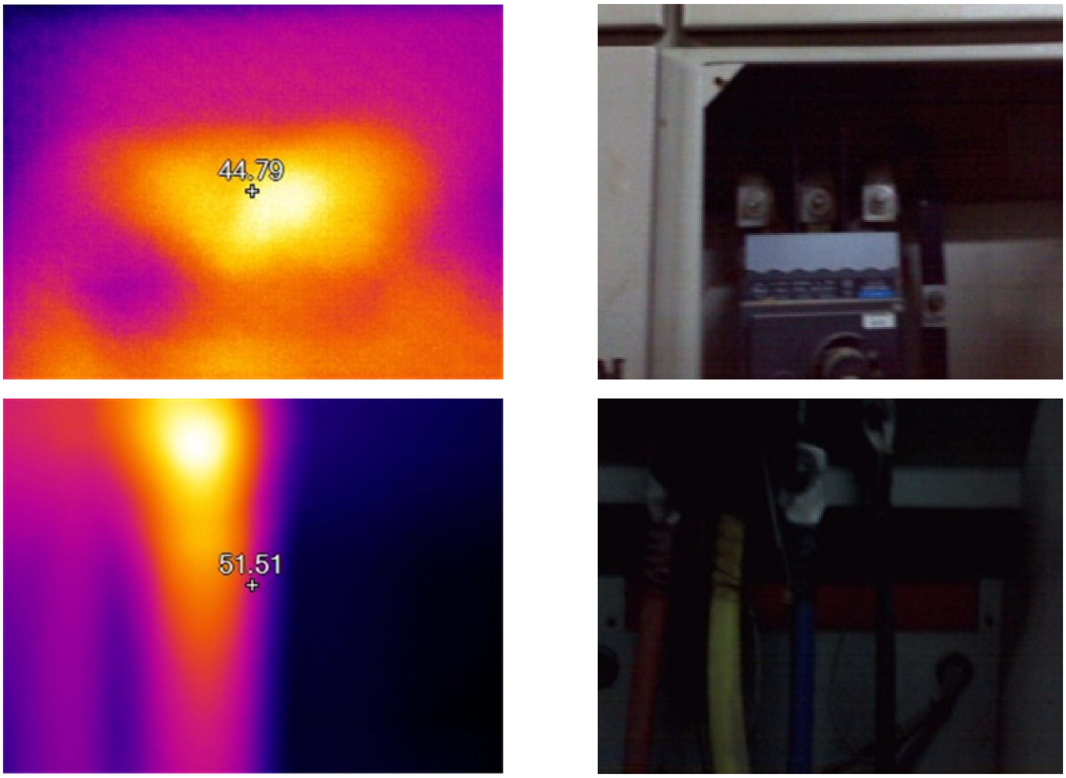


Fig 4.22. Thermal imaging picture of each electrical point

4.4.2 KSEB Electricity bill anaysis

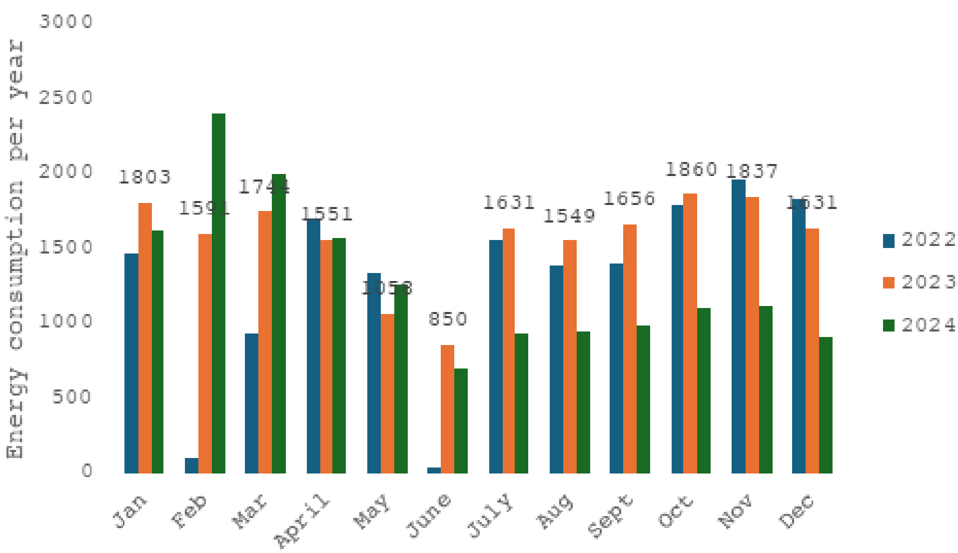


Fig 4.23. Yearly monthly consumption data (kWh) for Consumer No. 1155402000538.

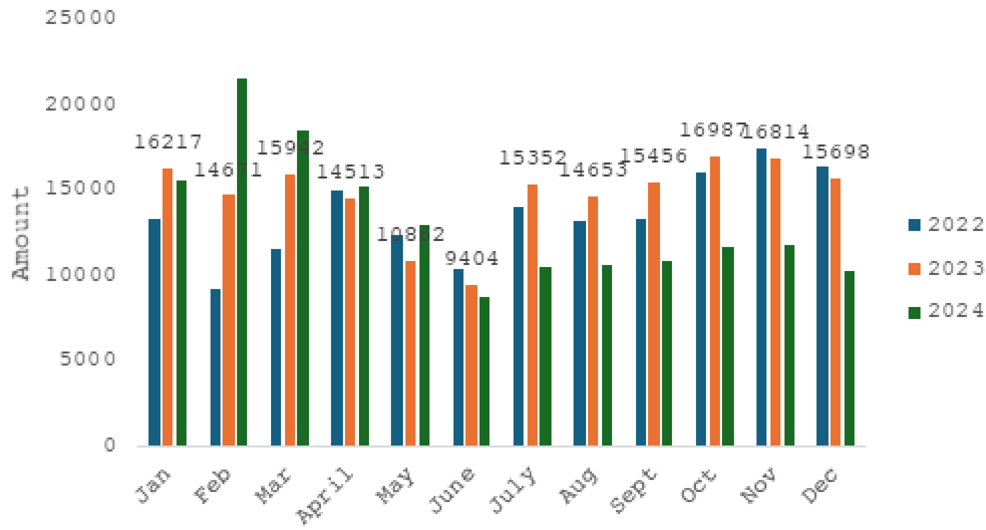


Fig 4.24.Monthly electricity consumption (kWh) for Consumer No. 1155402000538, presented annually.

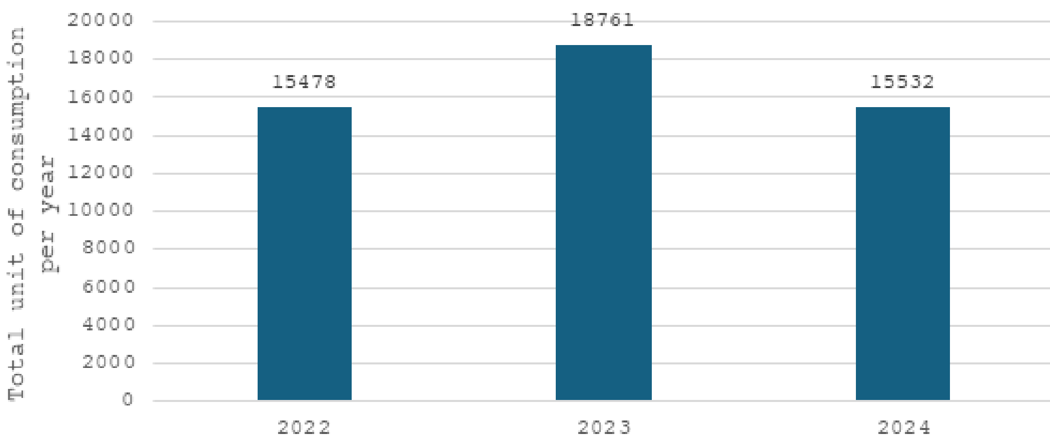


Fig 4.25. Total annual electricity consumption for Consumer No. 1155402000538 (kWh).

The home science block is equipped with a solar production capacity of 10 kW. In 2023, energy consumption was significantly higher compared to both 2022 and 2024. During this period, the solar system was not configured to export energy; all generated power was consumed on-site. This resulted in elevated electricity bills and high energy consumption in 2022, indicating that the solar system was not sufficient to reduce reliance on KSEB electricity.

In 2024, both the electricity bill and energy consumption decreased, suggesting a restored reliance on solar energy. The increased energy consumption in 2023 may have been due to overutilization, expanded infrastructure capacity, or potential issues within the solar system, contributing to the fluctuations observed in energy use and costs.

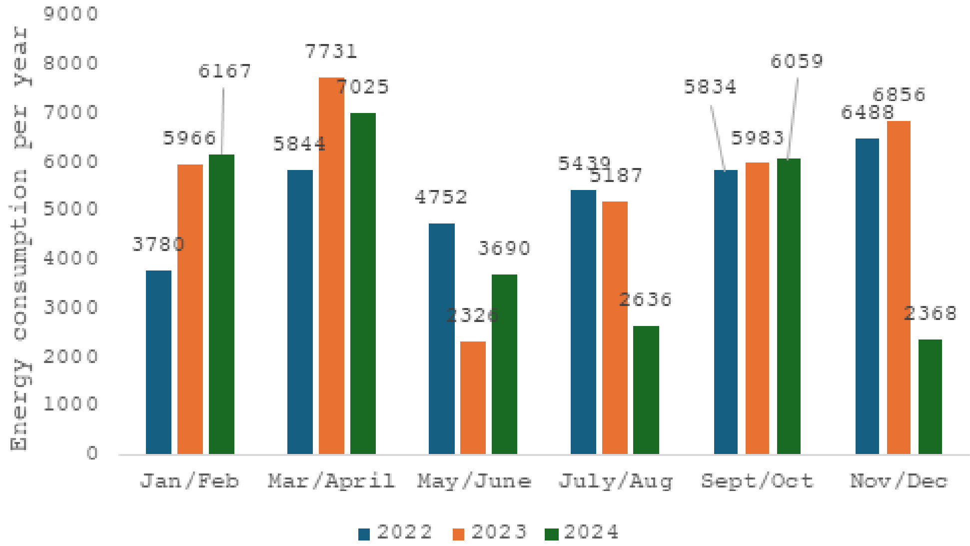


Fig 4.26. Yearly Monthly consumption data (kWh) for Consumer No. 1155405000539

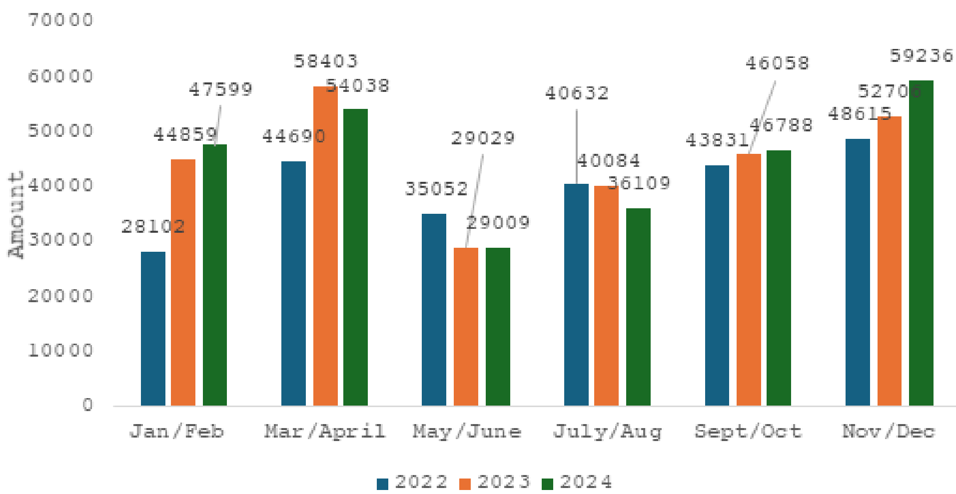


Fig 4.27. Monthly electricity consumption (kWh) for Consumer No. 1155405000539, presented annually.

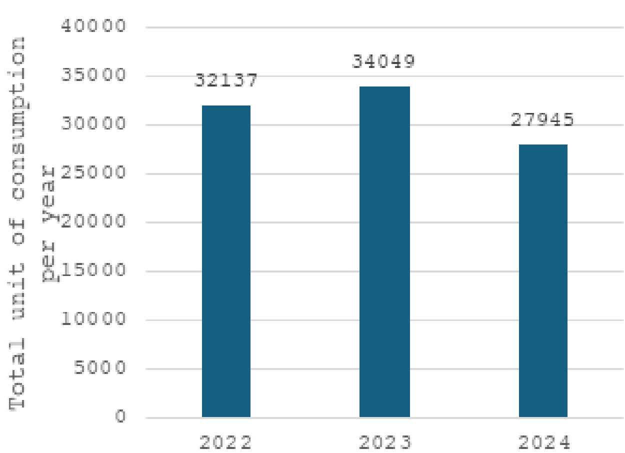


Fig 4.28. Total annual electricity consumption for Consumer No. 1155405000539 kWh).

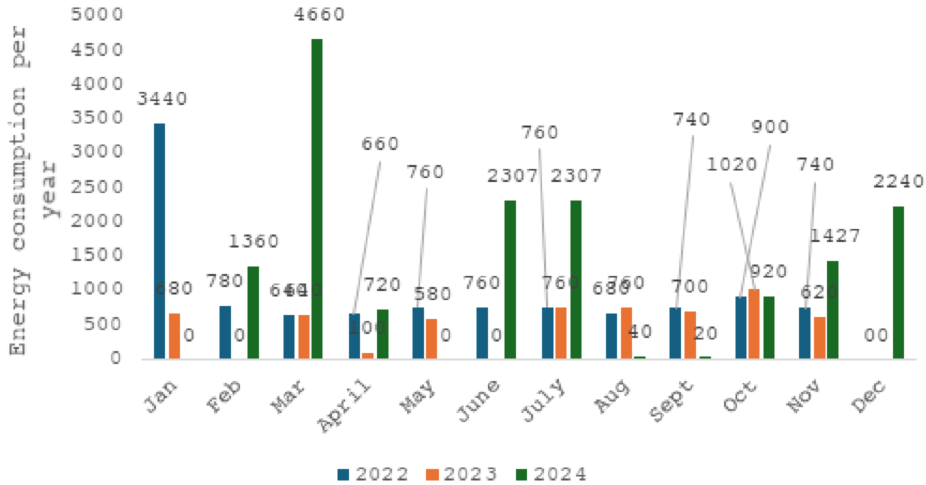


Fig 4.29. Yearly monthly consumption data (kWh) for Consumer 1155400000540.

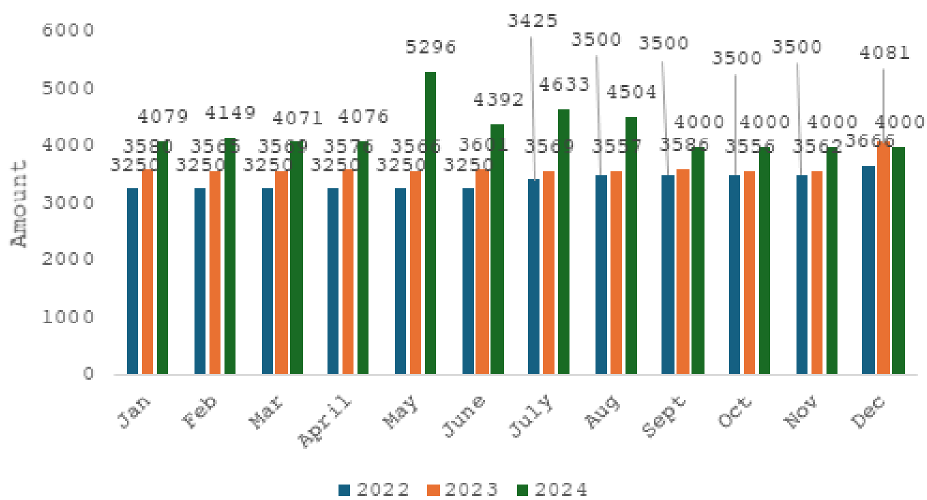


Fig 4.30. Monthly electricity consumption (kWh) for Consumer No. 1155400000540, presented annually.

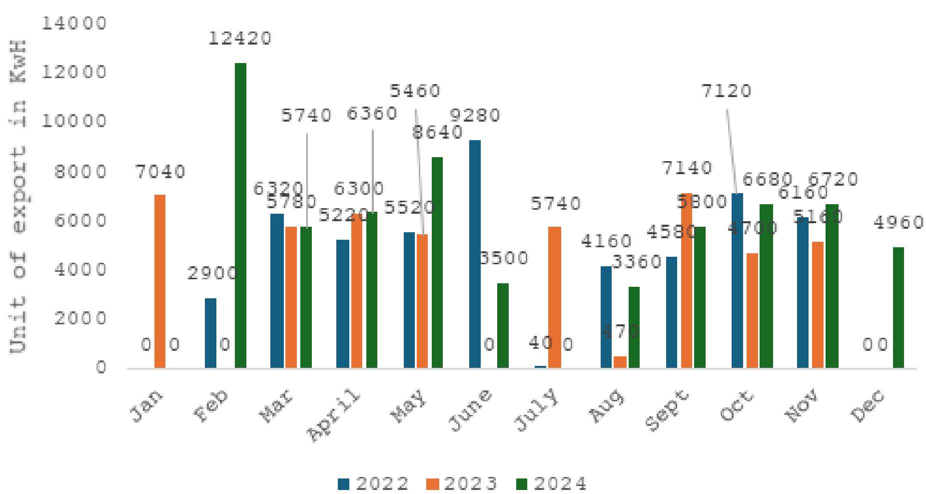


Fig 4.31. Annual Export Units (kWh) for Consumer No. 1155400000540, as reported by KSEB.

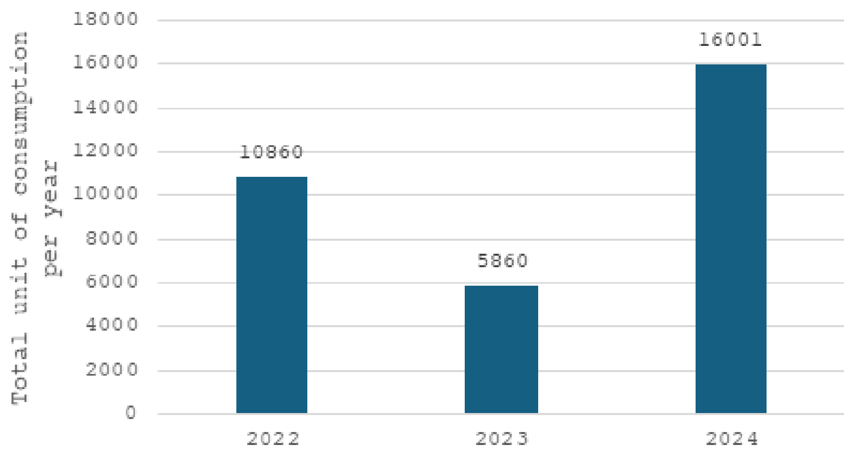


Fig 4.32. Total annual electricity consumption for Consumer No. 1155400000540 (kWh).

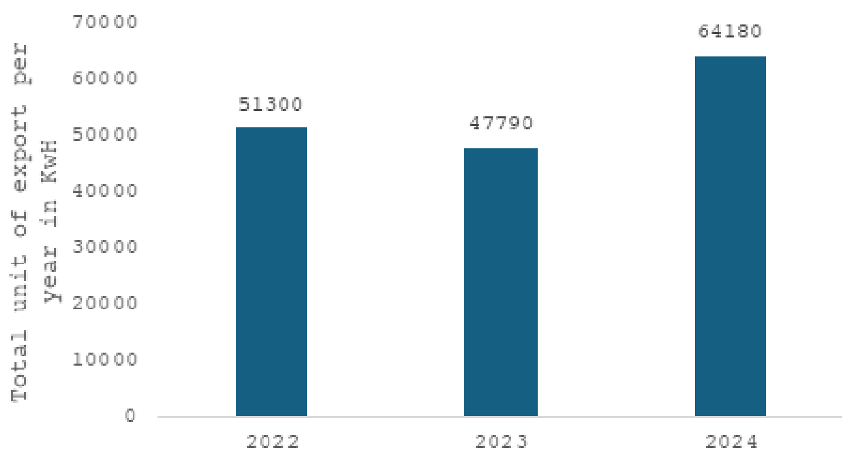


Fig 4.33. Total annual solar energy exports for Consumer No. 1155400000540 (kWh).

The science block generates approximately 60 kV of solar energy; however, the electricity consumption and billing amounts remain high in 2024 compared to 2022 and 2021. This suggests that electricity consumption and billing have not changed significantly despite the installation of solar power. Potential factors contributing to this include increasing the strength of the infrastructure capacity or addressing critical issues, such as load imbalance, which may be reasons for the reported energy usage.

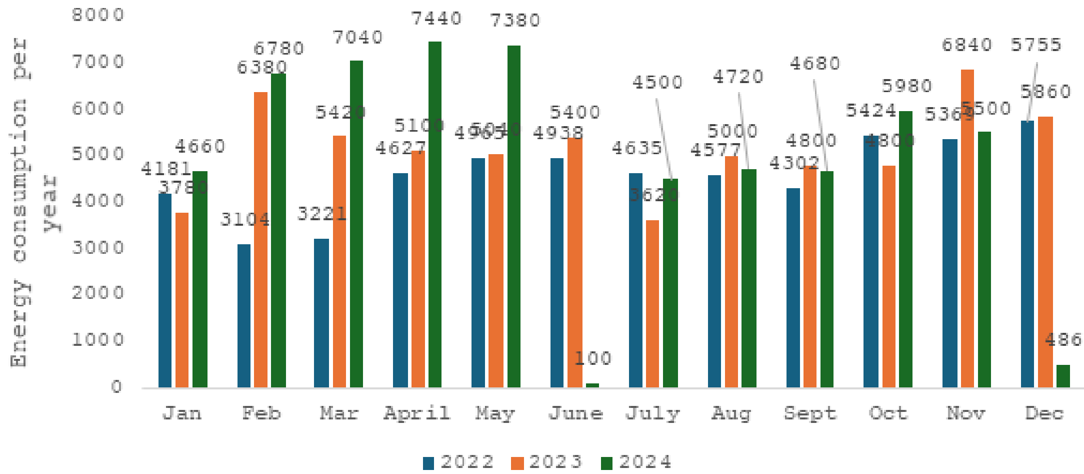


Fig 4.34. Yearly monthly consumption data (kWh) for Consumer No. 1155407000183.

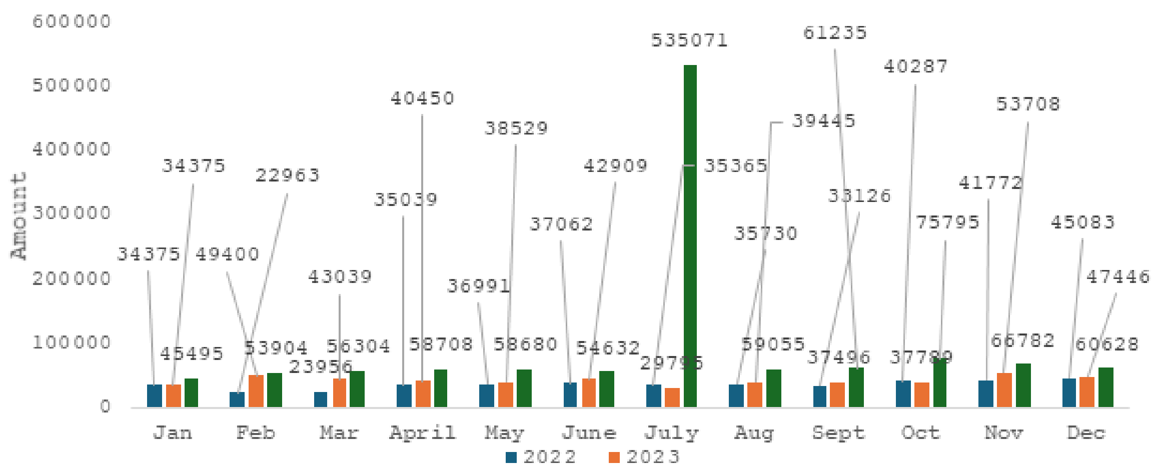


Fig 4.35. Monthly electricity consumption (kWh) for Consumer No. 1155407000183, presented annually.

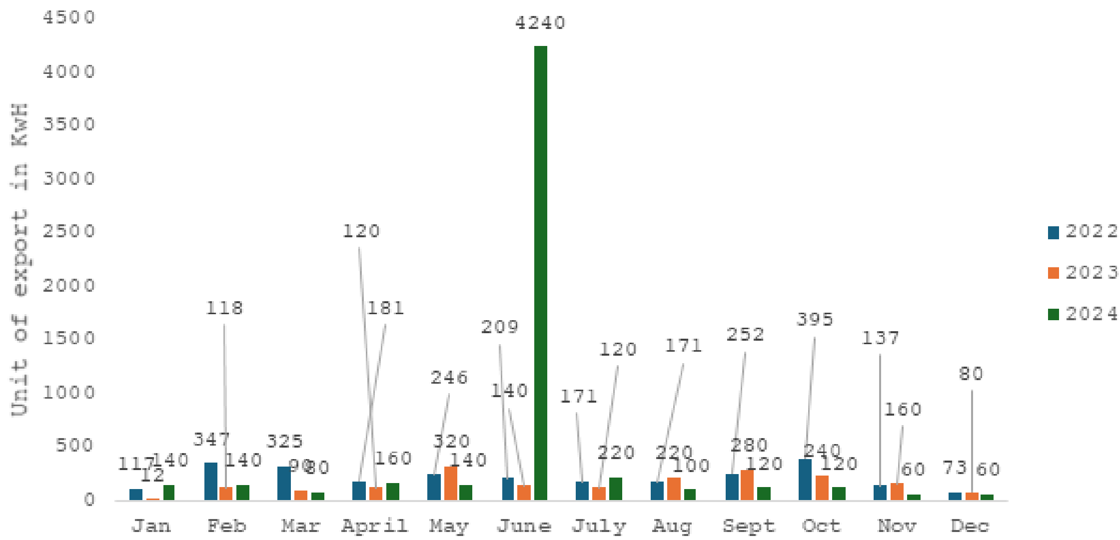


Fig 4.36. Annual Export Units (kWh) for Consumer No. 1155407000183, as reported by KSEB

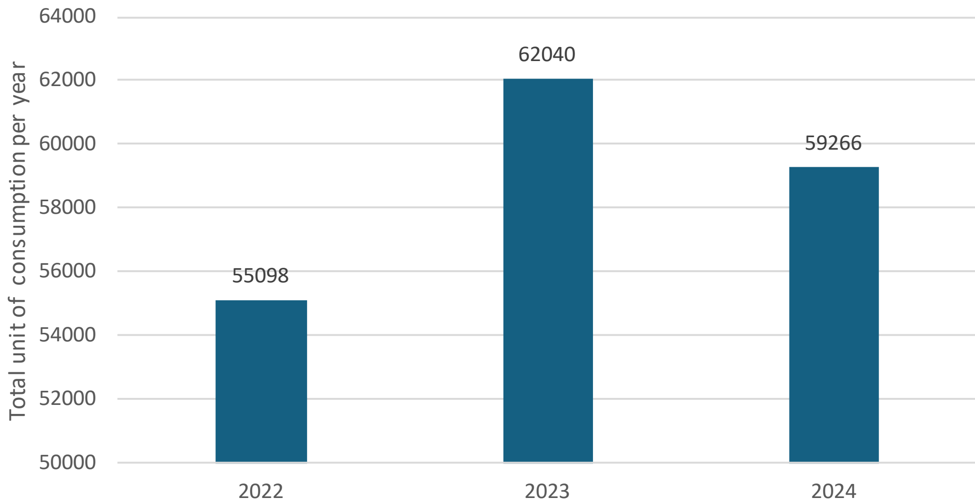


Fig 4.37. Total annual electricity consumption for Consumer No. 1155407000183 (kWh).

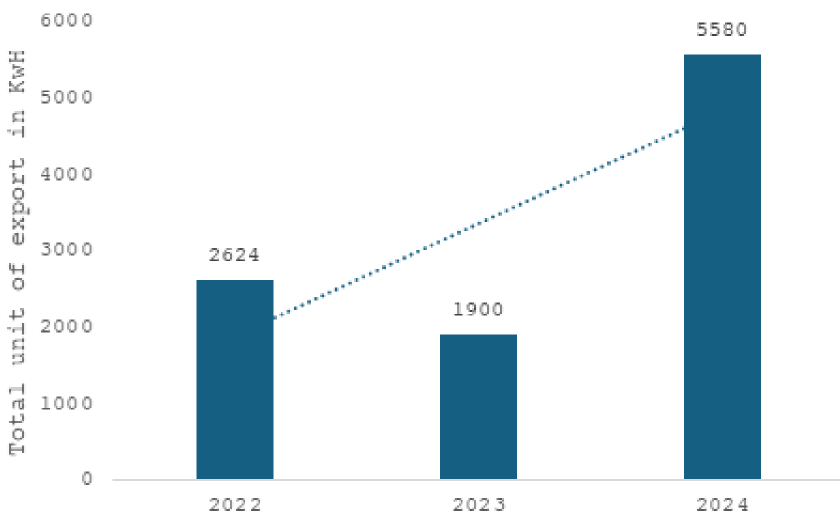


Fig 4.38. Total annual solar energy exports for Consumer No. 1155407000183 (kWh).

The arts block produces around 20 kV of solar energy; however, electricity usage and billing costs in 2024 remain elevated compared to 2022 and 2021. This indicates that electricity consumption and expenses have not significantly decreased even with the implementation of solar power. Possible reasons for this include enhancing the capacity of the infrastructure or tackling key problems, such as load imbalance, which could explain the reported energy consumption.

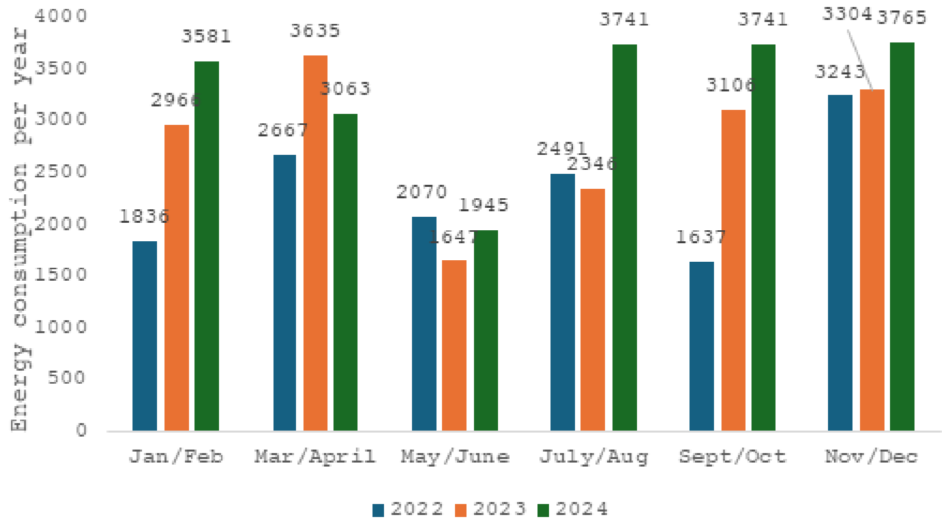


Fig 4.39. Yearly monthly consumption data (kWh) for Consumer No. 115540930185.

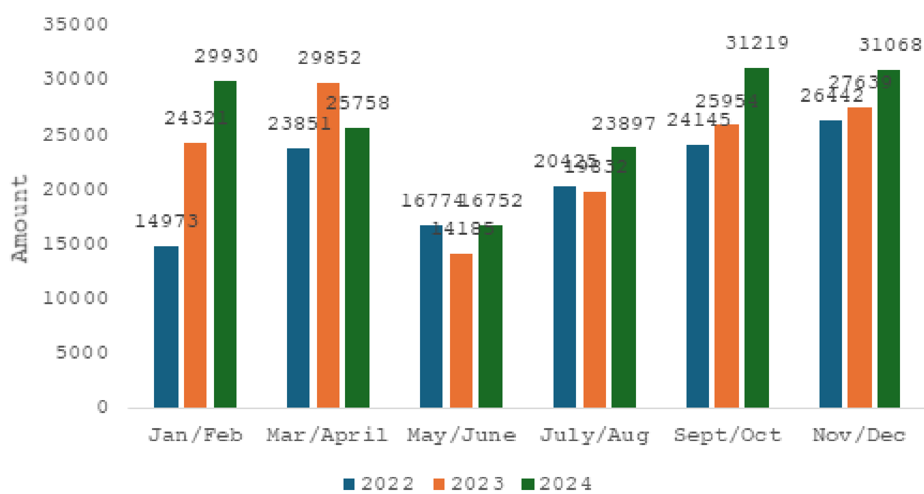


Fig 4.40. Monthly electricity consumption (kWh) for Consumer No. 115540930185, presented

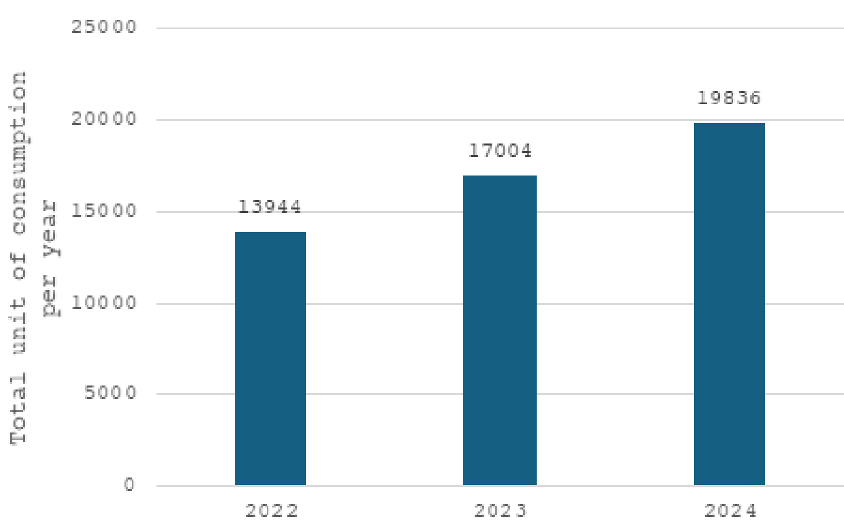


Fig 4.41. Total annual electricity consumption for Consumer No. 1155402000185 (kWh).

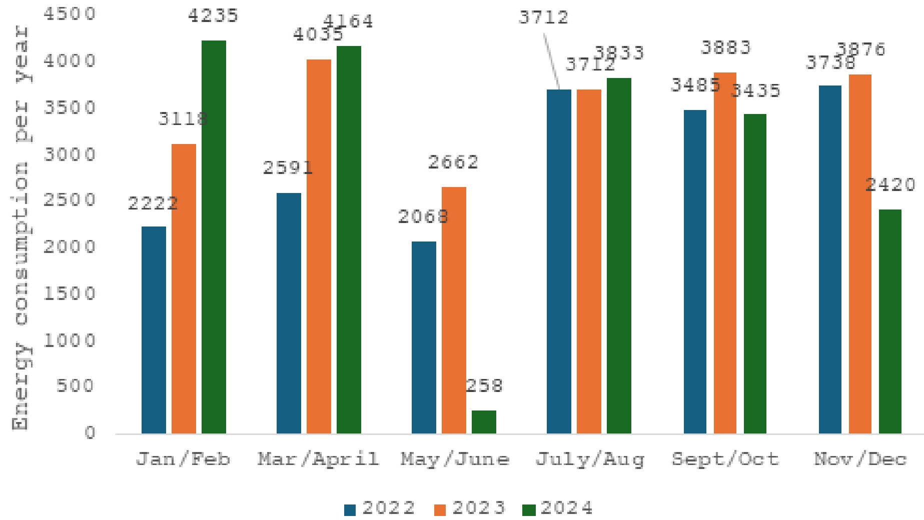


Fig 4.42. Yearly monthly consumption data (kWh) for Consumer No. 115540930185

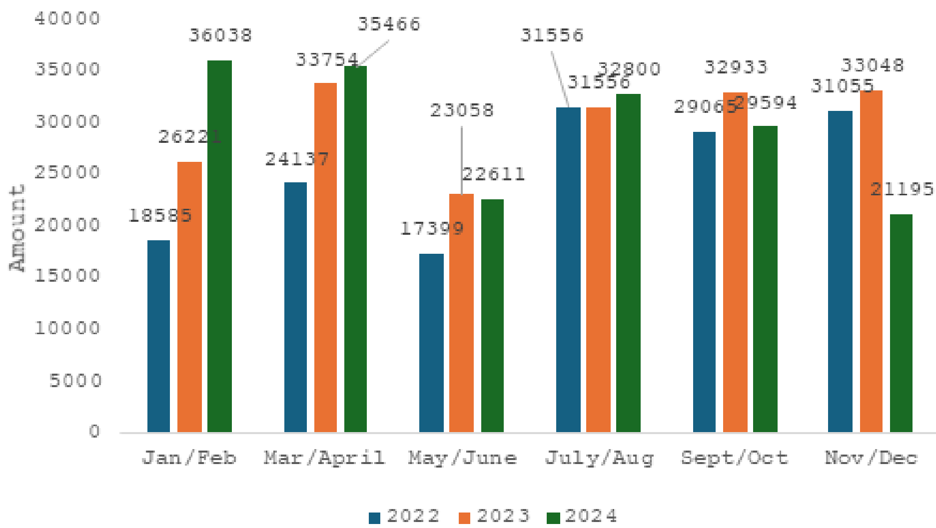


Fig 4.43. Monthly electricity consumption (kWh) for Consumer No. 115540930185, presented annually.

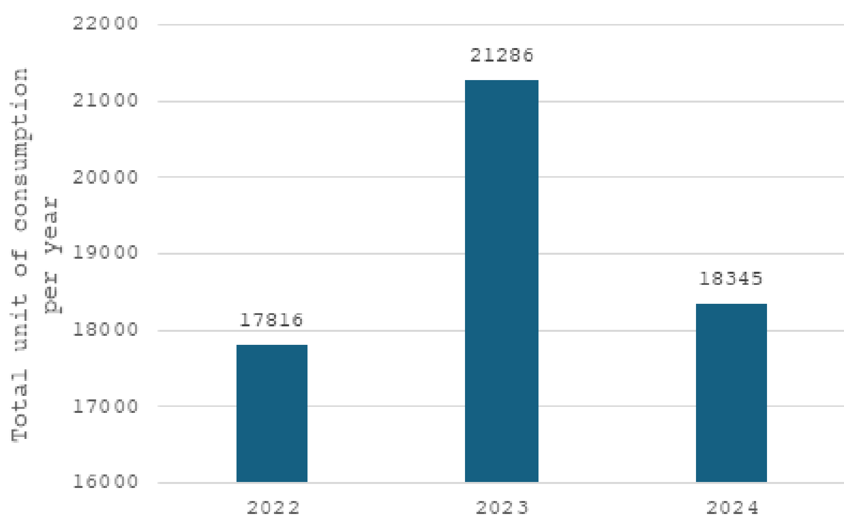


Fig 4.44. Total annual electricity consumption for Consumer No. 115540930185 (kWh).

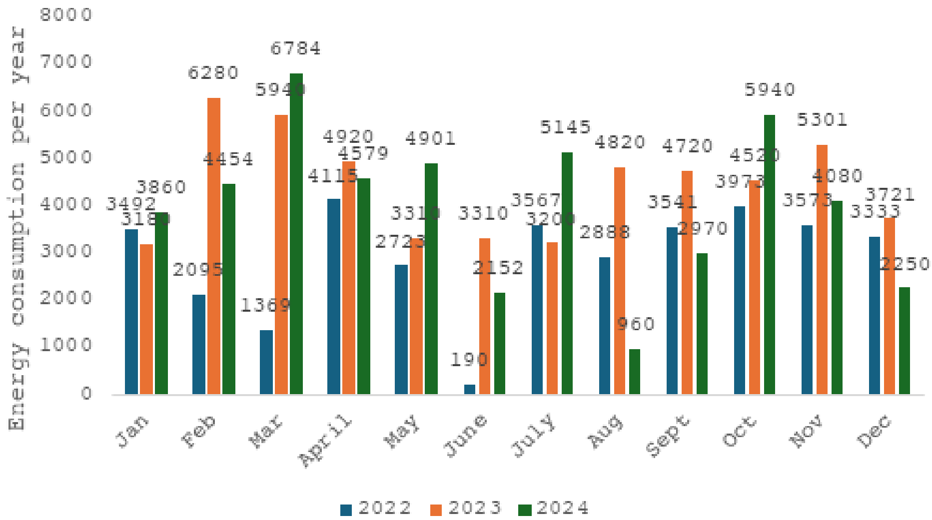


Fig 4.45. Yearly monthly consumption data (kWh) for Consumer No. 1155403010417.

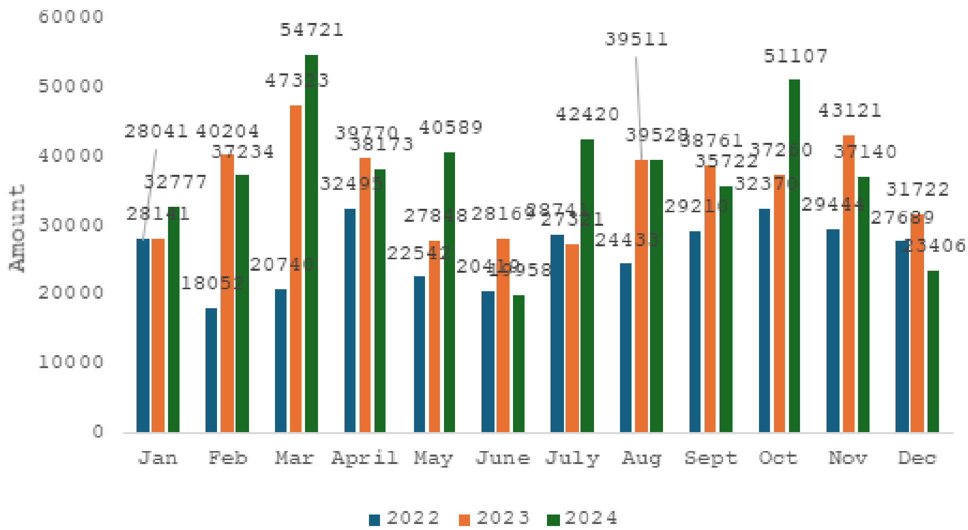


Fig 4.46. Monthly electricity consumption (kWh) for Consumer No. 1155403010417, presented annually.

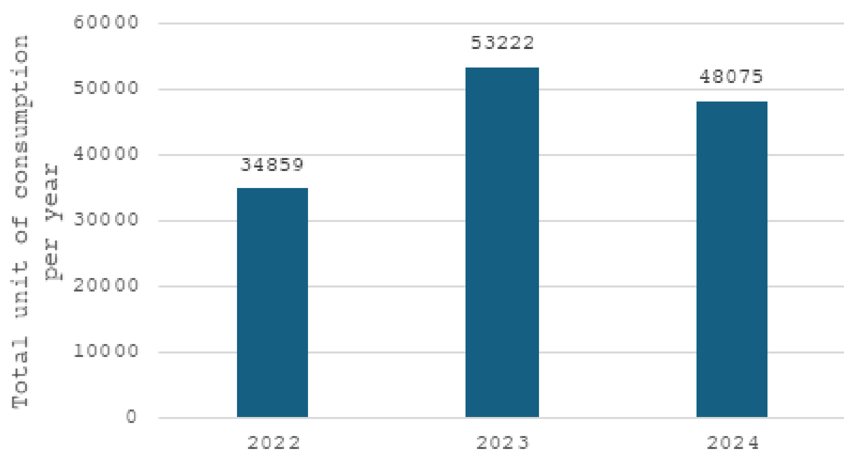


Fig 4.47. Total annual electricity consumption for Consumer No. 1155403010417 (kWh).

The D block is equipped with a solar production capacity of 80 kW. In 2023, energy consumption was significantly higher compared to both 2024 and 2022. During this period, the solar system was not configured to export energy; all generated power was consumed on-site. This resulted in elevated electricity bills and high energy consumption in 2022, indicating that the solar system was not sufficient to reduce reliance on KSEB electricity.

In 2024, both the electricity bill and energy consumption decreased, suggesting a restored reliance on solar energy. When compared to all buildings, D block accumulates more energy consumption due to classrooms, the IQAC office, a conference hall, and a dual auditorium, one of which is fully equipped with centralised air conditioning. All this might be a factor in high energy consumption

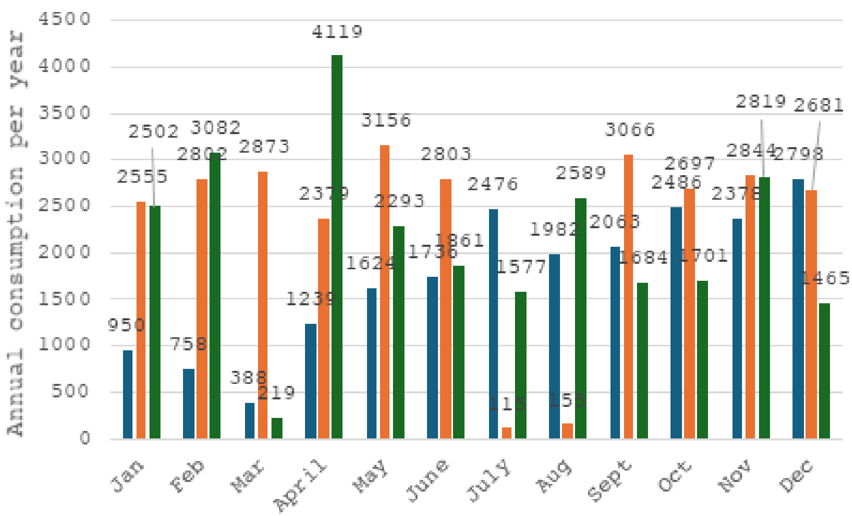


Fig 4.48. Yearly monthly consumption data (kWh) for Consumer No.115540604822.

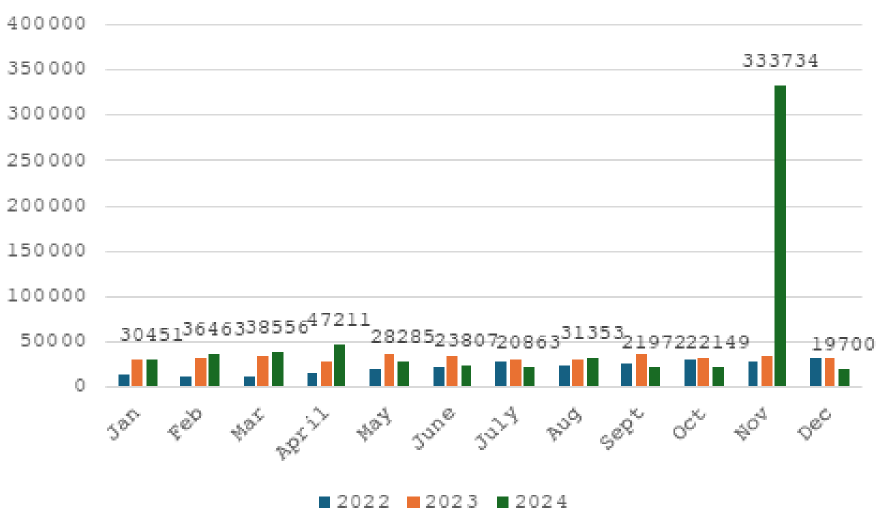


Fig 4.49. Monthly electricity consumption (kWh) for Consumer No. 115540604822, presented annually.

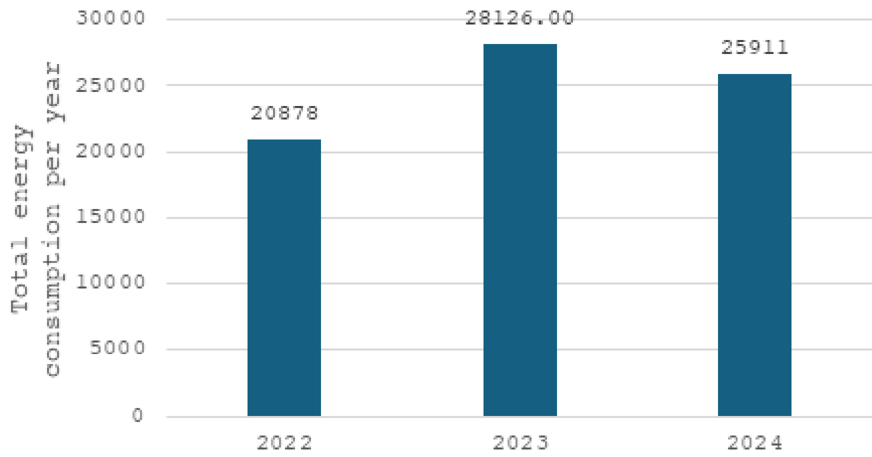


Fig 4.50. Total annual electricity consumption for Consumer No. 115540604822 (kWh).

When comparing all buildings of the college, the findings indicate that energy consumption is highest in the D block, followed by the A block (Arts). The D block includes classrooms, the IQAC office, a conference hall, and dual auditorium, one of which is fully equipped with centralized air conditioning. As a pioneering institution for academic, extracurricular, and cultural activities, this auditorium hosts a wide variety of programs, events, and practices throughout the academic year. This heavy usage is likely a significant factor contributing to the heightened energy consumption. A block serves as the main hub for the institution's arts-related activities, with all major programs taking place in the auditorium, further influencing energy use. The office block is also fully equipped with electronic devices, including a computer lab, meeting halls, and an FM radio station. These facilities collectively contribute to the overall energy consumption of the college.

4.4.3 KSEB meter reading sample study

Block	Building	Consumer Nos.	Details of On-Grid Solar
Science	Home Science	1155402000538	Solar 10 KV
	Science Block	1155400000540	Solar 60 KV (Export)
	Science Block- Lift	1155405000539	nil
Arts	Office – A Block	1155407000183	Solar 20 KV(Export)
	E Block	1155409000185	
	B Block	1155403000186	
	D Block	1155403010417	Solar 80 KV
Central	Central Block	1155406014822	

Table No.4.11 Total number of consumers and their respective locations for connections within the college

Sampling days	Average annual consumption (KwH)
Working day	41402826.67
Semi holiday	30238.50
Holiday	23366.00
Average per year	41456431.17

Table No.4.12 Annual energy consumption for Consumer ID No. 1155403000186

Working days recorded the highest energy consumption, followed by semi-holiday and holiday days. The regular function of electronic equipment requires additional support due to various events in the college, resulting in peak usage on working days during the semi-holiday. The college's strength might be lower compared to working days, which results in low energy consumption

Sampling days	Average annual consumption per year (KwH)
Working day	560846.67
Semi holiday	989.33
Holiday	237.5
Average per year	562073.50

Table No. 4.13 Annual energy consumption for Consumer ID No.1155407000183

Working day dominates high usage corresponding to the regular function of the college, followed by semi-holiday and holiday. The presence of electronic equipment like computers, printers, AC, and networking equipment contributes significantly to power usage. Offices consist of various forms of lighting, including overhead fluorescent or LED lights, desk lamps, and conference room lights. Offices that operate late into the evening and on Saturday. Frequency of conducting conferences equipped with lighting, projects, and so on. The library belongs to this block; it accelerates the demands of digital use, lighting, and the fan.

Sampling days	Average annual consumption
Working day	1145697.00
Semi holiday	120.00
Holiday	15.83
Average per year	1145832.83

Table No. 4.14 Annual energy consumption for Consumer ID No.1155403010417

Working days contribute significantly to energy consumption compared to a semi-holiday, and the D block holiday consists of the staffroom, classroom, and regular college functions, resulting in increased power usage.

Sampling days	Average mean consumption
Working day	25915633.33
Semi holiday	5993.33
Holiday	1944.33
Average per year	25923570.99

Table No. 4.15 Annual energy consumption for Consumer ID No.1155405000539

On working day, higher power consumption is observed. During working hours, lifts are used more frequently, which directly increases energy consumption. If the lifts are operated mostly during peak hours, the electricity rates may be higher. In situations where heavy loads are being lifted, it requires greater energy to operate, especially when starting from a standstill or moving to higher floors. Frequent stopping and starting throughout the day lead to accelerated power usage

Sampling days	Average mean consumption per year
Working day	9049779.33
Semi holiday	2814.23
Holiday	877.48
Average per year	9053471.04

Table No.4.16 Annual energy consumption for Consumer ID No.1155400000540

Working days contribute higher energy consumption when compared to semi-holiday and holiday days. The science block consists of classrooms, departments, the Aamphitheatre, physics, chemistry, zoology, and the Botany lab. The full operation of weekdays resulted in higher energy consumption. Laboratory equipment requires significant power, such as microscopes, centrifuges, fume hoods, spectrophotometers, incubators, and various heating elements, which can contribute to energy usage. Moreover, the lab is structured by HVAC systems, a leading factor. If the labs are accessible at all hours for research or study, they can consume a significant amount of power even outside regular class hours. Semi-holiday exhibit energy consumption due to extra class or lab practical session, and so on.

Sampling days	Average annual consumption
Working day	4413.33
Semi holiday	589.00
Holiday	228.67
Average per year	5231.00

Table No. 4.17 Annual energy consumption for Consumer ID No.1155402000538

Working days highlight higher energy consumption compared to semi-holiday and holiday days. The home science department consists of the food technology lab and the biochemistry lab. Labs often require specific temperature and humidity controls to maintain optimal conditions for experiments and storage of materials. This results in increased use of HVAC systems and equipment, which depend on operational demands.

Sampling days	Average annual consumption
Working day	31760.00
Semi holiday	5370.67
Holiday	336.00
Average per year	37466.67

Table No. 4.18 Annual energy consumption for Consumer ID No.1155406014822

Working days recorded a higher consumption proportional to the regular function of the college. This block consists of classrooms and a food technology lab, utilising lighting, fans, electronic equipment, and laboratory equipment to minimise the potential for energy use.

Energy consumption may fluctuate with the academic calendar, with increased usage notice during regular classes, programs, exams, or mid-semester when students and faculty are more active on campus.

The functioning of electronic appliances, HVAC, and instruments is a contributing factor to high energy consumption. Outdated wiring and electrical issues might be influencing the energy consumption. Sampling study based on the energy metre reading identified high energy consumption reported in the B block of Arts,(41456431.17 kWh) which is one of the oldest buildings that consists of classrooms, staffrooms, refreshment counter, aged wiring, lighting, and fan, followed by the science block lift, and the science block

Fig 4.51. Arts auditorium.

4.4.4 Total energy consumption of St.Teresa's college

No.	Assessment Mode	Total energy Consumption (kWh)
1	Infrastructure assessment	111653.40
2	Mandatory Audit	11640.00
3	KSEB Bill analysis	601459.00
4	Energy Meter Reading Sample Study	78184076.70
5	Annual solar Production	52680.00

Table 4.19 Findings from the energy assessment of each method.

4.4.5 Total solar energy production of tereasa's college

No.	Assessment Mode	Total Export (kWh)
1	Block (Arts)	10104
2	Block (Science)	163270

Table 4.20 Total solar energy export as determined by bill assessment.

4.4.6 Vehicle sharing status

Sl No	Vehicle type	Distance travelled (Km)	Status	Type of fuel	Fuel required (Lit/Year)
1	Two-wheeler	15	Yes	Petrol	450
2	Two-wheeler	6	Yes	Petrol	180
3	Two-wheeler		Yes	Petrol	900
5	Two-wheeler	16	Yes	Petrol	480
6	Two-wheeler	25	30Yes	Petrol	750
7	Two-wheeler	19	Yes	Petrol	570
8	Two-wheeler	3	Yes	Diesel	90
9	Two-wheeler	8	Yes	Petrol	240
10	Two-wheeler	3	Yes	Petrol	90
11	Two-wheeler	5	Yes	Petrol	150
12	Two-wheeler	10	Yes	Petrol	300
13	Two-wheeler	4.5	Yes	Petrol	135
14	Two-wheeler	11	Yes	Petrol	330
15	Two-wheeler	12	Yes	Petrol	360
16	Two-wheeler	5	Yes	Petrol	150
17	Two-wheeler	5	Yes	Diesel	150
18	Two-wheeler	5	Yes	Petrol	150
19	Two-wheeler	6	Yes	Petrol	180

Table No.4.21 Two-wheeler sharing details

Sl No	Vehicle type	Distance travelled (Km)	Status	Type of fuel (Kwh)
1	Two-wheeler	15	Yes	Electricity
2	Two-wheeler	8	No	Electricity
3	Two-wheeler	20	No	Electricity
4	Two-wheeler	40	No	Electricity
5	Two-wheeler	40	No	Electricity
6	Two-wheeler	10	Yes	Electricity
7	Two-wheeler	3	No	Electricity
8	Two-wheeler	6	Yes	Electricity
9	Two-wheeler	12	Yes	Electricity

Table No. 4.22 Electric two- wheeler sharing details

Sl No	Four-Wheeler	Distance travelled (Km)	Status	Type of fuel	Fuel required (Lit/year)
1	Four-wheeler	8	Yes	Petrol	80
2	Four-wheeler	7	Yes	Diesel	70
3	Four-wheeler	14	Yes	Petrol	140
4	Four-wheeler	2.3	Yes	Petrol	23
5	Four-wheeler	11.2	Yes	Petrol	112
6	Four-wheeler	4	Yes	Petrol	40
7	Four-wheeler	5	Yes	Petrol	50
8	Four-wheeler	7	Yes	Petrol	70
9	Four-wheeler	28.3	Yes	Petrol	283
10	Four-wheeler	20	Yes	Petrol	200
11	Four-wheeler	3	Yes	Petrol	30
12	Four-wheeler	10	Yes	Petrol	100
13	Four-wheeler	33	Yes	Diesel	330
14	Four-wheeler	16	Yes	Petrol	160
15	Four-wheeler	14	Yes	Petrol	140
16	Four-wheeler	50	Yes	Diesel	500
17	Four-wheeler	6	Yes	Diesel	60
18	Four-wheeler	15	Yes	Petrol	150
19	Four-wheeler		Yes	Petrol	0
20	Four-wheeler	6	Yes	Petrol	60
21	Four-wheeler	30	Yes	Petrol	300
22	Four-wheeler	8	Yes	Petrol	80
23	Four-wheeler	3	Yes	Petrol	30

24	Four-wheeler	16	Yes	Petrol	160
25	Four-wheeler	10	Yes	Petrol	100
26	Four-wheeler	15	Yes	Petrol	150
27	Four-wheeler	8	Yes	Diesel	80
28	Four-wheeler	5	Yes	Petrol	50
29	Four-wheeler	4.8	Yes	Petrol	48
30	Four-wheeler	5	Yes	Petrol	50
31	Four-wheeler	40	Yes	Petrol	400
32	Four-wheeler	3.3	Yes	Petrol	33
33	Four-wheeler	5	Yes	Diesel	50
34	Four-wheeler	10	Yes	Petrol	100
35	Four-wheeler	2	Yes	Petrol	20
36	Four-wheeler	10	Yes	Diesel	100
37	Four-wheeler	4.6	Yes	Petrol	46
38	Four-wheeler	3	Yes	Petrol	30
39	Four-wheeler	6	Yes	Diesel	60
40	Four-wheeler	13	Yes	Petrol	130
41	Four-wheeler	1	Yes	Diesel	10
42	Four-wheeler	2	Yes	Diesel	20
43	Four-wheeler	6.8	Yes	Diesel	68
44	Four-wheeler	10	Yes	Petrol	100
45	Four-wheeler	10	Yes	Petrol	100
46	Four-wheeler	20	Yes	Diesel	200
47	Four-wheeler	18	Yes	Diesel	180
48	Four-wheeler	3.5	Yes	Diesel	35
49	Four-wheeler	10	Yes	Diesel	100
50	Four-wheeler	13	Yes	Petrol	130
51	Four-wheeler	9.5	Yes	Petrol	95
52	Four-wheeler	6	Yes	Diesel	60
53	Four-wheeler	8	Yes	Diesel	80
54	Four-wheeler	14	Yes	Diesel	140
55	Four-wheeler	15	Yes	Petrol	150
56	Four-wheeler	50	Yes	Petrol	500
57	Four-wheeler	10	Yes	Diesel	100
58	Four-wheeler	15	Yes	Petrol	150
59	Four-wheeler	6	Yes	Petrol	60

60	Four-wheeler	15	Yes	Petrol	150
61	Four-wheeler	32	Yes	Diesel	320
62	Four-wheeler	8.8	Yes	Diesel	88
63	Four-wheeler	25	Yes	Petrol	250
64	Four-wheeler	13	Yes	Diesel	130
65	Four-wheeler	12	Yes	Petrol	120
66	Four-wheeler	11	Yes	Diesel	110
67	Four-wheeler	28	Yes	Diesel	280
68	Four-wheeler	2.5	Yes	Diesel	25
69	Four-wheeler	5	Yes	Diesel	50
70	Four-wheeler	8	Yes	Diesel	80
71	Four-wheeler	7.4	Yes	Diesel	74
72	Four-wheeler	10	Yes	Diesel	100
73	Four-wheeler	12	Yes	Diesel	120
74	Four-wheeler	8.8	Yes	Petrol	88
75	Four-wheeler	12	Yes	Petrol	120
76	Four-wheeler	3	Yes	Diesel	30
77	Four-wheeler	4	Yes	Diesel	40
78	Four-wheeler	12.5	Yes	Petrol	125
79	Four-wheeler	4	Yes	Petrol	40
80	Four-wheeler	4	Yes	Petrol	40
81	Four-wheeler	17	Yes	Diesel	170
82	Four-wheeler	4	Yes	Petrol	40
83	Four-wheeler	3	Yes	Petrol	30
84	Four-wheeler	5.7	Yes	Petrol	57
85	Four-wheeler	7	Yes	Petrol	70
86	Four-wheeler	4	Yes	Petrol	40
87	Four-wheeler	4	Yes	Petrol	40

Table No. 4.23 Four- Wheeler sharing details

Sl No	Four-Wheeler	Distance travelled (km)	Status	Type of fuel (Kwh)
1	Four-wheeler	20	No	Electricity
2	Four-wheeler	42	Yes	Electricity
3	Four-wheeler	60	Yes	Electricity
4	Four-wheeler	5	No	Electricity

Table No. 4.24 Electric four-Wheeler sharing details

Colleges encourage the practice of vehicle sharing through each year, 565500 L of fuel is saved by sharing two-wheelers, and 648000 L of fuel is saved from four-wheelers. total of thirteen electric vehicles are used by the college community, from which nine two two-wheelers and four are four-wheelers and share electric vehicles

4.4.7.LPG usage in campus

Sl No	Department	Number of cylinders per month	Capacity (Kg)	Capacity used per year (Kg)
1	Chemistry Lab	4	14.2	681.6
2	Zoology Lab	1	14.2	170.4
3	Botany Lab	2	14.2	340.8
4	Physics Lab	3	14.2	511.2
5	Biochemistry Lab	2	14.2	340.8
6	Home Science – Food lab	6	14.2	1022.4
7	Canteen	6	14.2	1022.4

Table No. 4.25 LPG usage pattern

A total of 276 cylinders have been purchased, and approximately 4,089.6 kg of LPG is used annually. Implementing biomass energy solutions could significantly benefit the college by reducing LPG purchases and facilitating carbon footprint credit opportunities.

4.4.8 Fossil fuel

Diesel is the primary fuel used for operating the Diesel Generator (DG); however, there is no precise data available to quantify the actual fuel consumption. According to information provided by the college electrician, approximately 850 to 900 liters of diesel have been purchased.

4.5 CONCLUSION

The campus is powered by a low-tension (LT) connection, with electrical supply provided by the Kerala State Electricity Board Ltd. The total annual energy consumption is 28,863.88 kWh, of which 11,640 kWh is imported energy. A solar plant has been installed, enabling a total annual export of 52,680 kWh. The Arts and Science blocks operate on the grid, while the D block and Home Science block are connected to the off-grid system.

- The mandatory energy assessment reveals several critical issues. Current harmonics exceed acceptable limits, and there is a current imbalance, although no voltage imbalance or voltage drop has been detected. It is essential to test, calibrate, and document the protection relays throughout the entire system. During the audit, earth pits were not identified and should be located, thoroughly inspected, and documented annually. Moreover, the layout for the earth pits is currently unavailable. The solar panels are heavily soiled with dust and cobwebs, and the U-beading for IP protection is missing. Furthermore, there are potential hazards associated with the use of temporary or extension wiring. To enhance the quality of the power supply, it is necessary to address the presence of harmonics within the electrical system. Relays are not functioning correctly and require replacement and testing. Moreover, Residual Current Circuit Breakers (RCCBs) are absent in the distribution boards and should be installed promptly to ensure safety
- The rubber mats in the electrical panel room are extensively damaged, with some panels lacking mats entirely. Additionally, there is a lack of proper identification and labelling for the panels, which complicates the tracing of electrical circuits in the event of an accident. The electrical panel room is currently being used as a storage area for scrap materials, increasing the risk of an electrical incident.

Exposed cables require appropriate covering to ensure safety, and the outer covers of some panels are burnt. Furthermore, personal protective equipment and fire extinguishers are not present in the electrical room, which poses a significant safety risk.

- The analysis of energy consumption across the college buildings reveals that the D block has the highest energy usage, closely followed by the A block (Arts). The D block, which houses classrooms, the IQAC office, a conference hall, and a dual auditorium, one of which features centralized air conditioning, experiences significant activity throughout the academic year. This high level of use is a major contributor to its elevated energy consumption. Meanwhile, the A block serves as the focal point for arts-related activities, with key programs held in its auditorium, further adding to its energy demands. Additionally, the office block's extensive use of electronic devices, including a computer lab, meeting rooms, and an FM radio station, further supports the overall energy consumption of the college. These findings highlight the need for targeted energy management strategies to enhance efficiency across these key facilities.
- Energy consumption within the college demonstrates significant variability in accordance with the academic calendar, peaking during times of heightened campus activity such as regular classes, exams, and special programs. Factors contributing to this elevated energy usage include the operation of electronic appliances, HVAC systems, and various instruments. Additionally, issues related to outdated wiring and overall electrical infrastructure may exacerbate energy inefficiencies. A focused study utilizing energy meter readings revealed notably high energy consumption in the B block of the Arts, one of the college's oldest buildings, which houses classrooms, staff rooms, and a refreshment counter, all of which are equipped with ageing infrastructure, including lighting and fans. Following this, the science block lift and the science block itself also showed substantial energy usage. These findings underscore the necessity for strategic energy management and infrastructure upgrades to optimise energy efficiency across the college.
- The analysis of energy consumption across the blocks reveals a notable decreasing trend, with the Arts block exhibiting the highest levels, followed by the Science and Central blocks. This pattern can be attributed to the superior infrastructure facilities available in the Arts block compared to the others. Understanding these differences can provide valuable insights for future energy management and infrastructure development initiatives.

4.6 RECOMMENDATION

Institution can initiate the energy conservation measures by promoting behavior change and infrastructure upgrading.

- The major recommendation for energy conservation is behavioral change. Need to conductawareness programs for staff members. Also, creating a target for energy conservation and motivating employees to achieve the target will help to reduce the wastage of energy.
- To understand will check a real case scenario. There are around 758 Ceiling Fans in the facility. The usage pattern differs and switching off at least 10% of the fans, that is 75 numberswhen not in use, and if we can reduce an hour from the current usage pattern, it will benefit as:
-

By switching off the fan for an Hour / Day - 200 Fans out of 760 Nos	
Power drawn by Fans (kW), 100 Nos	6
Annual Energy Savings if 1 Hr / Day for 365 Days (in kWh)	365
Average Cost of Electricity per unit (₹)	7.71
Annual savings in (₹)	2814.15

Table No. 26 Energy saving metrics -fan

- Another measure without any investment is deploying and ensuring the energy saving in Desktop Computers. A normal computer's average wattage is 200W, but in sleep mode, it will consume 5-10Watts of Electricity. There are 99 Desktop PCs in the facility. By adjusting the energy saving setting, after 5 minutes of inactivity, the system goes to sleep mode, and if an hour can be saved by this, the results will be:

Energy Saving Mode in Desktop Computers - 50 PC's	
Power drawn by Computer (kW) 50 PC's x 200 Watts	10
Power drawn by Computer in Sleep Mode (kW) 50 PC's x 10 Watts	0.5
Annual Energy Savings if 1 Hr / Day for 365 Days (in kWh)	3650
Average Cost of Electricity per unit (₹)	7.71
Annual savings in (₹)	26734

Table No. 27 Energy saving metrics -Desktop computer

Another way of energy saving is to switch off the printer. In standby mode, most printers will draw around 3 to 5 watts of power. Commercial printers, which are used in an office, will draw 30 to 50 watts on standby and 1200 to 1500 watts when printing.

Switching Off the Printers 10 Printers	
Power drawn by Printer (kW) 10 x 5 Watts	0.5
Annual Energy Savings if 7 Hr / Day for 365 Days (in kWh)	1.275
Average Cost of Electricity per unit (₹)	7.71
Annual savings in **(₹)**	9849.52

Table No. 28 Energy saving metrics -Printer

The regular Ceiling Fans consume 70 Watts of Power, whereas the BLDC Fans only take 27 -30Watts of Power. Replace the existing fans with Energy Efficient fans. Energy-efficient fans have energy-efficient BLDC motors. Their operation is more reliable, efficient, less noisy, and lighter compared to conventional fans with the same power output. They produce much less heat and result in significant efficiency improvement. They work on the unity power factor and will help reduce your reactive energy requirement.

- Not all the fans are used 24 Hours a day, but there are areas where the fans are used for 24 Hours a day. The fans that are used all day can be replaced with BLDC Fans. Suppose 75 are used for the whole day, and if converted to BLDC Fans.

Power drawn by Regular Fans (kW) (60W x 70)	4.2
Average Annual working (Hrs) 15 Hrs / Day for 200 Days	12600
Annual Energy Consumed (kWh)	12600
Annual Energy Consumed by Energy Efficient Fan (kWh)	12600
Estimated Energy Saving after Implementation (in kWh)	5250
Average Cost of Electricity per unit (Rs.)	7,71
Annual savings in (Rs.)	40477.5
Investment required (Rs)(Approx.)	280000
Simple Pay Back (in Months)	82
Life Cycle Savings (7 Years)	283342.5

Table No. 29 Detailed Energy Consumption of a regular fan

Energy Saving through replacement of Tube Lights T5(28W), T8(32W) & T12(55W) with LED Tube of 20 Watts each in the future. Most of the places the facility has LED Light Fittings. But several T5, T8 & T12 were identified during the energy audit field survey. A 20-watt LED tubewill produce a lumen of 2000, which is equivalent to the lumen of a 55W-T12 Tube.

Total Number of T-5 Lamps available (Nos)	50
Power drawn by T-5 lamps (W)	1.4
Total Number of T-8 Lamps available (Nos)	30
Power drawn by T-8 lamps (W)	0.84
Total Number of T-12 Lamps available (Nos)	40
Power drawn by T-12 lamps (W)	2.2
Total Power drawn by all lamps (kW)	4.44
Annual working hrs (@ 4 Hours /Day @ 365 days / Year (Hrs)	1460
Annual Energy Consumed (kWh)	6482.4
Power consumption for LED Tube (W)	20
Number of replacing with LED Tube	120
Annual Energy Consumed After Implementation (kWh)	22,229
Estimated Energy Saving by Implementation (kWh)	3504
Cost of Electricity (Rs)	7.71
Annual saving in (Rs) (1st year)	22963.46
Investment required @ Rs 120 per fitting (Rs)	24000
Simple Pay Back (in Months)	13

Table No. 30 Detailed Energy Consumption of LED

- Reinstate initiatives such as "I Connect" to foster innovative approaches and enhance student participation in advanced energy management workplace experiences.
- Upgrading the appliances to a five-star rating will ensure superior performance compared to lower-rated alternatives, leading to increased efficiency and productivity. This improvement will also result in fewer breakdowns and maintenance issues, ultimately saving time and reducing costs over the long term. These upgraded appliances are designed to consume less energy, which will contribute to lower utility bills and a smaller carbon footprint, while also reducing the risk of accidents and promoting a safer working environment.

4.7 ENERGY MANAGEMENT PLAN

4.7.1. Establish an Energy Management Team

- Create a dedicated Energy Management Committee composed of faculty, technical staff, and student representatives to oversee the implementation, management, and periodic review of energy efficiency initiatives.
- The internal auditor will be responsible for introducing innovative initiatives aimed at enhancing energy efficiency practices within the college, as well as conducting comprehensive energy audits

4.7.2.Formulate a Comprehensive Strategy

- Formulate a comprehensive long-term strategy to diminish reliance on fossil fuels and enhance energy efficiency, grounded in green building practices, renewable energy initiatives, and fostering behavioural change.
- Integrate academic operations by actively involving students in hands-on learning experiences that promote sustainable practices and energy management.
- Foster collaboration with expert teams and external agencies to expand core knowledge, enhance student networking opportunities, and strengthen community engagement in sustainability efforts.
- Explore avenues for bolstering research initiatives for both students and faculty, aimed at advancing understanding and innovation in energy efficiency and sustainability.
- Transition the college's electrical system to adhere to ISO standards and align with the criteria set forth by the Bureau of Energy Standards to ensure optimal performance and compliance.
- Encourage the energy conservation practices within the campus (Signage board for switch off, vehicle sharing, solar energy)

4.7.3.Implement Effective Methods

- Introduce LED lighting, automated HVAC controls, solar panels, biogas usage, and real-time energy monitoring systems.
- Conduct regular maintenance and ensure all equipment adheres to BEE norms and conditions.
- Prepare single line diagram for the entire buildings and campuses.
- Appoint a dedicated person for the effective management of the electrical system of the college.

4.7.4.Establish Communication Channels and Governing Body

- The Energy Management Committee will collaborate with administration, academic departments, and external partners to enhance performance and identify gaps in energy efficiency.
- Disseminate best practices, guidelines, and updates on energy conservation through newsletters, workshops, and orientation programs to promote awareness and engagement across the institution.

4.7.5.Set Long-term and Short-term Goals

Short-term (1–2 years)

- Contacting expert agency for reframing the electric system in the campus designing line diagram, enable electrical safety device, RCCB to protect against shock, fire hazards by detecting and disconnecting a circuit with a dangerous current leakage.
- Identify the earth pit and conduct annual quality assessment

- Maintained a electric room by a responsible custodian or electrician to take of the entire functioning
- Implement the safety regulation in electric room like, mat, gloves, labelling the pannel, clean the pannel from dust and cobwebs , firs extinguisher and remove the storing of used materials inside electric room
- Full transition to LED lighting, initiation of energy audits, student awareness campaigns.

Long-term (3–5 years):

- Expand solar energy coverage of the college
- Establish zero-energy buildings, integrate conservation fully into the curriculum and campus culture.
- Purchase and procurement of high-quality products, five start rated appliances and BLDC fan
- Integrated student projects and internship opportunities with reputed institution and introduce advance energy conservation initiates and strengthen non- conventional source of energy

4.7.6.Continuously Monitor and Enhance the System

- Implement digital tracking tools and software to analyse energy usage patterns and identify trends effectively.
- Conduct biennial audits and annually revise the policy, incorporating appropriate modifications based on the findings and recommendations of the auditors.
- Evaluate pilot projects and expand successful initiatives to establish efficient practices, while highlighting additional opportunities for improvement with guidance from industry experts.

4.7.7.Conclude and Follow Up

- Prepare an annual progress report for the administrative body, addressing identified challenges related to risk and emergency management. Facilitate discussions to develop strategies for rectifying these challenges.
- Review outcomes, gather stakeholder feedback, and integrate suggested improvements into the subsequent planning cycle.

4.8.ACTIVITIES CONDUCTED

Glowing Blooms

The Department of Physics at St. Teresa's College (Autonomous), Ernakulam, organized a skill enhancement programme and competition titled Glowing Blooms on 10th July 2023. Held at the Department of Physics, the event aimed to empower undergraduate students through hands-on creativity and technical application. A total of 35 internal student participants took part in the competition, which focused on crafting decorative items using LED technology. The students showcased their innovation by designing glowing bouquets and other ornamental creations, blending aesthetics with basic electronics. This initiative served as a platform for enhancing practical skills, promoting creativity, and encouraging women empowerment through technical engagement.

Empowering Efficiency: Exploring LED Technology and Energy Conservation

On 26th November 2024, The Department of Physics organized a TROP activity titled Empowering Efficiency: Exploring LED Technology and Energy Conservation at Sree Narayana Higher Secondary School, Ayyappankavu. The programme featured an interactive workshop where participants were introduced to the fundamentals of energy conservation and LED technology. Experts highlighted the benefits of transitioning from conventional lighting to LED bulbs, emphasizing their superior energy efficiency, cost-effectiveness, and environmental advantages. Hands-on sessions provided participants with practical experience in handling LED lighting solutions, deepening their understanding of sustainable alternatives.A vibrant flash mob was staged in a public space, creatively conveying the message of energy conservation. The performance encouraged spectators to reflect on their personal energy choices and embrace greener practices. By blending education with entertainment, the activity successfully inspired participants and the wider audience to adopt energy-efficient habits, fostering a culture of sustainability and long-term behavioral change.

A similar programm was held in Govt.High School, Edakochi,were awareness class on Energy Conservation was conducted by UG students which included an informative session, highlighting the importance for sustainability and offering practical tips for energy efficiency.Hands-On Training on LED Bulb Assembling were also provided in the second session, were the UG students guided the high school students in assembling LED bulbs, explaining the components and the assembly process, promoting practical understanding of energy-efficient technology.

4.9.SUMMARY

- The campus is powered by a low-tension (LT) electrical connection.
- Currently, there are no comprehensive or updated electrical drawings available, particularly schematic diagrams.
- The electrical supply is provided by the Kerala State Electricity Board Ltd.
- The total annual imported energy consumption is recorded at 11,640 kWh.
- An installed solar plant has contributed to a total annual exported energy of 52,680 kWh.
- An infrastructure assessment estimates the overall energy consumption at 111,653.40 kWh.
- The energy consumption indicated by the mandatory audit assessment is 11,640.00 kWh.
- Analysis of the Kerala State Electricity Board (KSEB) bill shows an annual energy consumption of 601,459.00 kWh.
- A sample study based on energy meter readings reveals an annual consumption of 78,184,076.70 kWh.
- A total of 565,500 liters of fuel is conserved through the sharing of two-wheelers, while an additional 648,000 liters is saved from the use of four-wheelers. The college community utilizes 13 electric vehicles, comprising nine two-wheelers and four four-wheelers, all of which are shared among members.

Chapter V

WATER EFFICIENCY MANAGEMENT SYSTEM (We MS): AUDIT REPORT

WATER EFFECIENCY MANAGEMENT SYSTEM (WEMS 2025)

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5

Water Efficiency Management System Audit Report

5.1 INTRODUCTION

Water is a vital natural resource necessary for the existence of all living beings. Both animals and plants depend on water to sustain life as it is essential for their everyday metabolic processes. For plants, water is crucial for photosynthesis, which enables them to produce their own food and encourage growth. Water resources encompass all natural water bodies on Earth, regardless of their state—vapour, liquid, or solid—that can be used by humans. The most accessible sources include oceans, rivers, and lakes, while additional reserves comprise groundwater, deep subsurface waters, glaciers, and permanent snowfields. On average, a person consumes approximately 600 to 700 liters of water per day. While humans may survive for several days without food, enduring without water is unfathomable; likewise, plants will droop and shed their leaves in its absence.

India experiences an average annual precipitation of 4,000 billion cubic meters (BCM), which is unevenly distributed across various regions and times. Roughly 75% of this rain occurs during four months of the monsoon season, with nearly half falling within just 15 days and under 100 hours. Kerala, known for its high annual rainfall of around 3,000 mm, receives about 60% of this precipitation during the two monsoon phases, while the remaining 40% comes from summer showers. However, recent changes in weather patterns have disrupted this predictable cycle, leading to more localized rainfall and flooding, which pose significant challenges for the state. ISO standards offer a unified framework for technology and terminology, promoting effective collaboration among countries sharing water resources. These standards provide practical solutions and best practices for sustainable water management, focusing on aspects such as measuring and optimizing water usage, treating and reusing wastewater, and managing water services and irrigation in fields like agriculture, manufacturing, and construction. Additionally, they form a foundation for public policies that address the repercussions of climate change, sanitation, and commitments to water management.

ISO environmental management guidelines, which include assessments of water footprints, help organizations evaluate the impact of their water use and identify ways to enhance efficiency and reduce consumption. These standards also describe procedures for managing and treating sludge and by-products arising from urban wastewater systems, stormwater, and water treatment facilities, thus promoting sustainable practices in water and wastewater management.

5.1.1 What is Water Audit?

A water audit provides a thorough evaluation of an entity water utilize , beginning from the source of water intake to the point of discharge, carefully examining every aspect of its usage. This analysis quantifies the amount of water used, detects any leaks or wastage, and identifies opportunities for reducing consumption. Moreover, it reviews the current treatment systems and practices, suggesting improvements to boost efficiency and lower overall usage. Based on these findings, the audit offers recommendations to limit wastage and consumption, enhance treatment practices, and perform cost-benefit evaluations. It also proposes the establishment of a system to track water intake, distribution, and usage.

The necessary requirements for conducting a water audit include:

- A record of the total water supply consumed in the college
- Identification of water loss and recommended actions to mitigate it (due to leaks, overflow, and other unaccounted losses from misuse, etc.).
- A sustainable water conservation strategy (including behavioural changes, promoting water reuse, recycling wastewater, and tapping into alternative water sources).

The water audit involves systematically creating 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 final discharge. This process includes calculating the water balance, evaluating water consumption, and identifying potential water conservation opportunities.

5.1.2 Need for Water Audit

Water audits serves as a tool to identify areas with elevated water usage, assess the impact of wastewater pollutants, and develop strategies for mitigation by applying the principles of 3R (Reduce, Reuse, and Recycle). Our water audit services have enabled industries to select effective methods for lowering water use, minimizing wastewater production, and enhancing resource recovery. These audits provide thorough water efficiency solutions, resulting in cost savings while supporting internal policy compliance, legal regulations, and demonstrating a commitment to sustainability.

The purposes of the water audit include:

- Minimized water losses
- Enhanced financial performance
- Increased reliability of the supply system (quality water)
- Improved performance of the distribution system
- Better protection for public health and property
- An effective educational and public relations resource for the water
- System reduced legal risks, and
- Limited disruptions, thereby enhancing service levels for the entire college/university community.

By raising awareness among water users (students, staff, and guests), the water audits employ a multi-staged approach aimed at providing both immediate and long-term sustainable water management solutions. During this process, teams of analytical, design, and engineering experts work together to analyse the audit results and develop improved strategies for water management and sustainability.

5.1.3 Benefit of Water Efficiency Management System

Implementing a water efficiency management plan effectively leads to significant savings in both water and energy, thereby minimising the environmental effects associated with water discharge and the necessity to transport water over extended distances.

The establishment and correct execution of a water efficiency management system aims to enhance water efficiency and can contribute to the following results:

Considering water as a resource can be integrated into organisational and budget planning.

- Aiding an organisation in better managing its water usage and optimising water demand.
- Understanding the potential impacts on others that can arise from changes in water consumption.
- Ensuring higher accountability regarding water usage.
- Offering a framework for ongoing evaluation to identify opportunities for improvements in water efficiency.
- Cost savings achieved by lowering water consumption through sustainable design, the use of water-saving devices, and effective monitoring.

5. 2 WATER EFFICIENCY MANAGEMENT POLICY

Water is one of the most essential and finite natural resources critical to sustaining life and ensuring the well-being of communities. Educational institutions, as centres of learning and leadership, bear a unique responsibility in promoting the sustainable use and management of water. St. Teresa's College (Autonomous), highlight the significance of water conservation through a comprehensive campus-wide water audit led by students and faculty. The institutional vision for long-term sustainability. It aims to guide responsible practices, promote innovation, and integrate water consciousness into all aspects of campus life.

5.2.1 Statement of Commitment

St. Teresa's College (Autonomous) is committed to becoming a model for environmental responsibility, through water resource conservation as a core priority. Aligned with the United Nations Sustainable Development Goals, particularly SDG 6 (Clean Water and Sanitation), the college pledges to reduce water wastage, enhance reuse practices, and foster a culture of accountability and awareness among all stakeholders. The policy reflects the institution's dedication to transforming insights from the water audit into meaningful action ensuring that water sustainability is not just a policy but a lived value throughout the campus.

5.2.2 Goals

The institution embeds water conservation into campus culture and operations. Direct strategies to reduce consumption through infrastructure upgrades, expanded water reuse systems, and high-efficiency standards for all new projects. Concurrently, foster a community-wide commitment to eliminating waste through education and engagement. Through a dual approach significantly curtail water footprint and establish our campus as a model for sustainable resource stewardship.

5.2.3 Objectives

- To ensure all water management practices across the college campus are aligned with current environmental standards, state regulations, and institutional sustainability goals.
- To actively engage students and staff through at least two water conservation awareness drives or training sessions per semester, ensuring the campus community remains informed and participatory.
- To create a transparent and accountable data system where water usage reports are compiled and reviewed quarterly, with a comprehensive annual summary shared with the Internal Quality Assurance Cell (IQAC).
- To incorporate water management as a learning and research theme across at least five academic departments to encourage interdisciplinary approaches to conservation.

5.2.4 Resource Management

5.2.4.1 Leakage Monitoring and Preventive Maintenance

The water audit confirmed the successful functioning of the college's water infrastructure and fixtures, revealing minimal leakages. Building on this achievement, the college is committed to upholding this high standard through a robust program of regular inspections and proactive maintenance. To support this commitment, dedicated staff will continue to oversee infrastructure integrity. A quarterly inspection schedule will be implemented, systematically covering pipelines, tanks, washroom fixtures, and water outlets across all campus blocks. Moreover, a formal reporting system will be developed by internal auditors to empower students and staff to promptly report any leaks or irregularities. Key personnel, such as non-teaching staff and caretakers, will be designated as points of contact. Their details will be communicated via class teachers. All reported issues will be addressed by the caretakers upon authorization from the Water and Electrical Management System (WEMS). This integrated approach ensures early detection and timely repairs, preventing water loss and maintaining peak infrastructure efficiency.

5.2.4.2.Greywater Collection and Reuse

The institution promotes practice of water conservation, the institution captures and recycles greywater from wash basins, kitchen sinks, and bathing facilities in its hostels and canteens. Treated greywater will be directed for non-potable purposes such as gardening and flushing, reducing the dependency on fresh water. Plans are underway to install basic greywater filtration units and collection systems across identified blocks by 2026, as part of the college's transition toward a closed-loop water system.

5.2.4.3. Rainwater Harvesting and Groundwater Recharge

The campus's existing 1,000-liter rainwater harvesting units will undergo regular maintenance to ensure optimal functionality. This work will be performed by designated caretaking and non-teaching staff under the supervision of the internal water audit team. The college also plans to expand harvesting capacity through rooftop collection systems and recharge pits. These systems aim to capture and store rainwater effectively while also contributing to groundwater replenishment. The institution sets a target to utilize at least 50% of collected rainwater for appropriate uses by 2026.

5.2.4.4.Water Quality Testing and Monitoring

To safeguard the health and wellbeing of the campus community, water quality testing will be conducted periodically. Samples from drinking water points, storage tanks, and filtered systems will be analysed for microbial and chemical content in collaboration with certified laboratories. Testing reports will be reviewed by the Water Management Committee and used to guide necessary interventions in purification or infrastructure upgrades.

5.2.4.5.Smart Water Use and Digital Tracking

Current campus-wide water monitoring is constrained by the sole placement of a flow meter in the Arts Block. The absence of individual meters in the Central, Centenary, and Science Blocks hinders the ability to accurately track and analyse consumption on a per-building basis. Recognizing this as a significant deficiency, the institution has committed to a phase-by-phase installation of flow meters in all remaining blocks to enable comprehensive resource management. This will enable comprehensive and accurate monitoring of water usage and strengthen the campus's long-term conservation strategy. In the future, this data will support the implementation of a digital water usage dashboard for real-time tracking and analysis.

5.2.5 Curriculum Integration

At St. Teresa's College (Autonomous), sustainability is not just a policy objective but an integral part of the educational experience. Following the success of the student-led water audit, the institution recognizes the value of embedding water conservation and management themes into academic and co-curricular activities across disciplines. This approach empowers students to engage in hands-on learning while promoting long-term environmental responsibility.

5.2.5.1.Water Audit as Field-Based Learning

Students from multiple departments actively participated in the campus water audit, engaging in data collection, infrastructure analysis, and solution design. These practical experiences are being encouraged as part of field-based coursework, internal assessments, and internship projects. The audit model may be replicated in future semesters to train new student batches on sustainability auditing and conservation of water resources.

5.2.5.2.Awareness Campaigns and Creative Expression

Departments collaborate to conduct poster-making competitions, street plays, awareness walks, and flash mobs focusing on water conservation. These initiatives aim to blend scientific awareness with cultural expression, making sustainability both engaging and visible on campus.

5.2.5.3.DIY Water-Conservation Projects

Workshops are organized where students create low-cost greywater filters, terracotta drip irrigation pots, or mini rainwater collection units as part of sustainability skill development. Selected student innovations may be piloted for actual use within the campus gardens and green spaces.

5.2.5.4.Reusable Bottle and Tumbler Program

In line with the green protocol, the college encourages all students and staff to use refillable water bottles and steel tumblers. Awareness sessions are conducted to reinforce the environmental cost of single-use plastic water bottles. Special incentives or "green points" are awarded to participants using reusables consistently.

5.2.5.5.Water Conservation in Curriculum Projects

Departments including Physics, Chemistry, Economics, Botany, and Sociology are encouraged to assign project topics related to water usage, traditional conservation methods, urban water issues, or water economics. These projects can be research-based, design-based, or community engagement-oriented.

5.2.5.6.Rain Garden & Water-Friendly Landscaping Projects

Students and faculty from environmental science and Botany were invited to plan rain gardens and water-retentive green zones on campus. These projects help manage runoff, reduce erosion, and improve biodiversity, all while providing a living classroom for sustainability education.

5.2.5.7.Integration with Student Clubs

Eco and science clubs host "Water Weeks" that include activities such as debates, water footprint calculator workshops, mural-making on the water cycle, and pledge walls where students commit to personal water-saving habits.

5.2.5.8.Skill Development & Community Training

As part of community outreach, students may receive training to teach water-saving practices in local schools, anganwadis, and households. This supports mutual learning and strengthens the relationship between the college and the surrounding community.

5.2.6 Green initiatives

St. Teresa's College (Autonomous) upholds the principle that sustainability must be a daily, visible practice integrated into all aspects of campus life. As part of the institution's commitment to responsible water stewardship, the following green initiatives have been developed or proposed to enhance water conservation, awareness, and resilience.

5.2.6.1.Promotion of Reusables

The college actively encourages the use of refillable water bottles, personal tumblers, and jug-and-glass systems in all classrooms and administrative spaces. Bottled water use at campus events is discouraged under the Green Protocol. Water dispensers with reusable cups or steel tumblers have been placed in key locations, and students are incentivized to adopt sustainable hydration practices.

5.2.6.2.Creative Water Harvesting Projects

Students are encouraged to design and install DIY rainwater harvesting prototypes, including vertical collection units, rain barrels, and gutter filter systems. Selected student models are showcased during environmental exhibitions and serve as live demonstrations for awareness.

5.2.6.3.Rain Gardens and Water-Friendly Landscaping

The campus is developing rain garden in low-maintenance, landscaped depressions that collect and filter stormwater. These gardens help manage runoff, promote groundwater recharge, and add to the aesthetic and ecological richness of the college environment.

5.2.6.4.Water Literacy Campaigns and Behavioural Change

Regular campaigns are conducted to raise awareness about responsible water use. Posters in restrooms, hostels, and canteens highlight simple actions like turning off taps, reporting leaks, and reducing unnecessary washing. Water-saving slogans and infographics are part of a visual nudging strategy.

5.2.6.5.Skill Development and Water-Tech Workshops

Hands-on training workshops teach students to build basic water filtration models, low-flow faucet adapters, and greywater channels. These workshops promote innovation while empowering students with real-world sustainability tools.

5.2.6.6.Community Outreach and Local School Engagement

In collaboration with the STEP team and Bhoomitra Sena, college students conduct interactive sessions in nearby schools and panchayats, teaching children and families about traditional water conservation methods, water footprint awareness, and hygiene practices using minimal water.

5.2.6.7.Water-Sensitive Event Management

As part of the Green Protocol, several measures are in place to ensure water conservation and waste reduction during campus events. A formal water budget is instituted for each event to strictly manage and minimize water usage. For sanitation, event organizers are required to wash utensils using either treated greywater or other minimal-water methods. Furthermore, the distribution of single-use plastic bottles is eliminated; instead, guests are encouraged to use personal reusable bottles, with eco-refill stations strategically placed throughout the venue.

5.2.6.8.Water Reuse and Gardening

Greywater from hostel kitchens and washrooms is diverted and used for watering campus gardens. Additionally, natural mulching techniques are used to reduce evaporation and retain moisture in garden beds. Compost-enriched soil is used in planting zones to improve water retention.

5.2.6.9.Internal Water Audit System

A dedicated water audit team conducts regular reviews of consumption patterns across campus. These audits help track progress toward goals, identify wastage hotspots, and recommend upgrades to fixtures or practices. Block-wise reports are submitted to IQAC for evaluation and approval.

5.2.6.10.Future-Oriented Innovations

The college is exploring the integration of smart water meters, sensor-based taps, and real-time digital dashboards that display water usage statistics per block. This data-driven approach aims to bring visibility to water consumption and create opportunities for gamified conservation challenges.

5.2.7 Purchasing And Procurement

St. Teresa's College (Autonomous) acknowledges that purchasing decisions directly influence the sustainability of water usage on campus. As such, the college is committed to promoting responsible and water-conscious procurement practices that reduce indirect water consumption (also known as "virtual water") and enhance long-term conservation.

- **Water-Efficient Fixtures and Fittings:** The college prioritizes the procurement of low-flow taps, dual-flush systems, aerators, and sensor-based handwashing units to reduce unnecessary water usage in washrooms, laboratories, and kitchens. Procurement policies will ensure that only fixtures with verified water-saving technology are installed in future construction or renovation.
- **Sustainable Landscaping Supplies:** Ensure the purchasing materials for gardening and greening projects, preference is given to native plant species, soil with high moisture retention, and mulching materials that reduce watering frequency. Biodiversity Management committee are encouraged to select landscaping elements that require minimal irrigation.
- **Green Cleaning Products:** The college promotes the use of biodegradable, low-water cleaning solutions in hostels and academic buildings. These reduce the need for excessive rinsing and prevent contamination of greywater channels.
- **Water-Sensitive Cafeteria Supplies:** Cafeteria and canteen operations are encouraged to reduce the purchase of products that demand high water for production (e.g., disposable packaged food). Instead, reusable crockery and water-efficient dishwashing practices are prioritized.
- **Departmental Procurement Guidelines:** Departments are advised to assess the water footprint of materials and laboratory equipment before purchase. Guidelines will be circulated for selecting items that contribute to reduced water usage or better management.

5.2.8 Research and innovation

The college recognizes research and innovation as essential drivers for achieving water sustainability goals. Through academic inquiry, technological exploration, and student-led initiatives, the institution aims to create scalable solutions that can be applied both on and off campus.

- **Applied Water Research Projects:** Students and faculty are encouraged to take up interdisciplinary research in areas such as greywater treatment, rainwater filtration, water footprint analysis, and traditional Kerala water systems. Selected projects may receive seed funding or research mentorship.
- **Digital Water Management Tools:** The Department of Computer Science and Mathematics will be invited to design apps and dashboards to track real-time water consumption in campus blocks. These innovations may feature leak alerts, usage trends, and personal water tracking goals.
- **Green Lab Guidelines:** Science departments will implement Water-Smart Lab Practices such as closed-loop rinsing systems, minimal-flow water baths, and protocols for reusing distilled water in experiments. A model water-smart lab will be developed as a demonstrative pilot.
- **Student Innovation Cells:** The college will support student teams in developing low-cost water-saving devices, DIY greywater filters, or sensor-based conservation tools. Winning prototypes may be piloted on campus or shared with local schools.
- **Academic Publishing and Presentation:** The college promotes publication and presentation of water-related studies at national and international forums. Students and faculty will be supported to attend green conclaves, UGC seminars, and environmental hackathons that focus on water resilience and innovation.

5.2.9 Community Engagement

The college's commitment to sustainability extends beyond the campus boundary through dynamic community engagement programs led by student clubs, departments, and eco-focused initiatives.

STEP and Bhoomitra Sena Activities: Both STEP and Bhoomitra Sena spearhead multiple campaigns such as "Save Every Drop" initiatives, blue-ribbon awareness drives, and home-based water conservation workshops. These programs reach out to schools, Anganwadi's, and Kudumbashree units across Ernakulam district.

5.2.9.1.Botany & Zoology Department Collaborations:

Botany & Zoology Departmen departments organize field visits to wetlands, conduct biodiversity assessments of water bodies, and lead awareness classes on aquatic ecosystems and sustainable water usage. They also coordinate eco trails and "Know Your River" days for school students.

5.2.9.2.Ente Haritha Bhavanam Extension (Water Edition):

Under the successful household sustainability initiative, students will now be encouraged to document and improve water conservation at home. This includes checking for leaks, promoting the use of water-saving taps, and practicing greywater reuse.

5.2.9.3.Eco-Workshops in Panchayats:

In collaboration with local self-government institutions, students train community members on traditional water preservation methods, household rainwater harvesting, and kitchen greywater reuse models in selected panchayat.

5.2.9.4.Water Literacy Drives in Schools:

Interactive sessions, quiz competitions, and hands-on demos are conducted in nearby schools to educate younger students on the water cycle, water scarcity, and daily conservation practices.

5.2.9.5.Green Campus Integration:

Students are encouraged to act as "Block Water Ambassadors" responsible for raising awareness within their department or hostel, reporting wastage, and promoting responsible use of water resources.

5.2.9.6.Water Walks and Nature-Based Observations:

Inspired by the idea of "water trails," Bhoomitra Sena organize guided walks across campus that showcase rainwater harvesting pits, greywater systems, and plant species requiring minimal irrigation. These trails serve both as education tools and eco-tourism experiences for visiting students and dignitaries.

5.2.10 Monitoring and Reporting

Following the monitoring and reporting phase, a thorough evaluation and impact assessment are essential to determine the effectiveness of implemented water management strategies. This process involves analysing data trends, comparing outcomes with predefined goals, and assessing the real-world impact of interventions on water usage, infrastructure performance, and behavioural change across the campus.

Both quantitative data (e.g., reduction in water consumption, number of fixtures upgraded) and qualitative inputs (e.g., stakeholder feedback, user satisfaction) will be considered. Evaluations will be conducted periodically by the Water Management Committee, and the findings will help refine action plans, prioritize areas needing attention, and promote evidence-based decision-making. This step ensures continuous improvement and accountability, aligning all efforts with the institution's broader sustainability vision.

5.2.11 Compliance and Review

In aligned with the institution's broader Green Campus Initiatives, as well as national and state-level environmental sustainability standards. The implementation of this policy shall be reviewed periodically to ensure that the campus continues to uphold its commitment to responsible water use and environmental stewardship.

A framework for internal assessment and monitoring will be coordinated by the Water Management Committee in collaboration with the Internal Quality Assurance Cell (IQAC). This includes quarterly reviews of block-wise water data, flow meter records, and infrastructure maintenance logs. Suggestions and observations will be presented in review meetings and shared with relevant departments for action.

To remain responsive to changing environmental conditions and institutional demands, the Water Management Policy will undergo a formal internal review every three years. Updates will incorporate evolving best practices, technological advancements, and feedback from stakeholders to ensure continued relevance and effectiveness

5.2.12 Leadership and Accountability

5.2.12.1.Decentralized Responsibility and Role-Based Action

The implementation of this Water Management Policy will be carried out through a decentralized leadership model that engages both faculty and students. Each academic block is assigned a faculty coordinator and a student lead who together ensure that all recommended water conservation measures are followed, block-level issues are identified, and solutions are implemented efficiently. Faculty members are responsible for enabling institutional support, while students act as peer advocates for daily practices and reporting.

5.2.12.2.Audit-Driven Team Leadership

The Water Audit was led by a student-faculty task force divided by blocks, with each team responsible for collecting data, verifying infrastructure, and maintaining reporting consistency. These student-led audit teams have now evolved into active Water Monitoring Units that will continue to track consumption trends, raise awareness, and work with departments to integrate conservation into everyday campus life.

5.2.12.3.Collaborative Communication and Feedback Systems

To maintain continuous engagement, periodic review meetings will be held at the block level with student leads, faculty coordinators, and the Water Management Committee. Updates on water usage, flow meter readings, or issues like fixture repair needs will be shared through a multi-channel approach, including department WhatsApp groups, digital dashboards (when implemented), and physical notice boards. Suggestion boxes or digital feedback forms will be made available to collect student input and ideas for improvement.

5.2.12.4.Fostering Ownership Across Campus

All members of the college community are viewed as active stakeholders in sustaining the policy's success. Beyond the data and audits, responsibility is embedded in practice by carrying personal water bottles, reporting drips and leaks, and participating in water-saving initiatives. The college will foster a culture of ownership by integrating water sustainability into student orientations, club responsibilities, and regular campus-wide initiatives.

5.2.12.5.Scaling Through Innovation and Partnerships

As a next step, the college will explore forming a student-led Water Innovation Forum where ideas and small-scale prototypes for conservation can be discussed, developed, and possibly piloted. Additionally, partnerships with the Suchitwa Mission, local panchayats, and environmental research organizations will be explored to further expand the campus's water sustainability network.

5.2.13 Conclusion

Water is not just a utility but a shared responsibility, and through this Water Management Policy, St. Teresa's College (Autonomous) reaffirms its commitment to sustainability, resilience, and environmental accountability. This policy reflects the collective effort of faculty, staff, and students who have worked together to audit, understand, and improve the campus's water infrastructure and practices. By promoting mindful usage, expanding conservation systems, and empowering the community through education and innovation, the college envisions a future where every drop is respected, reused, and remembered. This is not just a policy it is a promise to act with purpose, protect our resources, and set an example for generations to come.

5.3 METHODOLOGY

A comprehensive water efficiency assessment, essential for sustainable progress, evaluated water consumption and maintenance practices throughout the college. The methodology for the audit included a ground-level survey carried out by a team of 21 members (18 students and 3 faculty) following a predetermined schedule. The team was divided into specialized groups to carry out tasks such as documenting activities, inspecting plumbing fixtures, and performing site evaluations on a block-by-block basis. The organized audit relied on eight different registers and five main guiding documents.

5.3.1 Internal audit training

Green audit training executes detailed, participatory methods to cultivate a sense of ownership and involvement within the institution. To prepare the college for this initiative, the implemented Environmental Management System (EMS) identifies students and faculty for training as internal auditors. This one-day course certifies participants as internal auditors, enabling them to perform a water audit. The internal water audit procedure consists of several essential phases: evaluation, risk assessment, data gathering, policy development, and the creation of records and programs for water conservation and resource management.

5.3.2 Water infrastructure survey

The internal audit team conducted a comprehensive survey of the water infrastructure. This process included cataloguing taps and faucets according to their type and quantity, evaluating their condition, and specifically noting the locations and counts of any leaks. The team created a map of all water sources for each block, including external sources, and recorded the details of water storage systems, such as type, capacity, year of installation, and placement. This information enabled an evaluation of the functionality of the infrastructure (taps, faucets, pumping lines). The audit also included an analysis of water quality, an assessment of water risk management strategies, and a review of maintenance practices.

5.3.3 Sampling data collection of nine water meters

To oversee water distribution, flow meters were installed at five sites where main lines emerge from their designated sources or tanks. Meter readings were collected over three weeks during planned sampling days. Simultaneously or independently, based on the actual procedures, pump operating times and related water volumes were recorded in triplicate throughout a nine-day observation period. The data gathered, which included date, time, volume, and duration measures, enabled calculations of flow rates.

5.3.4 Registers for the monitoring and analysis

The audit subsumes an evaluation of water footprint records, examination of consumption trends, grey water recycling systems, strategies for reducing water loss, and thorough management of water resources. Additionally, organized documentation of meetings and initiatives centered on water conservation and sustainability created a solid baseline of the college's existing water resources and practices.

5.3.5 External auditing

Following the completion of the internal audit, an external auditor arrives at the college to assess compliance and identify any non-conformities related to the water management audit standards. In cases where only minor non-conformities are identified, the external auditor can grant the institution certification in alignment with the applicable ISO standards.

5.3.6 Assumption

The global challenge of water scarcity is critical and increasingly urgent, necessitating proactive solutions. To address this concern and promote water conservation in non-domestic sectors, organizations should adopt sustainable water management practices. The ongoing shortage of freshwater, made worse by consumption habits, high agricultural and industrial demands, and climate change, calls for improved resource management. Although freshwater supplies cannot be expanded, their management can be refined through a structured approach that includes enhancing water efficiency, utilizing consumption analysis tools, and implementing systematic conservation efforts. This approach not only yields significant savings in water and energy but also lessens environmental impacts.

By aligning water management strategies with established standards, such as those specified in ISO 46001, organizations can reap considerable benefits. This alignment involves incorporating water resource identification into organizational planning and financial decisions, optimizing water demand, enhancing management of usage, and promoting accountability by emphasizing potential societal impacts. Regular evaluation procedures uncover chances for efficiency improvements, resulting in operational savings through conservation technologies, sustainable design, and careful monitoring. Thorough audits of critical infrastructure elements—from source and treatment facilities to distribution systems and end-users—are vital for detecting water losses, supporting system enhancements, and ensuring water quality via systematic monitoring, which guides the development of suitable treatment systems. Assessing leaks is a fundamental component of this evaluation process.

5.3.7 Water footprint verification

The critical role of water usage within national sustainability initiatives highlights the necessity for reliable and comparable data to enable effective regulation. ISO 14046 meets this need by providing a standardized approach for assessing and reporting water footprints, emphasizing precision through independent verification protocols. There is a growing interest among stakeholders, consumers, and international organizations in the water performance of corporations, focusing on the overall water footprint which encompasses both direct and indirect water usage along with associated environmental effects. As a result, the ISO 14046 standard was created to offer a solid framework for these evaluations. It aids in determining the water footprints for entities, processes, and products, assessing not only the volumes of water consumed but also the potential environmental impacts. ISO 14046 assessments can be executed independently, focusing specifically on water-related effects, or integrated into a broader life cycle assessment (LCA). With increasing pressures in the 21st century, such as climate change leading to diminished water resources, businesses need to implement effective water management strategies. Leveraging ISO 14046 and its verification process, often supported by training programs (e.g., SGS), allows organizations to credibly showcase their commitment to responsible water management.

5.3.8 Stages of water audit

Water audit has the following three phases:

5.3.8.1 Pre audit phase

- Formation of audit team; scheduling audit programmes
- Setting up of scope and objectives (in tune with the water conservation policy of the institution)
- Discuss 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 the following specific activities:

5.3.8.1.1.System audit (inventory of infrastructure)

- The current water usage 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.

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

- Water audit comprises the preparation of a 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.

5.3.8.2 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 an 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.

5.3.8.3 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:

5.3.8.3.1.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 project future requirements.
- Data on the development of a sustainable source of water through rainwater harvesting and wastewater (grey water) recycling should also be taken into consideration.
- Water conservation measures shall be identified and included in the action plan.

5.3.8.3.2.Discharge audit

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

5.3.9 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.

5.3.9.1 . Site assessment

Collection of contour maps and campus diagrams

- Preparing an inventory of the water infrastructure of each building:

- Water meter data (from various points of use)
- Data on the quantity of water pumped every day (pump-wise/location-wise)
- Data on leaking infrastructure and the 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)

5.3.9.2 . 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

5.3.9.3 . Final audit by external audit team

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

5.3.10. Work plan and schedule of water audit

Date to date	Work Plan
01/08/2025-08/08/2025	• Divide the students into 4 groups • Obtain maps of each block • Collect the data of water infrastructure in each block. • Conduct an offline meeting • Prepare minutes, action plan and reports. • Upload the collected data into an excel sheet for analysis.
09/08/2025-16/08/2025	• Measure the rate of water discharge using an equipment. • Upload the collected data
18/08/2025-25/08/2025	• Collection of the water source data
26/08/2025-02/09/2025	• Provide a sample of water to a laboratory for grey water analysis
03/09/2025-24/09/2025	• Take flow meter readings (Three replication)

Table No.5.1 Schedule of water efficiency management audit

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 (Holiday) 03/08/2025, 10/08/2025,17/08/2025 Three semi holidays as 09/08/2025, 16/08/2025,23/08/2025 Three working days as 04/08/2025, 11/08/2025 ,18/08/2025	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 division of the college (for eg, in the 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 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 No.5.2. Work plan of water efficiency management audit

Fig.5.1. Internal audit review meeting

5.4.RESULT DISCUSSION

5.4.1. Water source

The primary source of water for the college is two wells and cooperative water. One well is located in the central block campus, while the other is an underground well, designed to accommodate both vehicular and pedestrian traffic and located in Science Block campus.

Sl No.	Type	Year of Installation	Location	Water Source	Area/Building to Which Delivery	Purpose of Water	Type of Tank	Times Daily Filled
1	Underground Borewell Tank (Main Tank)	1925	Behind the arts auditorium	Underground/ Rainwater	Whole campus	Rainwater harvesting	Underground Concrete	Depends on rainfall
2	Well	1925	Behind Office	Underground and Rainwater	The Underground Tank	General Usage	N/A	Depends on Underground water and rainfall

Table No. 5.3.Water source of the college

5.4.2. Water storage

Sl No.	Type	Capacity (litres)	Year of Installation	Location	Water Source	Area/Building to Which Delivery	Purpose of Water	Type of Tank	Times Daily Filled
3	Underground Tank	16000	1925	Near well	well	Main/General	General usage	Underground Concrete	Fills from the Well
4	Concrete Tank	12000	2008	Rooftop	Main Tank	Main Building	General usage	Concrete	Automatic filling
5	Water Tank (Black)	1000	2004	Jubilee auditorium rooftop	Main Tank	Office	General usage	Plastic	Automatic filling
6	Water Tank (Black)	1000	2004	auditorium	Main Tank	Office	General usage	Plastic	Automatic filling
7	Water Tank (Black)	1000	2004	auditorium	Main Tank	Office	General usage	Plastic	Automatic filling
8	Water Tank (Black)	1000	2004	auditorium	Main Tank	Office	General usage	Plastic	Automatic filling

9	Water Tank (Black)	1000	2006	E Block	Main Tank	E Block	General usage	Plastic	Automatic filling
10	Water Tank (Black)	1000	2006	E Block	Main Tank	E Block	General usage	Plastic	Automatic filling
11	Water Tank (Black)	1000	2006	E Block	Main Tank	E Block	General usage	Plastic	Automatic filling
12	Water Tank (Black)	1000	2006	E Block	Main Tank	E Block	General usage	Plastic	Automatic filling
13	Water Tank (Black)	1000	2008	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
14	Water Tank (Black)	1000	2008	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
15	Water Tank (White)	1000	2024	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
16	Water Tank (White)	1000	2024	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
17	Water Tank (White)	1000	2024	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
18	Water Tank (White)	1000	2024	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
19	Water Tank (White)	1000	2024	Hostel	Main Tank	Hostel	General usage	Plastic	Automatic filling
20	Underground Tank	4000	2024	behind office	Main Tank	Main Building/ General	General usage	Underground Concrete	Automatic filling
21	Concrete Tank	6000	2024	Washroom	Main Tank	Bathroom	General usage	Concrete	Automatic filling
22	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling
23	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling

24	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling
25	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling
26	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling
27	Water Tank (White)	1000	2025	Block A Rooftop	Main Tank	Main	Drinking, washing, cleaning, bathing, cooking	Plastic	Automatic filling

Table No. 5.4.Arts block

Sl No.	Type	Capacity (litres)	Year of Installation	Location	Water Source	Area/Building to Which Delivery	Purpose of Water	Type of Tank	Times Daily Filled
1	Water Tank (Black)	1000	2021	Behind central block	Main Tank	Central Block	General Usage	plastic	Automatic filling
2	Water Tank (Black)	1000	2021	Behind central block	Main Tank	Central Block	General Usage	plastic	Automatic filling
3	Water Tank (Black)	1000	2021	Behind central block	Main Tank	Central Block	General Usage	plastic	Automatic filling

Table No.5.5. Centenary block

Sl No.	Type	Capacity (litter)	Year of Installation	Location	Water Source	Area/Building to which Delivery	Purpose of water	Type of tank	Times daily filled
1	Water Tank(Black)	1000	2008	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
2	Water Tank(Black)	1000	2008	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
3	Water Tank(Black)	1000	2008	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling

4	Water Tank(Black)	1000	2008	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
5	Water Tank(Black)	1000	2015	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
6	Water Tank(Black)	1000	2008	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
7	Water Tank(Black)	1000	2021	Behind The Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
8	Water Tank(Black)	1000	2021	Rooftop Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
9	Water Tank(Black)	1000	2021	Rooftop Science Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling

Table No.5.6. Science block

Sl No.	Type	Capacity(Liter)	Year Of Installation	Location	Water Source	Area/Building To Which Delivery	Purpose Of Water	Type Of Tank	Times Daily Filled
1	Water Tank(Black)	1000	2023	Behind The Centenary Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
2	Water Tank(Black)	1000	2023	Behind The Centenary Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
3	Water Tank(Black)	1000	2023	Behind The Centenary Block	Main Tank	Science Block	Common Usage	Plastic	Automatic Filling
4	Water Tank(Black)	1000	2023	Behind The Centenary Block	Main Tank	Centenary Block	Common Usage	Plastic	Automatic Filling

Table No.5.7.Central block

Fig No.5.2. Water tank (Arts block)

Fig No.5.3.Water Tank (Science block)

5.4.3. Water infrastructure of the college

SI No.	DEPARTMENT/FLOOR	FLOOR	TAP	FLUSH	FAUCET	FILTERS	SHOWER	SPRINKLERS	Leakage	Damage
1	RECEPTION	GROUND	0	0	0	0	0	0	0	0
2	OFFICE		3	1	1	0	0	0	0	0
3	VERANDAH		0	0	0	1	0	0	0	0
4	DEAN'S ROOM		2	1	1	0	0	0	0	0
5	HANDICAPPED TOILET		2	1	1	0	0	0	0	0
6	DIRECTOR'S ROOM	FIRST	4	1	1	0	0	0	0	0
7	VERANDAH		0	0	0	1	0	0	0	0
8	WASHROOM		7	5	5	0	0	0	0	0
9	STAFFROOM	SECOND	2	1	1	0	0	0	0	0
10	WASHROOM		6	3	3	0	0	0	0	0
11	VERANDAH		0	0	0	1	0	0	0	0
12	DYEING LAB	THIRD	2	1	1	0	0	0	0	0
13	WASHROOM		7	5	5	0	0	0	0	0
14	FOOD LAB	FOURTH	0	0	0	1	0	0	0	0
15	BIOCHEMISTRY LAB		9	0	0	0	0	0	0	0
16	PHYSIOLOGY LAB		4	0	0	0	0	0	0	0
17	WASHROOM		8	4	4	0	0	0	0	0
18	WASHROOM-STAFF		2	1	1	0	0	0	0	0
19	OUTSIDE THE WASHROOM		0	0	0	1	0	0	0	0
20	FINISHING SCHOOL	FIFTH	4	1	1	0	0	0	0	0
21	VERANDAH		0	0	0	1	0	0	0	0
22	WASHROOM		7	5	5	0	0	0	0	0
23	OUTSIDE THE BLOCK		1	0	0	0	0	0	0	0
	TOTAL		70	30	30	6	0	0	0	0

Table No.5.8. Centenary block

Sl No.	Department/Floor	Floor	Tap	Flush	Faucet	Filters	Shower	Sprinklers	Leakage	Damage
1	WASHROOM	GROUND	9	5	0	2	0	0	0	0
2	STAFF ROOM	FIRST	1	1	0	0	0	0	0	0
3	WASHROOM		8	4	0	0	0	0	0	0
4	VERANDAH		0	0	0	1	0	0	0	0
5	STAFF ROOM	SECOND	1	1	1	0	0	0	0	0
6	VERANDAH		0	0	0	1	0	0	0	0
7	WASHROOM		6	2	0	0	0	0	0	0
8	FOOD PROCESSING	THIRD	6	1	0	0	0	0	0	0
9	WASHROOM		6	2	0	0	0	0	0	0
10	VERANDAH		0	0	0	1	0	0	0	0
11	WASHROOM	FOURTH	7	3	0	0	0	0	0	0
12	VERANDAH		0	0	0	1	0	0	0	0
13	WASHROOM	FIFTH	7	0	0	0	0	0	0	0
14	VERANDAH		0	0	0	1	0	0	0	0
15	WASHROOM	SIXTH	8	4	0	0	0	0	0	0
16	DINING AREA		1	0	0	0	0	0	0	0
	TOTAL		60	23	1	7	0	0	0	0

Table No.5.9. Central block

Sl. No.	Department / Floor	Tap	Flush Tanks	Water Filter	Faucets	Leakage	Shower	Damage
1	STAFF ROOM (DEPT. OF CHEMISTRY)	1	0	0	0	0	0	0
2	STAFF REST ROOM	3	1	0	1	0	0	0
3	CHEMISTRY LAB	68	0	0	0	0	1	0
4	COMPLEMENTARY CHEMISTRY LAB	48	0	0	1	0	0	0
5	MSC CHEMISTRY LAB	24	0	0	0	0	0	0
6	RESEARCH LAB	19	0	0	0	0	0	0

7	ENTRANCE	0	0	1	0	0	0	0
8	HOMESCIENCE ROOM 1	1	0	0	0	0	0	0
9	HOMESCIENCE ROOM 2	1	0	0	0	0	0	0
10	WASHROOM	5	3	0	0	0	0	0
11	BIOCHEMISTRY LAB	1	1	0	1	0	0	0
12	RESTROOM-STAFF	6	2	0	2	0	0	0
13	VERANDAH	1	0	0	0	0	0	0
14	STAFF ROOM (DEPT.OF BOTANY)	1	0	0	0	0	0	0
15	STAFF REST ROOM	2	0	0	0	0	0	0
16	RESEARCH CENTRE	1	0	0	0	0	0	0
17	MSC BOTANY LAB	5	0	0	0	0	0	0
18	CLASSROOMS	2	0	0	0	0	0	0
19	ENTRANCE	0	0	1	0	0	0	0
20	CENTRE FOR INSTRUMENTATION	2	7	0	0	0	0	0
21	STAFF ROOM (DEPT.OF ZOOLOGY)	1	7	0	0	0	0	0
22	TOILETS	7	7	0	2	0	0	0
23	PG LAB	4	6	0	0	0	0	0
24	MUSUEUM	1	6	0	0	0	0	0
25	AQUARIUM	1	6	1	0	0	0	0
26	BSC SUB LAB	7	6	0	0	0	0	0
27	SPECIMEN STOREROOM	5	6	0	0	0	0	0
28	ROOM 1	6	6	0	0	0	0	0
29	CLASSROOM 1	1	6	0	0	0	0	0
30	MOLECULAR BIOLOGY LAB	1	6	0	0	0	0	0
31	ENTRANCE	0	3	1	0	0	0	0
32	STAFF ROOM (PHYSICS)	1	2	0	0	0	0	0
33	STAFF REST ROOMS	4	0	0	3	0	0	0
34	VERANDAH	0	0	0	0	0	0	0

35	STAFF ROOM (MATHEMATICS)	1	0	0	0	0	0	0
36	STAFF REST ROOM	1	0	0	1	0	0	0
37	LANGUAGE ROOM	1	0	0	0	0	0	0
38	COMMON WASHROOM	5	0	0	0	0	0	0
39	COMMON REST AREA	3	0	0	0	0	0	0
40	ENTRANCE	8	0	0	4	0	0	0
41	HOSTEL (ENTRANCE)	0	0	1	0	0	0	0
42	HOSTEL (COMMON WASHAREA)	41	0	0	0	0	0	0
43	HOSTEL (COMMON TOILETS)	41	0	0	4	0	0	0
44	WASHROOM(GROUND)	28	2	0	2	0	0	0
	TOTAL	359	83	5	21	0	0	0

Table No.5.10. Science block

Sl. No.	Department / Floor	Tap	Flush Tanks	Water Filter	Faucets	Leakage	Damage
1	B Block Ground Floor (Sociology Dept)	4	1	1	1	0	0
2	B Block Ground Floor (Hand Faucet)	1	0	0	1	0	0
3	B Block Ground Floor (Flush)	1	1	0	0	0	0
4	1st Floor (Eco Dept)	2	1	1	1	0	0
5	1st Floor (Mala Dept)	3	2	0	2	0	0
6	1st Floor (Commerce Dept)	2	1	0	0	0	0
7	2nd Floor (History Dept)	2	1	1	0	0	0
8	2nd Floor (Eng Dept Corridor - Unused)	1	0	0	0	0	0
9	2nd Floor (Eng Dept)	2	1	0	1	0	0
10	3rd Floor (Radio Dept)	2	1	1	1	0	0
11	4th Floor (Media Center)	1	1	0	1	0	0
12	5th Floor (Comp Lab)	6	2	1	0	0	0
13	Dept of Computer Applications	1	0	0	0	0	0
14	Library (1st Floor)	0	0	1	0	0	0
15	Library (2nd Floor)	5	2	0	2	0	0
16	Office (1st Floor)	0	0	1	0	0	0
17	Principal Office	2	1	0	1	0	0
18	B Block Cafeteria (Near Car Parking)	1	0	0	0	0	0

19	Director Room	2	1	1	1	0	0
20	A Block (Outside)	0	0	1	0	0	0
21	D Block (Washroom - Ground Floor)	31	26	0	26	0	0
22	D Block (Handicapped Washroom)	1	1	0	1	0	0
23	D Block (Exam Cell Entrance)	2	1	1	1	0	0
24	D Block (Dept. of Communicative Eng.)	1	1	1	1	0	0
25	D Block (Unused Tap – (America) open near to IQAC room	1	0	0	0	0	0
26	D Block (Jubilee Auditorium)	3	1	0	1	0	0
27	D Block (Café - Ground Floor)	1	0	0	0	0	0
28	A Block (Vice Principal's Office)	2	1	0	1	0	0
29	B Block (Washroom Entrance)	2	0	0	0	0	0
30	B Block (Washrooms)	7	7	0	7	0	0
31	B Block (Non-Teaching Staff)	2	1	0	1	0	0
32	B Block (Entrance)	1	1	0	1	0	0
33	Block E (Dept. of Communicative Eng.)	3	1	1	1	0	0
34	Block E (Dept. of Physical Education)	4	1	0	0	0	0
35	Block E (Dept. of Industry Integrated)	2	1	1	1	0	0
36	Block E (Rest Room)	8	4	0	0	0	0
37	Block E (Dept. of Bharatnatyam)	2	1	1	0	0	0
38	Extra Findings (Behind Gate - B Block)	1	0	0	0	1	0

39	Extra Findings (Entrance Gardening Tap)	1	0	0	0	0	0
40	Hostel (Ground Floor - General Washroom)	8	4	0	4	0	0
41	Hostel (Ground Floor - Kitchen)	7	0	0	0	0	0
42	Hostel (Ground Floor - Mess Hall)	6	0	1	0	0	0
43	Hostel (Ground Floor - Wash Area)	18	2	0	2	0	0
44	Hostel (Ground Floor - Visitor's Washroom)	2	1	0	0	0	0
45	Hostel (1st Floor - Sister's Room)	2	1	0	1	0	0
46	Hostel (1st Floor - Washroom LHS)	28	1	0	2	0	0
47	Hostel (1st Floor - Washroom RHS)	37	3	0	3	0	0
48	Hostel (2nd Floor - Filter Ground Floor)	1	0	1	0	0	0
49	Hostel (2nd Floor - Sister's Room)	2	1	0	1	0	0
50	Hostel (2nd Floor - Washroom RHS)	23	0	0	0	0	0
51	Hostel (2nd Floor - Washroom LHS)	12	1	0	1	0	0
Total		395	50	12	67	0	0

Table No.5.11.Arts block

The college's water supply is primarily sourced from three locations: two wells located in the Arts Block and Central Block. The Central Block's water source is an underground well designed to optimise space utilisation, accommodating both vehicle passage and pedestrian walkways, while seamlessly integrating into the college's overall water supply system. The water management is supported by 41 automatically refilling tanks, strategically positioned to meet the water demands of each building. The distribution of these tanks includes four 1,000-litre tanks in both the Auditorium and E Block, seven 1,000-litre tanks in the Hostel, six 1,000-litre tanks in Block A, and a single 6,000-litre tank in the Office. The main water supply is sourced from an 80,000-litre underground borewell tank dedicated to rainwater harvesting, with additional tanks ranging from 1,000 litres to 16,000 litres. Among the buildings, the Arts Block has the highest number of fixtures, totalling 524, followed by the Science Block with 468 fixtures, the Centenary Block with 136 fixtures, and the Central Block with 91 fixtures. Furthermore, both the Arts and Science Blocks lead in the number of taps, each having 359 taps, while the Centenary and Central Blocks have 70 and 60 taps, respectively.

The science block consists of 1000L in four tanks. The Science block has the highest number of high-strength flushes at 83, followed by the Arts block (50), Centenary block (30), and Central block (23). The Science block also has the most water filters at 21, followed by the Arts block (12). The central block consists of four 1000 L capacity filters: the Central block (7) and the Centenary block (6). The Arts block has the highest number of faucets with 67, followed by the Centenary block (30), Science block (5), and Central block (1).

Fig No. 5.4. Infrastructure assessment

Fig No. 5.5. Water risk assessment

5.4.4. Water consumption study using manual water discharge data

FIXTURES	COUNT	RATE OF DISCHARGE (L/MIN)	AVERAGE DURATION OF USE(MIN)	AVG QTY PER USE(L)	NO:USES PER DAY	TOTAL DAILY USES(L)	PER CAPITA USE(L)
KITCHEN TAP	1	2.56	5	12.8	15	192	9.6
UTILITY TAP 1	1	3.92	3	11.8	10	117.6	5.88
UTILITY TAP 2	1	4.67	3	14	10	140.1	7
BATHROOM FAUCET 1	1	4.78	2	9.56	20	191.2	9.56
BATHROOM FAUCET 2	1	4.81	2	9.62	20	192.4	9.62
SHOWER 1	1	9.26	8	74.1	5	370.4	18.52
SHOWER 2	1	9.26	8	74.1	5	370.4	18.52
OUTSIDE TAP	1	9.79	6	58.7	5	293.7	14.69
LAB TAPS	1	nil	0	0	0	0	0
FLUSH	1	18	0.25	4.5	40	180	9
WATER PURIFIER	1	0.6	4	2.4	10	24	1.2
Total	11	67.65	41.3	272	140	2072	103.59

Table.No.5.12.Arts block

According to the sampling study, the daily water consumption is estimated to be 2,072 liters, based on an assumption of 20 users, which includes students, staff, and visitors. This results in a total annual water usage of 414,360 liters during working days; subsequently, the average per capita consumption is approximately 103.59 liters.

FIXTURES	COUNT	RATE OF DISCHARGE (L/MIN)	AVERAGE DURATION OF USE(MIN)	AVG QTY PER USE(L)	NO:USES PER DAY	TOTAL DAILY USES(L)	PER CAPITA USE(L)
KITCHEN TAP	1	2.8	4	11.2	12	134	6.7
UTILITY TAP 1	1	4	3	12	8	96	4.8
UTILITY TAP 2	1	4.2	3	12.6	10	126	6.3
BATHROOM FAUCET 1	1	4.5	2	9	18	162	8.1
BATHROOM FAUCET 2	1	4.6	2	9.2	18	166	8.3
SHOWER 1	1	8.8	7	61.6	4	246	12.3
SHOWER 2	1	9	7	63	4	252	12.6
OUTSIDE TAP	1	9.5	5	47.5	6	285	14.3
LAB TAPS	1	2	10	20	10	200	100
FLUSH	1	12	0.25	3	30	90	4.5
WATER PURIFIER	1	0.5	5	2.5	10	25	1.25
Total	11	61.9	48.25	251.6	130	1782.4	179.15

Table No.5.13.Science block

Based on the sampling study, the proposed daily water usage is calculated to be 1782.4 liters, assuming there are 20 users, comprising students, staff, and visitors. This leads to an estimated total annual water consumption of 356480 liters during weekdays; consequently, the average water usage per individual is roughly 179.15 litres.

Fixtures	Count	Rate Of Discharge (L/ Min)	Average Duration Of Use(Min)	Avg Qty Per Use(L)	No:Uses Per Day	Total Daily Uses(L)	Per Capita Use(L)
KITCHEN TAP	1	3	4	12	10	120	6
UTILITY TAP 1	1	4.2	3	12.6	7	88.2	4.4
UTILITY TAP 2	1	4.8	4	19.2	9	172.8	8.6
BATHROOM FAUCET 1	1	4.3	2	8.6	15	129	6.45
BATHROOM FAUCET 2	1	5	2	10	16	160	8
SHOWER 1	1	9	6	54	4	216	10.8
SHOWER 2	1	9.2	7	64.4	5	322	16.1
OUTSIDE TAP	1	10	5	50	3	150	7.5
LAB TAPS	1	4	6	24	12	288	14.4
FLUSH	1	6	0.3	1.8	35	63	3.15
WATER PURIFIER	1	0.5	5	2.5	15	37.5	1.88
	11	60	44.3	259.1	131	1746.5	87.28

Table No.5.14.Central block

In the sampling study, the estimated daily water usage is 1746.5 litres, calculated on the basis of 20 users, which encompasses students, staff, and visitors. This leads to an overall annual water consumption of 349,300 litres on working days; therefore, the average consumption per person is roughly 87.28 litres.

Fixtures	Count	Rate Of Discharge (L/ Min)	Average Duration Of Use(Min)	Avg Qty Per Use(L)	No: Uses Per Day	Total Daily Uses(L)	Per Capita Use(L)
KITCHEN TAP	1	2.5	3	7.5	14	105	5.25
UTILITY TAP 1	1	3.5	4	14	6	84	4.2
UTILITY TAP 2	1	5	2.5	12.5	10	125	6.25
BATHROOM FAUCET 1	1	4	2.5	10	16	160	8
BATHROOM FAUCET 2	1	4.8	2	9.6	15	144	7.2
SHOWER 1	1	8.5	5	42.5	4	170	8.5
SHOWER 2	1	9.5	6	57	5	285	14.25
OUTSIDE TAP	1	9	6	54	4	216	10.8
LAB TAPS	1	3.5	5	17.5	11	193	9.6
FLUSH	1	6	0.3	1.8	25	45	2.25
WATER PURIFIER	1	0.45	4	1.8	20	36	1.8
Total	11	56.75	40.3	228.2	130	1562.5	78.1

Table No.5.15.Centenary Block

The daily water consumption is 1562.5 litres, based on an assumption of 20 individuals, including students, staff, and visitors. This results in an estimated yearly water usage of 312,500 litres on working days; consequently, the average water usage per individual is approximately 78.1 litres.

The sampling studies indicate that while the Arts block is well-equipped in terms of fixture strength, the Science block exhibits higher water usage. This increased consumption is primarily attributable to the operational needs of the Chemistry, Zoology, Botany, and Biochemistry laboratories. In contrast, the Arts block has modified its water fixtures, whereas the Central and Centenary blocks, being new constructions, feature improved infrastructure. These factors contribute to the significantly greater water usage in the Science block.

Fig No. 5.6. Water infrastructure

Fig No. 5.7. Water filter

5.4.5.Water flow meter readings of water consumption

Sampling day	Water consumption per year (KL)
Semi holiday	82.49
Working day	177.20
Holiday	58.10
Average consumption per year	317.79

Table No.5.16. Arts block meter 1

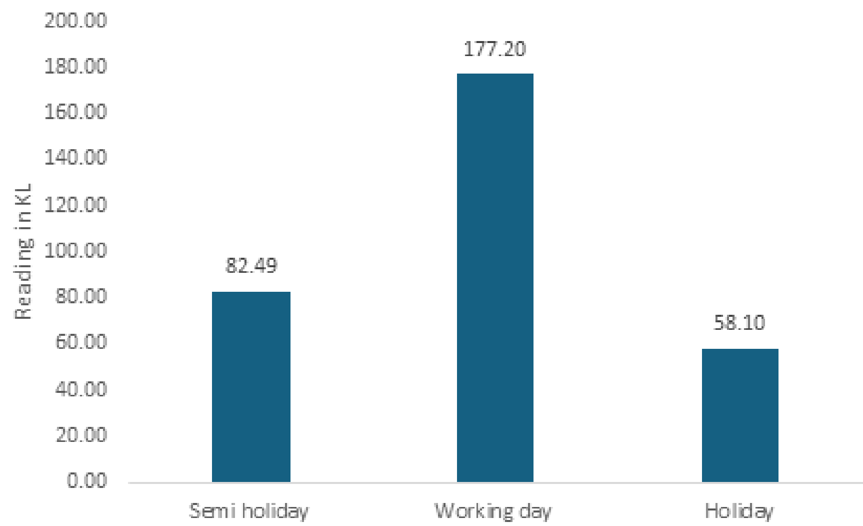

Fig.No. 5.8.Flow meter reading in KL

The flow meter readings from the arts block reveal a distinct pattern in water usage across different types of days. During working days, the readings peak significantly, indicating a high-water demand. This surge is closely tied to the increased human occupancy of the college, as the block primarily consists of classrooms and administrative offices that operate at full capacity. On semi-holidays, the readings show a noticeable decline, reflecting reduced activity and partial operations.

Holidays register the lowest flow rates, which aligns with minimal campus functioning, limited human presence, and scaled-down maintenance routines. The current flow rate observed during holidays likely represents the refilling of water tanks from the main source rather than active consumption, suggesting that even in low-activity periods, essential infrastructure processes continue.

Sampling day	Water flow meter reading per year(KL)
Semi holiday	85.63
Working day	241.40
Holiday	49.28
Average consumption per year	376.31

Table No.5.17.Arts block meter 2

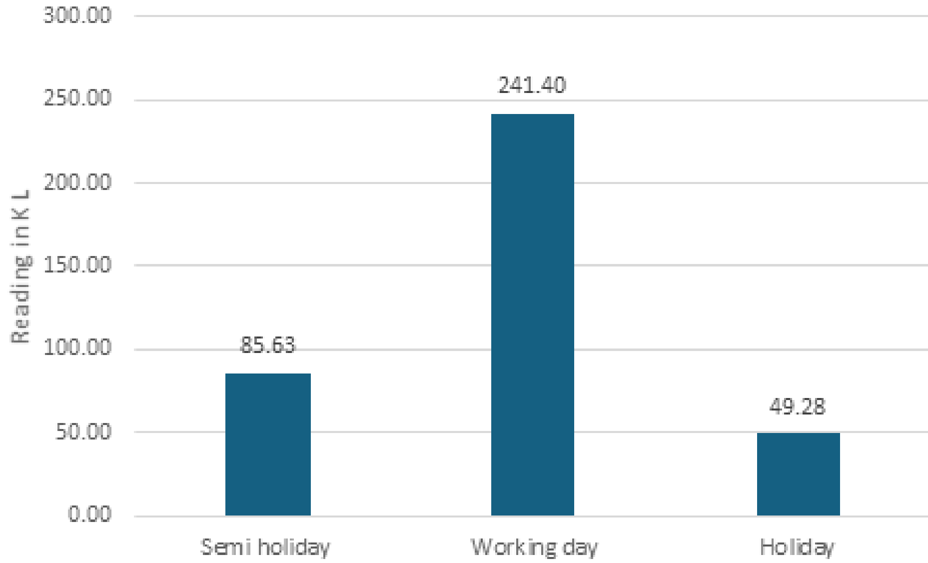

Fig.No. 5.9.Flow meter reading in KL

The second flow meter installed in the arts block records a noticeably higher water flow rate during working days compared to the first meter. This suggests that it may be supplying additional areas within the campus. The readings show only minor fluctuations between semi-holidays and holidays, indicating that the meter continues to register flow even when overall campus activity is reduced. This could be due to ongoing background operations, maintenance routines, or tank refilling processes. Overall, the pattern clearly reflects that water usage is closely tied to the operational status of the campus, which is higher during full activity and relatively stable during partial or minimal functioning.

Sampling days	Total average per consumption per year (KL)
Semi holiday	608.79
Working day	973.60
Holiday	640.64
Average consumption per year	2223.03

Table No. 5.18. Science block meter 1

Fig No.5.10. water consumption in KL

Working days are characterized by high water demand due to the usage of the washroom, cafeteria, as well as the function of laboratories for Botany, Zoology, and Chemistry. The Chemistry lab has a significant water requirement owing to frequent experiments, extensive cleaning procedures, and safety protocols that necessitate substantial water use, resulting in peak demand during operational days when academic and laboratory activities are at their highest. In contrast, water flow rates decrease noticeably during holidays, reflecting reduced human presence and the suspension of laboratory operations. On semi-holidays, there is a slight increase in water demand compared to holidays, likely due to reduced academic activities or partial laboratory usage.

Sampling days	Water flow meter reading per year(KL)
Semi holiday	721705.41
Working day	666861.20
Holiday	81.13
Average consumption per year	1388647.74

Table No.5.19.Science block meter 2

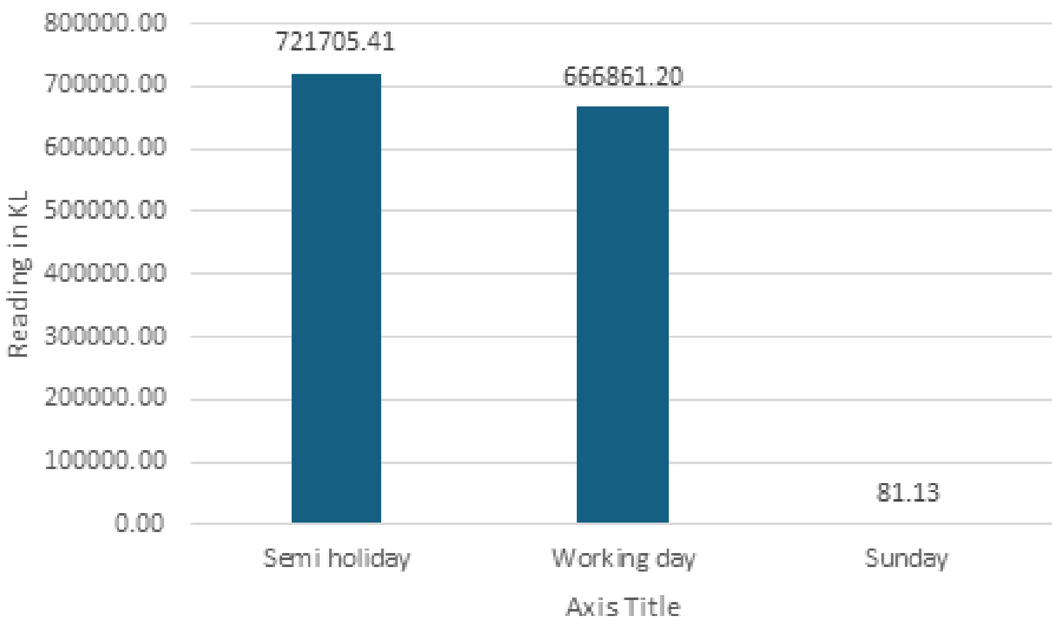

Fig.No.5.11.Flow meter reading in KL

The second flow meter in the Science block records a higher overall water flow than the first. Unlike typical expectations, the peak flow is observed during semi-holidays, followed by working days, and then on Sunday, which shows the lowest rate. This suggests that the second meter may be supplying water to additional areas or systems beyond the immediate block, possibly for preparatory lab work, cleaning, or maintenance that continues even when regular academic activities are scaled down. The notably low flow on Sundays reflects the college's minimal operational status, with limited staff presence and reduced infrastructure usage.

Sampling day	water flow meter reading per year(KL)
Semi holiday	0
Working day	200
Holiday	0
Average consumption per year	200

Table.No.5.20.Central block

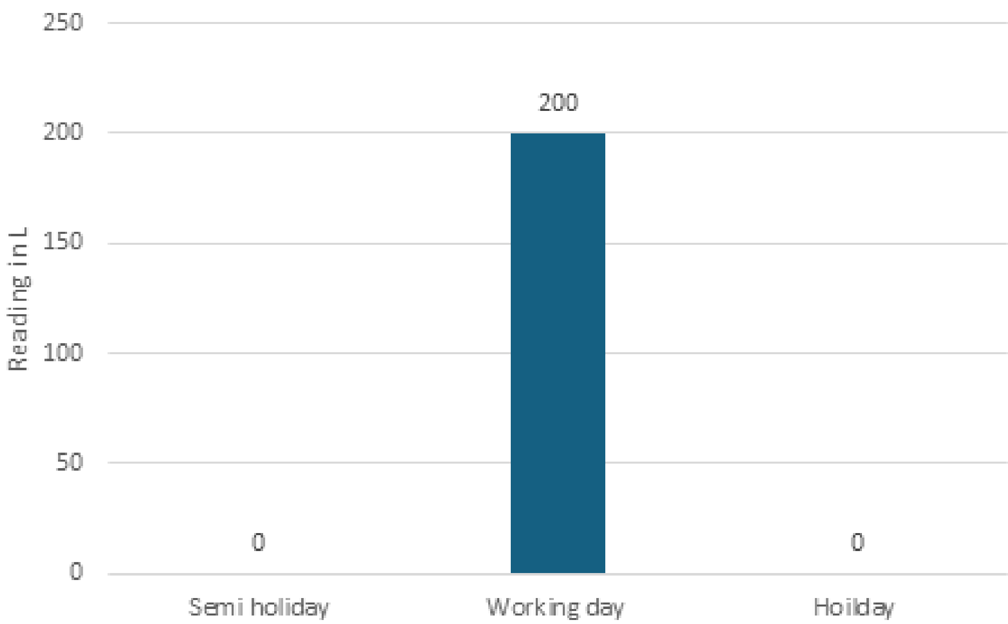

Fig No.5.12.Flow meter reading in KL

The central block, primarily housing the Food Processing Lab and a few classrooms, consistently shows the lowest water flow readings among all campus meters. This suggests that the block has minimal water demand and does not engage in water-intensive activities under normal conditions. The highest flow rate for this block occurs during working days, which is attributed to the regular operation of the college. Additionally, construction work is taking place during these periods. These activities temporarily increase water consumption on semi-holiday and holiday days. When the flow meter records a zero value, it indicates that there was no measurable water movement during the sampling times due to inactivity of the block's infrastructure or an absence of water usage during those intervals.

Sampling days	Water flow meter reading per year (KL)
Semi holiday	13813.33
Working day	24142664.00
Holiday	4087.50
Average consumption per year	24160564.83

Table.No.5.21. Flow meter reading (Atrs block filter)

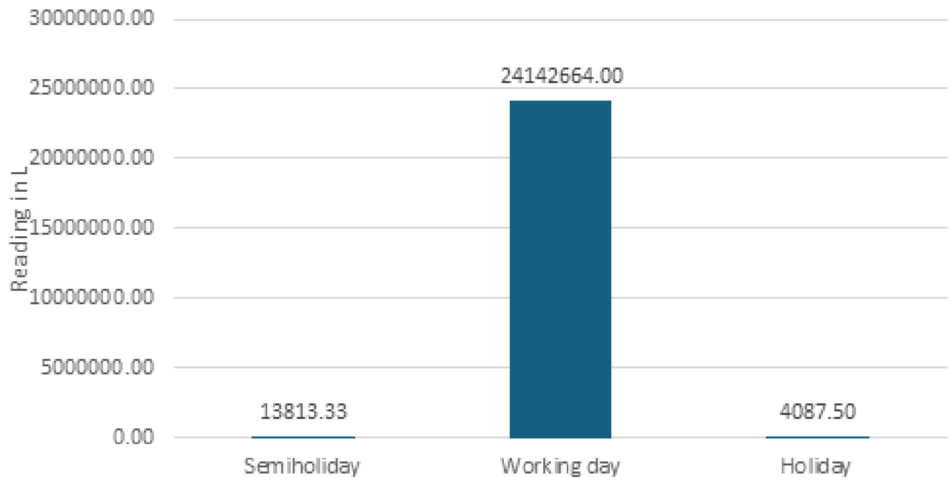

Fig No.5.13. Flow meter reading in KL

Block	Annual water consumption in (KL)	Per capita of annual water consumption (KL)
Arts block	694.1	0.17
Science block	1390870.77	343.68
Central Block	200.00	0.05

Table No.5.22.Block wise annual water usage trends

The third flow water meter located in the Arts Block is connected to the filter tank, which is a significant source of drinking water. Current readings indicate that the annual drinking water consumption for the Arts Block is 24,142,664 KL. The other two flow water meters monitor the overall water consumption from the cooperative water supply across the Arts, Science, and Central Blocks.

Assessment of the flow meter data reveals that the Science Block has the highest annual water usage at 1,391,099,566.67 KL, followed by the Arts Block and the Central Block. This higher consumption in the Science Block can be attributed to factors such as laboratory requirements, the community population, and ongoing construction activities between the Science and Central Blocks. An analysis of the infrastructure indicates that the Arts Block demonstrates greater fixture efficiency compared to the Science and Central Blocks. However, while this current setup allows for monitoring water usage at the block level, it does not provide insights into consumption patterns for individual buildings within each block. To address this limitation, we plan to install flow meters in each building during the upcoming year, with installations occurring in phases. This will facilitate the separate tracking of water usage for each building.

Fig No. 5.14. Water flow meter

Fig No. 5.15. Water storage tank

5.4.6. Grey water

5.4.6.1.Arts block

SL NO	LOCATION	AMOUNT OF WATER PER DAY (L)
1	Canteen 1 (block B)	300
2	Canteen 2(behind E block)	650
3	Canteen 3(block D)	370
	AVERAGE PER YEAR (KL)	440

Table No.5.23. Canteen of Arts block

Based on the responses of the canteen staff, it is estimated that approximately 88000 litres of grey water are released annually, which is directly discharged into the septic tank. Currently, there is no dedicated treatment process for the grey water generated by the canteen. However, a water-efficient management plan has been proposed, which outlines the potential for treating this grey water with the assistance of an expert team for non-potable applications. Additionally, the plan considers the feasibility of developing suitable facilities, such as sopit facilities.

5.4.6.2.Science block

SL NO	LOCATION	AMOUNT OF WATER PER DAY (L)
1	ZOOLOGY LAB	25
2	CHEMISTRY LAB	25
3	BOTANY LAB	30
4	BIOCHEMISTRY LAB	26
5	FOOD LAB	30
6	CAFÉ	300
	AVERAGE PER YEAR (KL)	72.67

Table No. 5.24.Science block

An annual average of 14,533.33 liters of grey water has been discharged from the science block. These figures may vary depending on the laboratory's activities during weekdays. The institution is currently implementing microscale analysis, which involves conducting experiments using minimal quantities of chemicals. This approach ensures that grey water does not overflow directly; instead, it is treated and diluted with water. The dilution of chemicals reduces their potency, thereby lowering the risk of chemical burns and toxic inhalations. Additionally, the college strictly adheres to guidelines that prohibit the direct overflow of grey water onto surfaces to prevent unintended dilution. This practice also minimises the risk of contaminating water supplies and soil, reinforcing a commitment to environmental responsibility.

To further advance these practices, the department has entered into a Memorandum of Understanding (MoU) with the Science Centre in Kodungallur. This collaboration aims to develop a system for converting chemical waste into a solid form through controlled heating. The proposed system will employ thermal treatment methods such as pyrolysis, gasification, or low-temperature calcination to transform chemical waste into a stable solid, effectively immobilising hazardous constituents.

5.4.6.3.Central block

SL NO	LOCATION	AMOUNT OF WATER PER DAY (L)
1	FOOD PROCESSING LAB	26
2	AVERAGE PER YEAR (KL)	26

Table No.5.25.Central block

Annually, approximately 5,200 liters of grey water are released from the central block. It is important to note that this figure may fluctuate based on the laboratory's activities during weekdays. The grey water primarily consists of food materials, and as no toxic chemicals are utilised, it is directly directed to the sewage system.

5.4.7.Summary of water usage data

No.	Block/section	Average usage per year (KL)	
		Manual discharge study data	Water flow meter data
1	Arts Block	2072.00	42737596.34
2	Science Block	1782.40	1391099566.67
3	Central Block	1746.50	200.00
4	Centenary Block	1562.50	Not applicable

Table No.5.26.Water usage in each block

5.4.8. Water quality report

Chemical testing					
Sl No	Parameter	Unit	Method	Result	Requirement
1	pH at 25°C		IS 3025 (Pt 11):2022	7.9	6.5–8.5
2	Total Dissolved Solids	mg/l, max	IS 3025 (Pt 16):2023	398	500
3	Total Hardness as $CaCO_3$	mg/l, max	IS 3025 (Pt 21):2009	188.1	200
4	Chloride as Cl	mg/l, max	IS 3025 (Pt 32):1988	87.42	250
5	Alkalinity as $CaCO_3$	mg/l, max	IS 3025 (Pt 23):1986	241.28	200
6	Iron as Fe	mg/l, max	IS 3025 (Pt 53):2003	BDL (MDL-0.02)	1
7	Calcium as Ca	mg/l, max	IS 3025 (Pt 40):1991	67.45	75
8	Magnesium as Mg	mg/l, max	IS3025(Pt:46):1994	4.81	30
9	Salinity	mg/l	IS 3025 (Pt 46):1994, USEPA 842-B-06-003 (Ch.14): 2006	4.81 / 144.14	30 / NA
10	Conductivity	µS/cm	IS 3025 (Pt 14):2013	663	NA
11	Acidity as $CaCO_3$	mg/	IS 3025 (Pt 22):1986	4.06	NA

Biological testing					
1	Total coliform bacteria	100 ml	IS15185:2016	Present	Shall not be detectable in any 100 ml sample
2	E-coli or thermotolerant coliform bacteria	100 ml	IS15185:2016	Present	Shall not be detectable in any 100 ml sample

Table No.5.27.Water quality report of well water

Chemical testing					
Sl No	Parameter	Unit	Method	Result	Requirement
1	pH at 25°C		IS 3025 (Pt 11):2022	6.63	6.5–8.5
2	Total Dissolved Solids	mg/l, max	IS 3025 (Pt 16):2023	10	500
3	Total Hardness as $CaCO_3$	mg/l, max	IS 3025 (Pt 21):2009	5.94	200
4	Chloride as Cl	mg/l, max	IS 3025 (Pt 32):1988	1.94	250
5	Alkalinity as $CaCO_3$	mg/l, max	IS 3025 (Pt 23):1986	4.16	200
6	Iron as Fe	mg/l, max	IS 3025 (Pt 53):2003	BDL (MDL-0.02)	1
7	Calcium as Ca	mg/l, max	IS 3025 (Pt 40):1991	1.59	75
8	Magnesium as Mg	mg/l, max	IS3025(Pt:46):1994	BDL (MDL-0.05)	30
9	Salinity	mg/l	IS 3025 (Pt 46):1994, USEPA 842-B-06-003 (Ch.14): 2006	3.2	30 / NA
10	Conductivity	µS/cm	IS 3025 (Pt 14):2013	17	NA
11	Acidity as $CaCO_3$	mg/	IS 3025 (Pt 22):1986	16.24	NA
Biological testing					
1	Total coliform bacteria	100 ml	IS15185:2016	Present	Shall not be detectable in any 100 ml sample
2	E. coli or thermotolerant coliform bacteria	100 ml	IS15185:2016	Present	Shall not be detectable in any 100 ml sample

Table No.5.28.Water quality of Tank water

The water quality report from the sampled well and filtration system indicates that the water is currently not safe for drinking purposes, due to the presence of coliform bacteria, which suggests the contamination likely stems from human waste. As an immediate response, the college will initiate chlorination of the water supply, following expert guidance. Additionally, post-chlorination testing will be conducted, with a primary focus on microbiological parameters to assess the effectiveness of the treatment. As a further action, the institution plans to invest in advanced water purifiers to ensure a safe supply from the storage tank. Currently, tank cleaning occurs once a year. It is now proposed to increase this frequency to twice a year, overseen by the WEMS and OHS committees.

Fig No. 5.16. Water tank connected filter

Fig No. 5.17. Motor

5.5.CONCLUSION

- The college's water supply system is a well-designed and efficiently managed infrastructure that ensures the sustainable distribution of water across its various blocks. With a diverse sourcing strategy that includes two wells and an extensive rainwater harvesting system, the college is effectively meeting the water demands of its numerous fixtures and facilities. The strategic placement of 41 automatically refilling tanks, coupled with sufficient tank capacity, enables the management of water consumption effectively while accommodating the requirements of each building. The college's infrastructure is strategically designed to eliminate any leakage or plumbing issues, ensuring it effectively meets the diverse and evolving needs of the campus community while fostering an accessible environment where all individuals can thrive. This system not only optimises space and resources but also contributes to the college's commitment to sustainable practices and effective water management, ensuring that the institution can adequately support its educational environment. The college's comprehensive approach to water supply demonstrates a proactive stance towards resource management, benefiting both the campus community and the environment.
- The Arts and Science blocks are equipped with two water meters, while not applicable in Centenary block does not have any. Currently, it is challenging to determine which building has higher water usage, necessitating the installation of water flow meters at the water delivery points of each block. Presently, a water purifier in the Arts block, typically used for drinking purposes, indicates an average consumption of 42,043,498 KL of water. As a result, assess the general water consumption for each block. According to the Bureau of Indian Standards (BIS), specifically IS 1172:1993 (Code of Basic Requirements for Water Supply, Drainage and Sanitation), the recommended consumption is 135 liters per person per day (LPHD) for colleges and universities. This suggests that the liters per head per day usage is notably higher in the Science, Arts, and Central blocks.
- The Foremost water sources for the college are municipal water and an open well. According to the water quality report, contamination has been detected in samples tested from both the well and the storage tank during the audit. In response, the college plans to clean the water storage tank biannually and perform source chlorination twice a year, along with regular monitoring of microbiological parameters. Additionally, the college has installed an extra water filter to ensure the quality of water drawn from the tank. This process includes filtration from the original source followed by further filtration from the tank for direct use.

5.6.RECOMMENDATION

- Identify the building corresponding to each flow meter. This step is crucial for determining the building with peak water usage. Subsequently, installing a flow water meter at the water delivery point will facilitate accurate consumption data collection.
- The college currently boasts well-maintained facilities that are free from leaks and damage. However, it may be beneficial to replace standard taps with sensor taps to optimise water usage, particularly in light of recent assessments indicating higher-than-expected water consumption. Upgrading the infrastructure in this manner could significantly enhance water conservation efforts.

Water pumping is currently not included in the assessment due to the college's implementation of an automatic water pumping system. Moving forward, the system has been upgraded to facilitate transparent tracking of its operational status, ensuring accurate future assessments

5.7. WATER EFFICIENCY MANAGEMENT PLAN

5.7.1.Establish and Adopt a Water Management Team

St. Teresa's College (Autonomous), Ernakulam, established a decentralized yet coordinated Water Efficiency Management System (WEMS) Team, responsible for the implementation and oversight of the Water Efficiency

Management Policy. This team includes:

- A WEMS Core Team comprising faculty coordinators, student leaders, and non-teaching staff.
- Block-wise faculty coordinators who mentor and supervise student representatives in assigned areas
- Student Water Ambassadors who act as peer educators, conduct awareness campaigns, and report leaks or inefficiencies.
- Maintenance staff (e.g., Mr. Aji) assigned the responsibility for infrastructure inspections and leak reporting.
- The team holds monthly meetings, compiles bi-monthly progress reports, and communicates directly with the Internal Quality Assurance Cell (IQAC). Responsibilities are clearly distributed among departments such as Chemistry (greywater), History (rainwater harvesting), and Botany and Home Science (landscaping and community engagement).

5.7.2.Formulate a Comprehensive Strategy for Sustainable Water Efficiency Management

The WEMS Plan operationalizes the vision of water sustainability by setting out structured strategies that include:

- Water budgeting for each campus block using flow meter data to regulate usage and detect anomalies.
- Leakage monitoring and maintenance are recorded in registers (Water infrastructure maintenance register) through regular inspections and regulated periodic reporting of the caretaker
- Greywater collection and reuse practice followed in hostels and canteens additionally ensures departmental responsibility for oversight and student involvement.
- Rainwater harvesting via rooftop collection and recharge pits managed and maintained by assigned departmental teams.
- Monthly water quality testing is administered through certified labs covering microbial, chemical, and physical parameters.
- Planning for the possibility of implementing digital transformation, including flow meters in all blocks, smart dashboards, and sensor-based fixtures.

This strategic framework integrates national mandates and the UN Sustainable Development Goal 6 (Clean Water and Sanitation) into campus operations.

5.7.3. Implement Effective Methods to Attain Set Objectives

Several methods have been introduced to realize the goals of the WEMS Plan:

- Greywater Reuse: Filtration systems installed for garden use and toilet flushing, managed by the Chemistry Department and students.
- Rainwater Harvesting: Maintenance of existing systems and plans for expansion; students from the History Department ensure upkeep.
- Water Quality Testing: Monthly assessments of water from tanks and taps, coordinated by the WEMS audit team with external lab partners.
- Smart Monitoring: Flow meters in each block and plans for digital dashboards, leak detection systems, and water usage analytics.
- DIY Projects: Student-led innovations like terracotta drip pots and rain barrels are implemented in gardens and departments.
- Curriculum Projects: Rain gardens and green landscaping initiatives integrated into academic projects, supported by the Biodiversity and Botany department.
- Reusable Bottle Programme: Active campaign encouraging steel tumblers and refillable bottles, reinforced through events and "green points" rewards.
- Green Event Protocols: Low-water dishwashing, refill stations, and a ban on bottled water are enforced during all campus events.

5.7.4.Establish Robust Communication Channels and a Governing Body

To ensure accountability and transparency, the following communication systems have been established:

- A multi-tier governance structure with core WEMS leadership, departmental liaisons, and block-level coordinators.
- Regular reporting to IQAC of audit findings, water budgets, and feedback to further modification and ensure accountability
- Suggestion and feedback mechanisms via physical boxes and digital forms to facilitate the convenience for college stakeholders
- Monthly review meetings and strengthen institutional linkages between the student club (STEP, NSS, NCC, Bhoomithra Sena) and the WEM Committee for the successful execution of the initiative
- Awareness and orientation sessions for new students explaining their role in sustainable water management.
- Public notice boards and class WhatsApp groups are employed for announcements and updates.

This ensures continuous engagement, real-time responsiveness, and institution-wide collaboration.

5.7.5.Set Both Long-Term and Short-Term Goals

5.7.5.1.Short-Term Goals:

- Monthly water quality checks and documentation.
- Introduction of smart taps and low-flow fixtures in washrooms.
- Curriculum integration of water audit as field-based learning.
- Execution of DIY projects and student innovation showcases.
- Monthly reports on event-wise green protocol compliance.

5.7.5.2.Long-Term Goals:

- Development of smart water tracking dashboards and digital alerts.
- Expansion of greywater and rainwater systems into all departments.
- Green landscaping through rain gardens and native planting.
- Formation of a Water Innovation Forum to incubate student ideas.
- Collaborative research output: minimum five projects per year on water issues across disciplines.
- Sustainable procurement of water-saving devices and environmentally friendly cleaning materials.

These goals guide the college's transition from awareness to advanced implementation and future readiness.

5.7.6.Continuously Monitor and Enhance the System

To maintain performance and relevance, a robust monitoring framework is in place:

Quarterly reviews by the WEMS Team and IQAC using:

- Maintain the water flow meter register (periodical record of every meter reading) and record the meter reading to observe water usage in each block
- Record the infrastructure maintenance register to ensure infrastructure maintenance is systematically managed
- Prepare event-wise water usage summaries to avoid the misuse, and educate and engage the college community in implementing strategies for the efficient and sustainable use of resources
- Regular leak tracking findings and caretaker reports are compiled into formal reports for revamping the identified issue
- Reports are submitted to IQAC, and actionable feedback is communicated to the respective departments.s
- The performance of rain gardens, refill stations, and

greywater systems is periodically evaluated and reported to IQAC

- Outreach sessions and community workshops are monitored to analyse the outcome and impact.
- Feedback is gathered from students and external communities as a reference for future modification

This ensures a continuous improvement loop, enabling timely interventions and better resource management.

5.7.7.Conclude and Conduct Follow-Up on the System

The WEMS Plan is not a static document; it evolves through structured follow-ups and reflection:

Three-year internal review of the Water Management Policy, incorporating:

- ➢ Practical implementation insights.
- ➢ Technological advancements.
- ➢ Stakeholder feedback.

- Integration of smart infrastructure, automation, and community feedback into future policy measures
- Extension of outreach activities trained through student leaders in schools, panchayats, and households.
- Innovation scaled through piloting and prototyping of successful student projects.
- Collaboration with external agencies like the Suchitwa Mission and water research organizations for student exchange and to enhance the opportunities for goal-oriented initiatives
- All updates are communicated through revised circulars, training sessions, and updated in departmental guidelines.

This concluding phase ensures that sustainability is deeply rooted, continually improved, and institutionally embedded.

5.8.ACTIVITIES CONDUCTED

Water quality analysis was conducted in Kumbalangi panchayat as a component of the Teresian Rural Outreach Programme which included the comprehensive analysis of various parameters such as pH level, alkalinity, hardness, ammonia concentration, chlorine content, and the presence of E. coli bacteria. A total of six parameters were examined in samples of tap water, well water, bore well water, pond water, and river water. The samples were collected randomly from various wards, specifically wards 1, 2, 3, 4, 7, 14, 16, and 17. Upon analyzing the water samples, it was discovered that certain wards in Kumbalangi panchayat exhibited all of these parameters. Among these parameters, the most hazardous ones, namely Ammonia and E. coli, were detected in specific samples from different wards. These findings may be attributed to the excessive use of fertilizers in the soil and the contamination of water sources due to sewage and animal waste. Consequently, this situation can have detrimental effects on aquatic life and the overall health of the residents in that area.

Awareness Campaigns and Creative Expression :Departments collaborate to conduct poster-making competitions, street plays, awareness walks, and flash mobs focusing on water conservation. These initiatives aim to blend scientific awareness with cultural expression, making sustainability both engaging and visible on campus

DIY Water-Conservation Projects:
Workshops are organized where students create low-cost greywater filters, terracotta drip irrigation pots, or mini rainwater collection units as part of sustainability skill development. Selected student innovations may be piloted for actual use within the campus gardens and green spaces.

Rain Garden & Water-Friendly Landscaping Projects:
Students and faculty from environmental science and Botany were invited to plan rain gardens and water-retentive green zones on campus. These projects help

manage runoff, reduce erosion, and improve biodiversity, all while providing a living classroom for sustainability education.

Integration with Student Clubs:
Eco and science clubs host "Water Weeks" that include activities such as debates, water footprint calculator workshops, mural-making on the water cycle, and pledge walls where students commit to personal water-saving habits.

Skill Development & Community Training:
As part of community outreach, students may receive training to teach water-saving practices in local schools, anganwadis, and households. This supports mutual learning and strengthens the relationship between the college and the surrounding community.

Water Literacy Campaigns and Behavioural Change:
Regular campaigns are conducted to raise awareness about responsible water use. Posters in restrooms, hostels, and canteens highlight simple actions like turning off taps, reporting leaks, and reducing unnecessary washing. Water-saving slogans and infographics are part of a visual nudging strategy.

Skill Development and Water-Tech Workshops:
Hands-on training workshops teach students to build basic water filtration models, low-flow faucet adapters, and greywater channels. These workshops promote innovation while empowering students with real-world sustainability tools.

Community Outreach and Local School Engagement:
In collaboration with the STEP team and Bhoomitra Sena, college students conduct interactive sessions in nearby schools and panchayats, teaching children and families about traditional water conservation methods, water footprint awareness, and hygiene practices using minimal water.

STEP and Bhoomitra Sena Activities:
Both STEP and Bhoomitra Sena spearhead multiple campaigns such as "Save Every Drop" initiatives, blue-ribbon awareness drives, and home-based water conservation workshops. These programs reach out to schools, Anganwadi's, and Kudumbashree units across Ernakulam district.

Eco-Workshops in Panchayats:
In collaboration with local self-government institutions, students train community members on traditional water preservation methods, household rainwater harvesting, and kitchen greywater reuse models in selected panchayat.

Botany & Zoology Departmen departments organize field visits to wetlands, conduct biodiversity assessments of water bodies, and lead awareness classes on aquatic ecosystems and sustainable water usage. They also coordinate eco trails and "Know Your River" days for school students

Water Literacy Drives in Schools:
Interactive sessions, quiz competitions, and hands-on demos are conducted in nearby schools to educate younger students on the water cycle, water scarcity, and daily conservation practices.

Water Walks and Nature-Based Observations:
Inspired by the idea of "water trails," Bhoomitra Sena organize guided walks across campus that showcase rainwater harvesting pits, greywater systems, and plant species requiring minimal irrigation. These trails serve both as education tools and eco-tourism experiences for visiting students and dignitaries.

5.9.SUMMARY

- Annual consumption in college based on manual water discharge data is 212291.4 L of water. Annual consumption in college based on the flow meter is 1433837363.01 KL
- Annual water consumption recorded at 1,562.50 L. 740410308 KL per capita water consumption
- The average annual grey water release is 440 L from the Arts Block canteen, 72.67 L from the Science Block, and 26 L from the Central Block.
- The campus is equipped with 41 automatically refilling water tanks and a rainwater harvesting system with a total storage capacity of 80,000 L.

Thousands have lived without love,
not one without water.

- H Auden

Chapter VI

CAMPUS BIODIVERSITY (CBR): AUDIT REPORT

TIES

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM

ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925

BIODIVERSITY MANAGEMENT COMMITTEE
(BMC 2025)

I. K. Nishitha
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Dr. Chandini V. K.
Dr. Gayathri Sharma
Assistant Professors

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Nasrath P S
Sivasankari K S
Students

6 Campus Biodiversity Audit Report

6.1 INTRODUCTION

Biodiversity is crucial for preserving life, offering essential ecosystem services like food supply, water purification, flood and drought regulation, nutrient cycling, and climate stabilization. These services are indispensable for both human health and economic growth. Biodiversity embodies a comprehensive representation of the biosphere, deeply intertwined with Earth's physical elements, including soil, rocks, water, and air, all powered by solar energy. Over the span of 2 to 3 billion years, a highly complex and balanced cyclical system has emerged, enabling the flow of energy, materials, and information between living beings and the physical environment of Earth. Despite its significant ecological, economic, and cultural value, biodiversity is being lost at an ever-increasing rate worldwide due to factors such as pollution, habitat loss, urban expansion, industrial activity, population increase, and excessive exploitation of species. One of the major causes of this decline is habitat destruction, mainly driven by development efforts, along with the overharvesting of particular species for economic gain or recreational activities. The loss of biodiversity disrupts ecosystems, resulting in species extinction or decline and negatively impacting ecosystem functionality and food webs. This has extensive repercussions, such as diminished agricultural productivity and reduced resilience to natural catastrophes like floods and droughts. It is vital to protect biodiversity, as its decline brings significant dangers, including: Reduction in genetic diversity; Uniformity in plant and animal life.

Disruption of crucial ecosystem functions that are essential for human survival, encompassing the production of food, medicines, timber, and the purification of air and water, raises a serious concern. Ecosystem services offer a broad range of benefits, which can be categorized into provisioning services (such as food, water, timber, and genetic resources), regulating services (like climate regulation, flood management, disease control, and water purification), cultural services (including recreational, aesthetic, and spiritual value), and supporting services (such as soil formation, pollination, and nutrient cycling). Nevertheless, human demand for these services is rapidly increasing. The Millennium Ecosystem Assessment suggests that approximately 60% of the evaluated ecosystem services, including 70% of regulating and cultural services, are facing degradation or unsustainable use, threatening their availability for coming generations.

Standardizing biodiversity management systems is necessary to establish principles, frameworks, requirements, guidance, and tools through a comprehensive and global approach for organizations, enhancing their contributions to sustainable development.

6.1.1.What is Biodiversity Audit?

The Biodiversity Audit entails a comprehensive evaluation of the significance of biodiversity across the campus. The aim of applying a Biodiversity Audit Strategy is to establish a robust groundwork for future projects. Assessing the capability of the campus's green spaces to support vital and protected species and habitats is crucial. Moreover, the audit offers tailored suggestions for enhancing and optimizing biodiversity. This assessment will identify the existing habitats on-site, create habitat maps for each specified area, and evaluate the condition of each type of habitat. Additionally, we will review current management strategies and, when needed, recommend approaches for improving the existing conditions. Our main goal is to gauge measurable progress in biodiversity, thereby paving the way for future advancements in this domain.

6.1.2. Why measure Biodiversity?

- The rapid degradation of habitats is concerning; it is crucial to assess their current condition before potential extinction occurs.
- Biodiversity metrics are seen as key indicators of the health of ecological systems.
- At present, biodiversity is the main focus of both ecology and development.
- A range of methods and tools is necessary to assess biodiversity across various habitats.
- It is mandatory, as a signatory of the Convention on Biological Diversity (1992).

6.1.3. Need for Biodiversity Audit

The biodiversity audit examines the extent to which the college/university campus supports wildlife habitats (referring to any animal or plant that is not cultivated by humans). Additionally, it plays a role in increasing awareness and educating the college community about the significance and benefits of biodiversity. The objectives of the biodiversity audit include:

- Raising awareness within the college community regarding the biodiversity present on campus
- Enhancing greenery and vibrancy
- Improving the visual appeal of the campus
- Augmenting both informal and formal educational opportunities on campus (an example being a name tag on a tree)
- Providing better protection for public health and the environment (such as ensuring clean air, water, and food)
- Serving as a useful educational and public relations resource (for instance, through exhibits of thematic gardens)
- Facilitating community education and gathering community feedback (such as sharing traditional knowledge about plants or animals)

6.2 CAMPUS BIODIVERSITY MANAGEMENT SYSTEM POLICY

At St. Teresa's College (Autonomous), Ernakulam, biodiversity conservation is integral to our commitment to environmental stewardship and sustainability. Situated in an urban landscape, the College recognizes the ecological value of even small green spaces in maintaining environmental balance and promoting native flora and fauna. In response to increasing global and local threats to biodiversity, including habitat loss, pollution, and climate change, necessitate that academic institutions to serve as exemplary conservation action to advance the 'Life on Land' objective. The institution's Biodiversity Conservation Policy delineates the vision, strategies, and responsibilities essential for protecting and sustaining campus biodiversity. It champions sustainable education, research, and community outreach; guides responsible landscaping; supports student-led conservation initiatives; fosters local community engagement; and ensures compliance with pertinent national and international environmental frameworks. By cultivating a culture of ecological awareness and responsibility, the policy aims to enhance ecosystem services, improve well-being, and contribute significantly to the global biodiversity agenda.

6.2.1 Statement of commitment

The institution underscores its dedication to advancing biodiversity conservation through education, research, sustainable campus practices, and community engagement. In alignment with the United Nations Sustainable Development Goals SDG 15 (Life on land), SDG 13 (Climate change), and SDG 4 (Quality education), the College aims to contribute meaningfully to local and global biodiversity efforts by involving the campus and surrounding communities in conservation initiatives.

6.2.2. Goal

To integrate ecological stewardship across campus life and social community by enhancing local biodiversity, promoting sustainability, and fostering environmental responsibility, in line with global conservation goals.

6.2.3 Objectives

- To integrate biodiversity conservation principles into teaching, research, and campus management practices while fostering responsibility and active participation in biodiversity conservation among students, faculty, and local communities.
- To promote native species planting in open soil patches, supporting natural soil restoration, and increasing green cover through space-efficient installations such as vertical gardens, green walls, rooftop gardens, and potted plants.
- To actively engage in community-based conservation projects through the Teresian Rural Outreach Programme (TROP) and other initiatives.
- To align with the National Mission for a Green India and other national sustainability initiatives.
- To collaborate with national and international institutions for biodiversity conservation.

6.2.4 Resource management

- Optimizing Limited Campus Space for Biodiversity and Aesthetics: The college acknowledges its limited campus area, necessitating a balanced approach to enhancing green spaces and aesthetic appeal alongside the development of upcoming facilities. Consequently, a high priority is placed on the maintenance and protection of existing green spaces, gardens, and tree cover to support local flora and fauna. If such areas are unavoidably impacted, the college is committed to implementing alternative initiatives to sustain biodiversity richness.

- Campus Biodiversity Management and Responsible Plant Stewardship: Campus Biodiversity Management holds a significant role and primary responsibility in the stewardship of campus flora. This entails a systematic approach including making informed decisions on the introduction of new plant species or the removal of existing ones. Effective communication regarding these decisions is paramount to facilitate responsible plant management, ultimately aiding in the preservation and enhancement of campus biodiversity

- Promotion of Indigenous Flora for Ecological Landscaping: Advocate for the preferential use of indigenous and native plant species in landscaping over modern and non-native varieties. The inclusion of indigenous plants provides critical habitat for small insects and butterflies, supports pollinator populations, and promotes the overall health of local ecosystems

- Environmental Safeguards During Campus Development Activities: Effective management of campus fauna, any activities posing a potential risk of disturbance or harm will be subject to a mandatory prior environmental assessment. The Internal Auditor is tasked with conducting an Environmental Assessment Report (EAR) that evaluates potential threats and impacts on campus biodiversity. This report will be submitted to the Internal Quality Assurance Cell (IQAC). The conclusions of the EAR will inform specific stipulations within agreements with construction teams, mandating measures to prevent adverse impacts on campus biodiversity during construction activities and to ensure the conservation of existing landscaping. Additionally, groundskeeping protocols will prohibit the use of chemical fertilizers, emphasizing the application of organic manure. The deployment of pesticides and herbicides will be rigorously minimized and restricted to approved, environmentally sound alternatives.

- Biodiversity Documentation Through Species Registers: Develop and maintain comprehensive biodiversity registers to document species within the campus. This initiative will establish a foundational data bank enabling the identification of threats, conservation challenges, causes of population decline and inform the development of targeted mitigation strategies
- Creation of Conservation Zones with Interactive Learning Tools: Establish designated conservation areas, including botanical gardens, herbal gardens, and butterfly parks. Within these gardens, QR-coded digital plant labels will be implemented to reduce plastic and laminated marker usage, while providing deeper engagement and information access via mobile devices. These initiatives will enable the college community and external visitors to expand their knowledge of the campus's diverse flora (herbs, shrubs, and trees), offering opportunities to learn more about their characteristics and benefits. Additionally, all identified nesting sites and animal habitats will be clearly marked and diligently protected from disturbance

6.2.5 Curriculum integration

- Field-Based Engagement in Biodiversity Conservation: The discipline of biodiversity conservation will be systematically integrated as a core theme throughout undergraduate and postgraduate programs. This will involve establishing sustainability as an essential component within relevant subjects, including Zoology and Botany. Moreover, actively promote the engagement of students and faculty in short- to long-term courses dedicated to biodiversity conservation, thereby supporting the development of new ventures and specialized expertise in the field. Real-world examples, such as those from the Teresian Rural Outreach Programme (TROP), including local tree plantation drives and biodiversity restoration initiatives in nearby Panchayats, will be incorporated into the curriculum to showcase the practical application of conservation strategies.

- Organization of Workshops, Seminars, and Awareness Campaigns: The College will organize workshops, seminars, and awareness campaigns focused on biodiversity conservation, partnering with community-based organizations and involving students in leadership roles.
- Fostering Collaborations with Environmental NGOs, Research Institutions, and Government Agencies: The College will establish partnerships with environmental NGOs, research institutions, and government agencies to enhance biodiversity-related research. Students will be actively engaged in these collaborations, participating in field research and community outreach programs, such as tree sapling distribution and school plantation drives, to apply their academic learning to real-world biodiversity conservation efforts.

6.2.6 Green initiatives

6.2.6.1 Planting Native Flora: At least two native flowering plants or fruit trees will be introduced in the campus area to attract and support local fauna such as birds, bees, and butterflies, contributing to enhanced biodiversity and ecological balance.

6.2.6.2. Restoration of Green Cover: Replant any greenery that is lost during construction/infrastructure modification activities by compensatory planting measures and adopt landscape restoration practices to recover natural vegetation. Incorporate green spaces into the planning and design of all future construction activities to minimize ecological disruption and preserve natural habitats on campus. Additionally, the campus biodiversity team will participate in selecting ecologically appropriate and native plant species, ensuring sustainability and compatibility with local ecosystems. Non-essential concreting and tilinSSSg on campus will be reviewed and progressively replaced with permeable surfaces, open soil, or green patches to promote plant growth and aid in the recovery of beneficial soil organisms and microbes.

6.2.6.3. Green Installations in Limited Spaces: Maximise the utilisation of available space through the strategic implementation of diverse green solutions. These include vertical gardens and green walls, rooftop gardens, potted plants, balcony greenery, and small-scale water gardens.

6.2.6.4. Miyawaki Forest Initiative: Allocate space for developing a Miyawaki forest, a dense mini-forest using native species to restore biodiversity quickly. This not only improves the microclimate but also serves as an educational tool to raise environmental awareness among students and faculty.

6.2.6.5. Field Trips and Nature Camp Engagement: Nature Camps and field trips will provide hands-on learning about flora and fauna in wildlife sanctuaries, national parks and biodiversity rich regions, helping students become more aware of the importance of biodiversity and the ongoing and needed efforts for its conservation.

6.2.6.6. Implementation of Green Protocol: The college actively implements the Green Protocol by promoting the use of eco-friendly, locally sourced, and sustainably produced materials, minimizing single-use plastics, reducing waste, and nurturing a culture of environmental responsibility through awareness and student participation.

6.2.7 Purchasing and procurement

The college administration provides necessary resources, including financial and technical support, for biodiversity conservation initiatives considering eco-friendly, locally sourced, and sustainably produced materials and products during procurement processes in accordance with the College Green Protocol. To support biodiversity conservation goals, the college will implement procurement practices that enhance ecological responsibility. Strategies will include:

6.2.7.1. Native Species Procurement: Give preference to native and ecologically appropriate plant species for all landscaping, afforestation, and beautification activities, based on recommendations from biodiversity experts.

6.2.7.2. Pollinator-Friendly Plants: Include flowering species known to attract pollinators like bees, butterflies, and birds during plant procurement.

6.2.7.3. Biodiversity-Friendly Products: Prefer products certified as biodiversity-safe to reduce indirect harm to ecosystems.

6.2.7.4. Organic and Non-Toxic Materials: Avoid procurement of chemical fertilizers, pesticides, and synthetic herbicides. Use only natural and organic alternatives to maintain soil biodiversity.

6.2.7.5. Sustainable Event Supplies: For biodiversity-related events and awareness campaigns, procure eco-conscious and biodegradable items (e.g., seed pencils, clay items, jute folders).

6.2.7.6. Partnership with Local Nurseries: Develop procurement partnerships with local nurseries or tribal communities involved in the conservation and propagation of native flora.

6.2.7.7. Low-Light and Indoor Greenery: Purchase indoor plant species for greening built environments, contributing to micro-ecosystem restoration within closed spaces.

6.2.8 Research & innovation

6.2.8.1. Encouragement of Student-Led Research Projects: Students will be encouraged to undertake research projects that focus on local biodiversity issues, including both flora and fauna, sustainable land use practices, and the impacts of climate change on ecosystems. Collaboration with local communities will be facilitated through TROP initiatives, such as tree sapling distribution drives, wildlife monitoring, and nature camps, where students can collect primary data on both plant and animal species and contribute to ongoing conservation efforts.

6.2.8.2. Strengthening Research Capacity and Scholarly Engagement: Enhance scholarly output and collaborative inquiry by promoting active participation of students and faculty in research endeavors. Key strategies include equipping participants with advanced training in contemporary action research for biodiversity conservation, and providing robust support for the dissemination of their findings through publication in reputable academic journals and scholarly articles

6.2.9 Community engagement

Community participation will be a core component of biodiversity conservation efforts. Engagement strategies will include:

6.2.9.1. Tree Plantation and Afforestation Drives: Afforestation programmes will be organized with the active involvement of students and local communities through the outreach programme of the

College – Teresian Rural Outreach Programme (TROP). TROP activities, such as tree sapling distribution and planting drives, biodiversity documentation across local Panchayaths, promotion of organic farming, vermicomposting and such similar activities will be continued as part of the biodiversity efforts of the College, encouraging student participation in local conservation.

6.2.9.2. Eco-literacy and Awareness in Schools and Panchayats: Nature education modules, interactive games, and biodiversity-themed awareness sessions will be conducted in nearby schools and Panchayats to promote conservation values among youth and rural residents.

6.2.9.3. Citizen Science and Biodiversity Monitoring: Students and community members will be encouraged to participate in bird watching, butterfly surveys, and plant documentation drives to support long-term biodiversity monitoring and data collection.

6.2.9.4. Local Ecosystem Restoration Partnerships: Collaborations with Panchayats and local authorities will be undertaken to restore and conserve wetlands, sacred groves, and other community-managed ecosystems.

6.2.9.5. Skill Development Linked to Biodiversity: Training workshops on biodiversity-linked livelihoods such as herbal gardening, organic composting, and eco-crafts will be facilitated in collaboration with Kudumbashree units and self-help groups through outreach programs.

6.2.9.6. Seed Banks and Nursery Initiatives: Student-led projects may support the development of community seed banks or nurseries for native plants, aiding ecological restoration efforts in rural areas.

6.2.9.7. Promotion of Cultural and Traditional Ecological Knowledge: Biodiversity documentation efforts will include identifying culturally significant flora and fauna, particularly in rural and indigenous contexts, to preserve traditional ecological knowledge systems.

6.2.9.8. Policy Advocacy and Local Collaboration: Students and faculty will participate in advocacy efforts supporting biodiversity conservation policies at the local level, while also collaborating with NGOs, forest departments, and civic bodies for joint initiatives.

6.2.10. Monitoring and reporting

6.2.10.1 Annual Biodiversity Monitoring: Internal auditor conduct an annual monitoring system will be implemented to assess and document the campus's floral and faunal diversity. Biodiversity registers will be maintained to record observations across different campus zones.

6.2.10.2. Periodic Biodiversity Audits: Structured biodiversity audits will be conducted at regular intervals to evaluate the ecological health of the campus. These audits will focus on indicators such as species count, habitat presence, and green space integrity.

6.2.10.3. Tracking and Review Mechanisms: Data from biodiversity monitoring and audits will be systematically analyzed and reviewed under the Internal Quality Assurance Cell (IQAC) to guide evidence-based improvements in conservation strategies.

6.2.10.4. Student and Faculty Participation: Active involvement of students and faculty in biodiversity documentation will be encouraged through eco-clubs, departmental projects, and extension activities, promoting hands-on environmental engagement.

6.2.11. Compliance and review

6.2.11.1. Regulatory Alignment: Biodiversity conservation practices will be aligned with relevant national frameworks including the Biological Diversity Act, 2002, the National Biodiversity Action Plan, and corresponding state biodiversity strategies.

6.2.11.2. Global Framework Integration: Campus strategies will follow the global guidelines set by the Convention on Biological Diversity (CBD) and Sustainable Development Goals (SDG 15: Life on Land).

6.2.11.3.Research Ethics Compliance: All biodiversity-related research activities will follow ethical protocols and statutory guidelines to ensure responsible conduct and sustainability.

6.2.11.4. Periodic Policy Review: The biodiversity policy will be reviewed every two years to reflect scientific updates, evolving conservation needs, and institutional priorities. Inputs from faculty, students, and biodiversity experts will inform revisions.

6.2.12. Leadership and accountability

6.2.12.1 Role of Biodiversity Management Committee: The Biodiversity Management Committee will oversee the implementation and monitoring of the biodiversity conservation policy. This committee will be responsible for ensuring that all departments adhere to the guidelines and track the progress of biodiversity initiatives across campus. The committee will also facilitate inter-departmental collaboration to achieve sustainability goals.

6.2.12.2. Administrative Support and Resource Allocation: The College Administration will be responsible for enforcing the biodiversity policy, allocating necessary resources, and ensuring the full participation of the campus community.

6.2.12.3. Faculty and Student Engagement in Conservation initiatives : Faculty and students will be encouraged to contribute to biodiversity efforts by actively participating in campus-wide initiatives, such as tree planting and nature camps. The active involvement of students and faculty in data collection, monitoring, and outreach activities will be essential for the successful implementation of the policy.

6.2.12.4. Collaborations and External Partnerships: The college will work closely with local environmental organizations, government agencies, and academic institutions to secure funding, share knowledge, and implement biodiversity conservation projects. These partnerships will provide additional expertise and support for large-scale campus initiatives, fostering long-term sustainability.

6.2.12.5. Empowering Student-Led Biodiversity Initiatives: Student-led initiatives, such as biodiversity clubs and awareness campaigns, will be promoted. These groups will work collaboratively with the administration to lead projects, conduct awareness programs, and participate in ongoing monitoring of campus biodiversity.

6.2.13 Conclusion:

This Biodiversity Conservation Policy represents St. Teresa's College (Autonomous), Ernakulam's ongoing commitment to environmental sustainability and biodiversity conservation. By integrating conservation efforts into campus activities, curriculum, and community outreach, the College aims to create a harmonious balance between academic growth and ecological responsibility. This policy underscores the importance of safeguarding local ecosystems, supporting native flora and fauna, and fostering a culture of sustainability within the college community. Through active participation, collaboration, and continuous monitoring, St. Teresa's College will contribute to broader national and global conservation efforts, ensuring a sustainable and ecologically rich environment for future generations.

6.3 METHODOLOGY

Integrating biodiversity conservation into its core sustainability strategy, the college has established a comprehensive plan for its preservation and enhancement. This initiative is guided by a Biodiversity Audit Team, consisting of 15 members (including 11 students and 4 faculty members), who are responsible for conducting thorough biodiversity assessments and overseeing internal review processes related to conservation efforts.

6.3.1 Internal audit training

Green audit training employs comprehensive and engaging methodologies to cultivate a sense of ownership and active participation within the institution. To prepare the college for this initiative, the Environmental Management System (EMS) selects students and faculty members for internal audit training. This one-day course certifies participants as internal auditors, equipping them to conduct biodiversity audits effectively. The internal biodiversity audit process encompasses several critical phases: evaluation, risk assessment, data collection, policy development, and the documentation of biodiversity conservation registers and initiatives.

6.3.2 Data sampling by categorising the area into different zones

Pivotal responsibilities focused on acquiring comprehensive taxonomic information through systematic and repeated field surveys. Plant data for herbs, shrubs, and trees were gathered employing random sampling techniques, spot surveys, and transect walks. Fauna data collection involved the use of transects for birds and quadrat studies for butterflies and insects.

6.3.3 Calculating the campus diversity

Quadrat sampling and transect methodologies are employed to collect data on plant and animal life, which is subsequently utilized to calculate biodiversity indices, including Simpson's Diversity Index. These measurements provide critical insights into species diversity and abundance, serving as essential indicators of the overall health of the biological community.

6.3.4 Preparing the checklist & threat and challenges to the biodiversity of the college campus

The audit team systematically identifies risks to campus biodiversity and formulates management strategies grounded in both primary data collection and a thorough analysis of secondary sources. Ongoing assessments are performed during regular meetings aimed at evaluating sustainability programs and awareness initiatives. Designated students and faculty members are responsible for documenting these activities, promoting a coordinated effort to foster a culture of sustainability on campus and to encourage its adoption within the surrounding community.

6.3.5 External audit

An external auditor conducts an assessment to evaluate compliance with biodiversity management audit criteria and identify any discrepancies. If only minor discrepancies are found, the auditor may proceed to grant certification to the institution in accordance with the relevant ISO standards.

6.3.6 Assumption of biodiversity audit iso standards

The decline in global biodiversity is occurring at an unprecedented rate, significantly impacting ecosystem stability, environmental health, and human well-being. This rapid loss of species is largely driven by the rising demand for biological resources, fuelled by population growth and consumption patterns.

Human societies fundamentally depend on biodiversity for critical ecosystem services. These services encompass provisioning elements such as food, freshwater, timber, and medicinal resources, as well as regulatory functions like climate moderation, air and water purification, pollination, and flood management. Furthermore, vibrant ecosystems provide vital support functions such as soil formation and nutrient cycling, along with essential cultural and aesthetic benefits. Consequently, the conservation of biodiversity is imperative for human survival and well-being.

The Biodiversity Areas Standard offers a structured approach to addressing this challenge by establishing clear, measurable criteria for the integration of biodiversity into land-use planning and management. It promotes best practices that foster resilient, self-sustaining ecosystems, enhance environmental cost-effectiveness, and mitigate the negative impacts of human development.

In alignment with global conservation goals aimed at mitigating habitat loss and land transformation, this standard highlights the significance of urban and surrounding areas. By incorporating ecological principles into all land-use decisions, we can protect and restore vital natural resources, thereby supporting a sustainable future.

6.3.7. 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.

6.3.8 Stages of biodiversity audit

Biodiversity audit has the following three phases:

6.3.8.1 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.)

6.3.8.2 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 distance 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.

6.3.8.3Post 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.)

6.3.8.4. Work plan and schedule of the biodiversity audit

Date to date	Work Plan
02/06/2025-09/06/2025	• First meeting of BMS (March 7th) • Request registers for flora and fauna documentation of the campus • Assign specific areas to individuals or groups for focused tasks. • Assign the task of documenting flora • Start sample survey of the assigned areas
10/06/2025-17/06/2025	• Second meeting of BMS (March 12th) • Finalize work schedule • Continue data sampling using reference document-Campus flora. • Documentation, geotagged photos.

18/06/2025-25/06/2025	• Third meeting (March 17th) • Assessment of flora and fauna documented by students • Finalize BMS policy • Prepare a comprehensive checklist of flora in the Science block, Central block, Centenary block and Arts Block. • Fourth meeting (March 20th) • Follow up on the fauna survey. • Preparation of a comprehensive checklist of fauna • Documenting herbs, shrubs, trees, butterflies, odonates, birds, amphibians, insects, and mammals in an Excel sheet, including their scientific, English, Malayalam, and common names. • Maintain a standardized list of registers for recording minutes, checklist, activities and action plan.
26/06/2025-03/07/2025	• Completion of documentation • Verification of the checklist and data documented by students
04/07/2025-11/07/2025	• Data entry • Uploading photos to the drive
12/07/2025-19/07/2025	• Final upload of documents.

Table 6.1 Schedule of the Biodiversity management audit

Activities	Frequency	Dates of study	Mode of data collection
Quadrat sampling	(3) days; three times a day	Dates 18/06/2025, 19/06/2025,20/06/2025	Entry in the given format
Transect sampling	(3) days; three times a day	Dates 23/06/2025, 24/06/2025,25/06/2025	Entry in the given format

Table 6.2 Workplan of Biodiversity management audit

Fig 6.1 Transect sampling

Fig 6.2 Qudrat sampling

6.4 RESULT AND ANALYSIS

6.4.1. Checklist of flora and fauna

Checklist of Fauna

6.4.1.1. Checklist of birds

SI.NO.	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Common Myna	*Acridotheres tristis*	നാട്ടുമൈന	2
2	Purple rumbed sunbird	*Leptocoma zeylonica*	മഞ്ഞതേൻക്കിളി	10
3	Greater Coucal	*Centropus sinensis*	ചെമ്പോത്ത്	5
4	Rock Pigeon	*Columba livia*	മാടപ്രാവ്	32
5	Oriental Magpie-Robin	*Copsychus saularis*	മണ്ണാത്തിപ്പുള്ള്	10
6	Large-billed Crow	*Corvus macrorhynchos*	ബലികാക്ക	10
7	House Crow	*Corvus splendens*	പേനകാക്ക	70
8	Rufous Treepie	*Dendrocitta vagabunda*	ഓലേഞ്ഞാലി	8
9	Black Drongo	*Dicrurus macrocercus*	ആനറാഞ്ചി പക്ഷി	5
10	Black-rumped Flameback	*Dinopium benghalense*	നാട്ടുമരംകൊത്തി	2
11	Asian Koel	*Eudynamys scolopaceus*	കുയിൽ	17
12	Brahminy Kite	*Haliastur indus*	കൃഷ്ണപ്പരുന്ത്	5
13	Black Kite	*Milvus migrans*	ചക്കിപ്പരുന്ത്	12
14	Rose-ringed Parakeet	*Psittacula krameri*	മോതിരത്തത്ത	2
15	Red-whiskered Bulbul	*Pycnonotus jocosus*	ഇരട്ടത്തലച്ചി	6
16	Common Tailor Bird	*Orthotomus sutorius*	തുന്നാരൻ	12
17	White Cheeked Barbet	*Megalaima viridis*	പച്ചിലക്കുടുക്ക	13
18	White Throated Kingfisher	*Halcyon smyrnensis*	മീൻകൊത്തിച്ചാത്തൻ	4
19	Jungle owlet	*Glaucidium radiatum*	ചെമ്പൻ നത്ത്	1
20	Pale billed flower pecker	*Dicaeum erythrorhynchos.*	ഇത്തിക്കണ്ണിക്കുരുവി	1
21	Red vented bulbul	*Pycnonotus cafer*	നാട്ടുബുൾബുൾ	1
22	Indian golden oriole	*Oriolus kundoo*	മഞ്ഞക്കിളി	1
			Simpson index	0.13

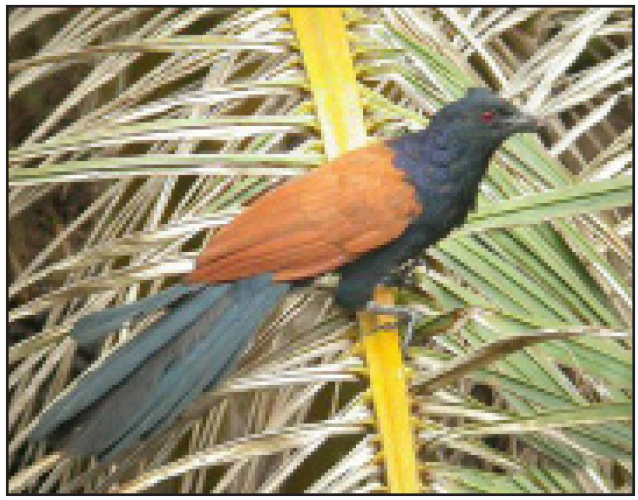
Table 6.3. List of birds sighted in college

Purple rumbed sunbird


Oriental magpie robin


White Cheeked Barbet


Rock pigeon


Greater coucal


Rose-ringed parakeet


Black drongo


Brahminy kite


Asian koel


Common myna


Black rumped flameback


Red whiskered bulbul


Red vented bulbul


White- throated kingfisher

6.4.1.2. Checklist of mammals

SL.NO.	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	*Bandicota bengalensis*	പെരുച്ചാഴി	2
2	*Mus musculus*	ചുണ്ടെലി	3
3	*Funambulus palmarum*	അണ്ണാൻ	7
		Simpson index	0.38

Table 6.4. List of mammals sighted in college

6.4.1.3. Checklist of dragonflies

SL.NO.	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Common Picturewing	*Rhyothemis variegata*	ഓണത്തുമ്പി	26
2	Green Marsh Hawk	*Orthetrum sabina*	പച്ചവ്യാളി	2
3	Pied Paddy Skimmer	*Neurothemis tullia*	സ്വാമിത്തുമ്പി	7
4	Scarlet Marsh Hawk	*Aethriamanta brevipennis*	ചോപ്പൻ കുറുവാലൻ	3
5	Wandering Glider	*Pantala flavescens*	തുലാത്തുമ്പി	50
6	Ground Skimmer	*Diplacodes trivialis*	നാട്ടുനിലത്തൻ	6
7	Granite Ghost	*Bradinopyga geminata*	മതിൽ തുമ്പി	2
			Simpson index	0.35

Table .6.5. List of dragonflies spotted in college

Aethriamanta brevipennis

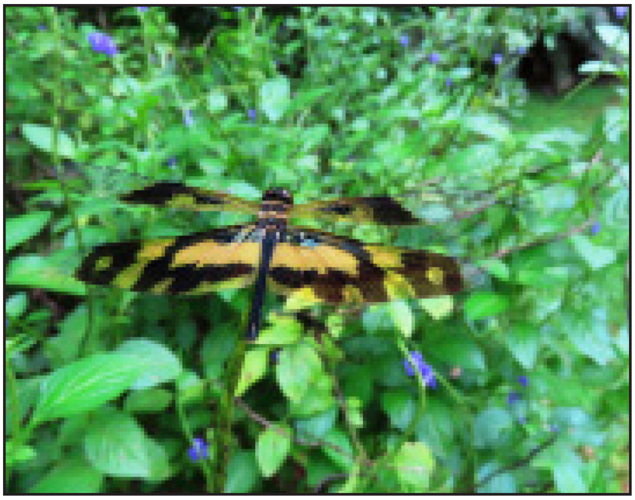
Diplocodes trivialis

Neurothemis tullia male

Orthetrum sabina

Neurothemis tullia female

Aethriamanta brevipennis



Rhyothemis varigata

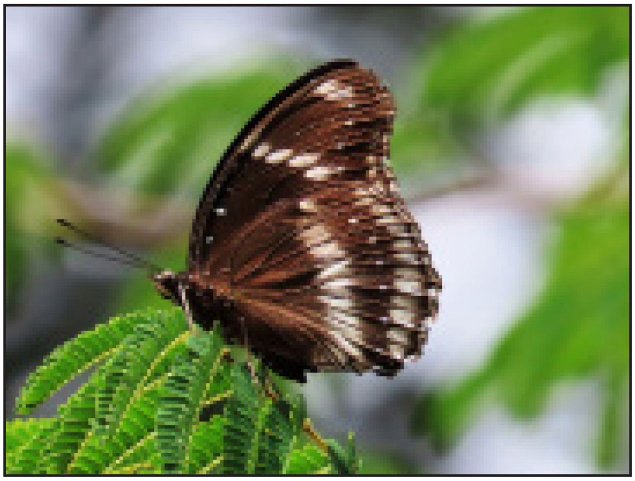
6.4.1.4. Checklist of butterflies

SI.NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	COMMON ROSE	*Pachliopta aristolochiae*	നാട്ടു റോസ്	2
2	COMMON MIME	*Papilio clytia*	വഴനപൂമ്പാറ്റ	4
3	COMMON MORMON	*Papilio polytes*	നരകക്കാളി	3
4	STRIPED TIGER	*Danaus genutia*	വരയൻ കടുവ	4
5	COMMON CROW	*Euploea core*	അരളി ശലഭം	3
6	GREAT EGG FLY	*Hypolimnas bolina*	വൻചോട്ടശലഭം	2
7	COMMON BUSHBROWN	*Mycalesis perseus*	തവിടൻ	4
8	PSYCHE	*Leptosia nina*	പൊട്ടുവെള്ളാട്ടി	2
9	COMMON JEZEBEL	*Delias eucharis*	വിലാസിനി	1
10	GAINT RED EYE	*Gangara thyris*	വൻ ചെങ്കണ്ണി	3
		Simpson index		0.66

Table 6.6. .List of Butterflies spotted in college

Common bushbrown

Common crow



Great eggfly

Psyche

6.4.1.5. Checklist of reptiles

SL. NO.	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Oriental garden lizard	***Calotes versicolor***	ഓന്ത്	4
2	Common garden skink	***Lampropholis guichenoti***	അരണ	3
3	Common house gecko	***Hemidactylus frenatus***	നാട്ടുപല്ലി	2
4	House geko	***Hemidactylus brookii***	വീട്ടുപല്ലി	7
			Simpson index	0.25

Table. 6.7. List of reptiles sighted in college

Calotes versicolor

6.4.1.5. Checklist of Other fauna

SL.NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Pod-sucking bug	*Riptortus dentipes*	കടലപ്പൊടി വണ്ട്	1
2	Thread-waisted wasp	*Ammophila laevigata*	കടന്നൽ	1
3	Fire ant	*Solenopsis geminata*	തീയുറുമ്പ്	50
4	Black ant	*Lasius niger*	കറുത്ത ഉറുമ്പ്	8
5	Millipede	*Diplopoda sps.*	തേരട്ട	15
6	Honey bee	*Apis cerana indica*	തേനീച്ച	2
7	Cricket	*Pomponia pseudolinearis*	ചീവീട്	1
8	Fruit fly	*Drosophila melanogaster*	പഴയീച്ച	5
9	Weaver ant	*Oecophylla smaragdina*	പുളിയുറുമ്പ്	82
10	Wall jumping spider	*Menemerus bivittatus*	ചിലന്തി	3
			Simpson index	0.33

Table 6.8. List of others spotted in college

6.4.2.CHECKLIST OF FLORA

6.4.2.1.CHECKLIST OF TREES

SL.NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Soursop	*Annona muricata*	മുള്ളാത്ത	1
2	Custard Apple	*Annona reticulata*	ആത്ത	1
3	Sugar-Apple	*Annona squamosa*	സീതപ്പഴം	1
4	Jack Fruit Tree	*Artocarpus heterophyllus*	പ്ലാവ്	1
5	Bilimbi	*Averrhoa bilimbi*	ഇരുമ്പൻപുളി	1
6	Neem	*Azadirachta indica*	ആര്യവേപ്പ്	2
7	Peacock Flower	*Caesalpinia pulcherrima*	രാജമല്ലി	1
8	Papaya	*Carica papaya*	കപ്പളം	8
9	Fishtail Palm	*Caryota urens*	ചൂൺപ്പന	2
10	Giant Fishtail Palm	*Caryota obtusa*	ചൂപ്പന	8
11	Indian Laburnum	*Cassia fistula*	കണിക്കൊന്ന	2
12	Parlor Palm	*Chamaedorea elegans*	പാർലർ പന	1
13	Indian Mahogany	*Chukrasia tabularis*	നാട്ടു മഹാഗണി	1
14	Coconut Tree	*Cocos nucifera*	തെങ്ങ്	1
15	Sea Trumpet	*Cordia subcordata*	നറുവരി	2
16	Mediterranean Cypress	*Cupressus sempervirens*	മെഡിറ്റേറിയൻ സൈപ്രസ്	5
17	Cycas	*Cycas circinalis*	ഈന്ത്	1
18	Sago Palm	*Cycas revoluta*	ചെറിയ ഈന്ത്	5
19	Red Palm	*Cyrtostachys renda*	ചുവന്ന പന	9
20	Bamboo Palm	*Dypsis lutescens*	അലങ്കാര പന	8
21	Banyan Tree	*Ficus benghalensis*	പേരാൽ	1
22	Weeping Fig	*Ficus benjamina*	വെള്ളാൽ	1
23	Rubber Fig	*Ficus elastica*	ശീമയാൽ	1
24	Hairy Fig	*Ficus hispida*	പേരകം	1
25	Cluster Fig Tree	*Ficus racemosa*	അത്തി	1
26	Peepal Tree	*Ficus religiosa*	അരയാൽ	1
27	Chinese Banyan	*Ficus retusa*	ചൈനീസ് ആൽ	9
28	Jasmine Tree	*Holarrhena pubescens*	കൊടകപാല	1
29	Blue Palm	*Latania loddigesii*	നീലപന	1
30	Ruffled Fan Palm	*Licuala grandis*	വിശറിപ്പന	1
31	Mango Tree	*Mangifera indica*	മാവ്	1
32	Sapotta	*Manilkara zapota*	സപ്പോട്ട	1
33	Narrow Leaf Paper Bark	*Melaleuca linariifolia*	തേൻ മിർട്ടിൽ	1
34	Spanish Cherry	*Mimusops elengi*	ഇലഞ്ഞി	1
35	Drumstick Tree	*Moringa oleifera*	മുരിങ്ങ	1
36	Mangrove Palm	*Nypa fruticans*	ഓലപ്പന	2

37	Malabar Chestnut	*Pachira glabra*	മലബാർ ചെസ്റ്റ്നട്ട്	1
38	Copper-Pod	*Peltophorum pterocarpum*	മഞ്ഞവാക	1
39	Avocado	*Persea Americana*	വെണ്ണപഴം	3
40	Purple Orchid Tree	*Bauhinia purpurea*	മരമന്ദാരം	1
41	Indian Gooseberry	*Phyllanthus emblica*	നെല്ലി	1
42	White Frangipani	*Plumeria alba*	വെള്ള ചെമ്പകം	2
43	Fiddle Leaf Plumeria	*Plumeria pudica*	വെള്ളപ്പൂച്ചെമ്പകം	2
44	African Fern Pine	*Podocarpus gracilior*	ഫേൺ പൈൻ	2
45	Yew Plum Pine	*Podocarpus macrophyllus*	ബുദ്ധിസ്റ്റ് പൈൻ	2
46	False Ashoka	*Monoon longifolium*	അരണമരം	1
47	Guava	*Psidium guajava*	പേര	1
48	Santol	*Sambucus koetjape*	സന്തോൾ	1
49	Asoka Tree	*Saraca asoca*	അശോകം	3
50	Paradise-Tree	*Simarouba glauca*	ലക്ഷ്മിതരു	5
51	Wild Mango	*Spondias pinnata*	അമ്പഴം	1
52	Rose Apple	*Syzygium jambos*	പനിനീർ ചാമ്പ	1
53	Malay Apple	*Syzygium malaccense*	മരചാമ്പ	3
54	Brush Cherry	*Syzygium myrtifolium*	ബ്രഷ് ചെറി	5
55	Teak	*Tectona grandis*	തേക്ക്	1
56	Madagascar Almond Tree	*Terminalia neotaliala*	മഡഗാസ്കർ ആൽമ്	1
57	Eastern Arborvitae	*Thuja occidentalis*	തൂജ	1
58	Oriental Arborvitae	*Thuja orientalis*	തൂജ	1
59	Tall Chaste Tree	*Vitex altissima*	മയിലെള്ള്	1
60	Chinese Chaste Tree	*Vitex negundo*	കരിനൊച്ചി	1
61	Foxtail Palm	*Wodyetia bifurcata*	നരിവാലൻ പന	1
			Simpson index	0.02

Table 6.9. List of trees present in college

6.4.2.2. CHECKLIST OF SHRUBS

SL.NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Indian Acalypha	*Acalypha indica*	കുപ്പമേനി	3
2	Desert Rose	*Adenium obesum*	അഡീനിയം	16
3	Caribbean Agave	*Agave angustifolia*	അഗാവെ	1
4	Aloe Vera	*Aloe vera*	കറ്റാർ വാഴ	1
5	Balfour Aralia	*Aralia balfouriana*	അരാലിയ	4
6	Asparagus	*Asparagus racemosus*	ശതാവരി	2
7	Paper Flower	*Bougainvillea glabra*	ബോഗൺവില്ല	69
8	Bird's Eye Chili	*Capsicum frutescens*	കാന്താരിമുളക്	10
9	Christ's Thorn	*Carissa carandas*	ചെറി	2
10	Clustering Fishtail Palm	*Caryota mitis*	ചെറിയ ചൂണ്ടപ്പന	1
11	Croton	*Codiaeum variegatum*	ക്രോട്ടൺ	1
12	Ti Plant,	*Cordyline fruticosa*	കോർഡിലൈൻ	2
13	Dumb Cane	*Dieffenbachia sp.*	ഡീഫെൻബാക്കിയ	1
14	Narrow-leaved Dragon Tree	*Dracaena angustifolia*	ഡ്രസീന	4
15	Spotted Dracaena	*Dracaena godseffiana*	ഡ്രസീന	1
16	Red-edged Dracaena	*Dracaena marginata*	ഡ്രസീന	1
17	Song of India	*Dracaena reflexa*	ഡ്രസീന	1
18	Gold Dust Dracaena	*Dracaena surculosa*	ഡ്രസീന	6
19	Golden Dewdrop	*Duranta erecta*	ചെമ്പഴുക്ക	5
20	Fukien Tea Tree	*Ehretia microphylla*	കാട്ടുവെള്ളില	1
21	Crown of Thorns	*Euphorbia milii*	ക്രൗൺ ഓഫ് തോൺസ്	1
22	Devil's Backbone	*Euphorbia tithymaloides*	തത്തമ്മച്ചെടി	2
23	Gardenia	*Gardenia jasminoides*	ഗന്ധരാജൻ	1
24	Parrot's Beak	*Heliconia psittacorum*	ഹെലിക്കോണിയ	4
25	Hibiscus	*Hibiscus rosa-sinensis*	ചെമ്പരത്തി	4
26	Dragon Fruit	*Hylocereus undatus*	ഡ്രാഗൺ ഫ്രൂട്ട്	1
27	Jungle Geranium	*Ixora coccinea*	തെച്ചി	4
28	Chinese Ixora	*Ixora chinensis*	ചൈനീസ് തെച്ചി	13
29	White Ixora	*Ixora finlaysoniana*	വെള്ള തെച്ചി	1
30	Indian Torch Tree	*Ixora pavetta*	ഈഴച്ചെത്തി	1
31	Arabian Jasmine	*Jasminum sambac*	മുല്ല	3
32	Peregrina	*Jatropha integerrima*	ജട്രോഫ	4
33	Buddha Belly Plant	*Jatropha podagrica*	ബുദ്ധബെല്ലി	7
34	Shrub Vinca	*Kopsia fruticosa*	കോപ്സിയ	2
35	Lantana	*Lantana camara*	അരിപ്പൂച്ചെടി	1

36	Henna	*Lawsonia inermis*	മൈലാഞ്ചി	2
37	Ruffled Fan Palm	*Licuala grandis*	വിശറിപ്പന	4
38	Chinese Fringe Flower	*Loropetalum chinense*	ലോറോപെറ്റാലം	1
39	Miniature Holly	*Malpighia coccigera*	സിംഗപ്പൂർ ഹോളി	1
40	Orange Jasmine	*Murraya paniculata*	മരമുല്ല	1
41	Night-flowering Jasmine	*Nychanthes arbor-tristis*	പവിഴമല്ലി	13
42	Sweet Olive	*Osmanthus fragrans*	ഓസ്മാന്തസ്	4
43	Dwarf Pandanus	*Pandanus pygmaeus*	കുള്ളൻ കൈത	2
44	Baby Rubber Plant	*Peperomia obtusifolia*	പെപ്പറോമിയ	2
45	Cape Plumbago	*Plumbago auriculata*	നീലക്കൊടുവേലി	1
46	Geranium Aralia	*Polyscias guilfoylei*	പോളിസിയാസ്	2
47	Dinner Plate Aralia	*Polyscias scutellaria*	പോളിസിയാസ്	8
48	Tropical Sage	*Pseuderanthemum grandiflorum*	ചുട്ടിമുല്ല	1
49	Bitter-wood	*Quassia amara*	ക്വാസ്സിയ	2
50	Dog Rose	*Rosa canina*	കാട്ടുറോസ്	2
51	Indian Rose	*Rosa indica*	പനിനീർ റോസ്	17
52	Sweet Briar	*Rosa rubiginosa*	റോസാപൂ	4
53	Dwarf Umbrella Tree	*Schefflera arboricola*	കുടമരം	1
54	Crape Jasmine	*Tabernaemontana divaricata*	നന്ത്യാർവട്ടം	10
55	Yellow Bells	*Tecoma stans*	മഞ്ഞ കോളാമ്പി	2
56	Triplaris	*Triplaris surinamensis*	ഉറുമ്പ് മരം	1
57	Cardboard Palm	*Zamia furfuracea*	കാർഡ്ബോർഡ് പാം	5
58	zz plant	*Zamioculcas zamiifolia*	സിസി പ്ലാന്റ്	4
			Simpson index	0.08

Table 6.10. List of shrubs present in college

6.4.2.3. Checklist of herbs

SL.NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Lady's Finger	*Abelmoschus esculentus*	വെണ്ട	26
2	Copperleaf	*Acalypha wilkesiana*	അകാലിഫ	5
3	Spotted Evergreen	*Aglaonema costatum*	ചൈനീസ് എവർഗ്രീൻ	1
4	Philippine Evergreen	*Aglaonema commutatum*	അഗ്ലോണിമ	1
5	Anthurium	*Anthurium sp.*	ആന്തൂറിയം	1
6	Begonia	*Begonia bacillaris*	ബിഗോണിയ	2
7	Beef steak Begonia	*Begonia erythrophylla*	ബിഗോണിയ	1
8	Little Tree Plant	*Biophytum sensitivum*	മുക്കുറ്റി	12
9	China Aster	*Callistephus chinensis*	ചൈന ആസ്റ്റർ	2
10	Elephant Ear	*Caladium bicolor*	കാലാഡിയം	80
11	Turtle Vine	*Callisia repens*	കാലിസിയ	1

12	Bird's Eye Chili	*Capsicum frutescens*	കാന്താരിമുളക്	1
13	Cockscomb	*Celosia argentea*	കോഴിപ്പൂവ്	1
14	Indian Chrysanthemum	*Chrysanthemum indicum*	ജമന്തി	1
15	Coleus, Painted Nettle	*Coleus scutellarioides*	ഇലച്ചെടി	2
16	Jade Plant	*Crassula ovata*	ജേഡ് പ്ലാന്റ്	12
17	Poison Bulb	*Crimum asiaticum*	ലില്ലി	1
18	Golden Eye-grass	*Curculigo orchioides*	നിലപ്പന	11
19	Turmeric	*Curcuma longa*	മഞ്ഞൾ	1
20	Fringed Dendrobium	*Dendrobium fimbriatum*	ഓർക്കിഡ്	1
21	Lindley's Dendrobium	*Dendrobium lindleyi*	ഓർക്കിഡ്	1
22	Money Plant, Pothos	*Epipremnum aureum*	മണി പ്ലാന്റ്	10
23	Amazon Lily	*Eucharis amazonica*	യൂക്കാരിസ് ലില്ലി	44
24	Nerve Plant	*Fittonia albivenis*	ഫിറ്റോണിയ	1
25	Dancing Girl Ginger	*Globba winitii*	ഡാൻസിംഗ് ഗേൾ ഇഞ്ചി (Dancing Girl Ginger)	10
26	Red Ivy	*Hemigraphis colorata*	മുറികൂടി	5
27	Balsam	*Impatiens balsamina*	കാശിത്തുമ്പ	5
28	Knoxia species	*Knoxia mollis*	നോക്സിയ	27
29	Dwarf Water Clover	*Marsilea minuta*	നാലിലക്കീര	2
30	Touch-Me-Not	*Mimosa pudica*	തൊട്ടാവാടി	2
31	Mangrove Palm	*Nypa fruticans*	ഓലപ്പന	1
32	Holy Basil	*Ocimum sanctum*	തുളസി	2
33	Creeping Woodsorrel	*Oxalis corniculata*	പുളിയാരില	1
34	Felted Peperomia	*Peperomia incana*	പെപ്പറോമിയ	4
35	Clearweed	*Peperomia pellucida*	മഷിത്തണ്ട്	2
36	Philodendron	*Philodendron auriculatum*	ഫിലോഡെൻഡ്രോൺ	1
37	Philodendron	*Philodendron birkin*	ഫിലോഡെൻഡ്രോൺ	1
38	Gripeweed	*Phyllanthus urinaria*	കീഴാർനെല്ലി	10
39	Celebes Pepper	*Piper ornatum*	ചെടി തിപ്പലി	1
40	Indian Borage	*Plectranthus amboinicus*	പനിക്കൂർക്ക	2
41	Indian Snakeroot	*Rauvolfia serpentina*	സർപ്പഗന്ധി	1
42	Snake Plant	*Sansevieria dubia*	മരുഭൂമി വാഴ	3
43	Snake Plant	*Sansevieria trifasciata*	മരുഭൂമി വാഴ	1
44	Peace Lily	*Spathiphyllum floribundum*	പീസ് ലില്ലി	20
45	Peace Lily	*Spathiphyllum sp.*	പീസ് ലില്ലി	7
46	Wandering Jew	*Tradescantia zebrina*	ട്രേഡെസ്കാന്റിയ	4
47	Little Ironweed	*Vernonia cinerea*	പൂവാംകുറുന്നില	1
48	Ginger	*Zingiber officinale*	ഇഞ്ചി	3
			Simpson index	0.09

Table6 .11. List of herbs present in college

6.4.2.4 CHECKLIST OF CLIMBERS

SL. NO	ENGLISH NAME	SCIENTIFIC NAME	MALAYALAM NAME	DENSITY
1	Coral Vine	*Antigonum leptopus Hook. & Arn.*	പവിഴവള്ളി	1
2	Asparagus	*Asparagus densiformis*	ശതാവരിച്ചെടി	1
3	Ash Gourd	*Benincasa hispida*	കുമ്പളം	3
4	Turtle Vine	*Callisia repens*	ടർട്ടിൽ വൈൻ	2
5	Balloon Vine	*Cardiospermum halicacabum*	ഉഴിഞ്ഞ	2
6	White Clematis	*Clematis paniculata*	നികിടകൊടി	1
7	BRIDAL BOUQUET	*Clematis terniflora*	നിറമുല്ല	1
8	Butterfly Pea, Asian Pigeonwings	*Clitoria ternatea L.*	ശംഖുപുഷ്പം	1
9	Cretan Yam	*Dioscorea cretica*	കാച്ചിൽ	2
10	Copper Leaf	*Episcia cupreata*	ഫ്ളെയിം വയലെറ്റ്	3
11	Swiss Cheese Plant, Monstera	*Monstera deliciosa*	മൊൺസ്റ്റിറ	10
12	Heartleaf Philodendron	*Philodendron hederaceum*	ഫിലോഡെൻഡ്രോൺ	2
13	Betel Pepper, Betel Vine	*Piper betle*	വെറ്റില	4
14	Java Long Pepper	*Piper chaba Hunter*	ജാവ തിപ്പലി	1
15	Indian Long Pepper	*Piper longum L.*	തിപ്പലി	1
16	Black Pepper	*Piper nigrum L.*	കുരുമുളക്	1
17	Pelliyonia	*Procris repens*	പെലിയോണിയ	2
18	Jade Vine	*Strongylodon macrobotrys*	എമറാൾഡ് വൈൻ	1
19	Five Fingers	*Syngonium auritum*	സിംഗോണിയം	2
20	Cowpea	*Vigna unguiculata*	വൻപയർ	21
			Simpson index	0.14

Table 6.12 List of Climber present in college

6.4.2.5 CHECKLIST OF PTERIDOPHYTES

SL.NO	ENGLISH NAME	SCIENTIFIC NAME	DENSITY
1	Broadleaf Maidenhair	*Adiantum latifolium*	2
2	Delta Maidenhair Fern	*Adiantum raddianum C.Presl.*	2
3	Giant Fern	*Angiopteris helfoeriana (Forst.) Hoff.*	1
4	Soft Fern	*Christella dentata (Forssk.) Brownsey & Jermy*	1
5	Hare's-foot Fern	*Davallia canariensis (L.) Sm*	1
6	Lacy Hare's-foot Fern	*Davallia fejeensis Hook.*	1
7	Dragon's Scale Fern	*Drymoglossum piloselloides (L.) C. Presl*	

8	Branched Horsetail	*Equisetum ramosissimum Desf.*	1
9	Japanese Climbing Fern	*Lygodium japonicum Thunb.*	1
10	Microsorum	*Microsorum monstrosum (Copel.) Copel.*	2
11	Java Fern	*Microsorum pteropus (Blume) Copel.*	4
12	Broad Sword Fern	*Nephrolepis biserrata (Sw.) Schott*	5
13	Tuber Sword Fern	*Nephrolepis cordifolia (L.) K. Presl*	5
14	Button Fern	*Nephrolepis duffii T. Moore*	5
15	Boston Fern	*Nephrolepis exaltata (L.) Schott*	10
16	Fishtail Swordfern	*Nephrolepis falcata (Cav.) C. Chr.*	10
17	Staghorn Fern	*Platycerium (Genus)*	2
18	Silver Lace Fern	*Pteris ensiformis Burm. f.*	2
19	Chinese Brake	*Pteris vittata L.*	17
20	Lanceleaf Tongue Fern	*Pyrrosia lanceolata (L.) Farw.*	1
		Simpson index	0.10

Table 6.13. List of Pteridophytes

SL. NO	Table No	Flora /Fauna	Abundance
1	6.3	Birds	22
2	6.9	Trees	61
3	6.10	Shrub	58
4	6.11	Herb	48
5	6.12	Climber	20
7	6.5	Dragonflies	7
8	6.4	Mammals	3
9	6.7	Reptiles	4
10	6.6	Butterflies	10
11	6.8	Other fauna	11
12	6.13	Pteridophytes	20

Table 6.14 Biodiversity of the campus

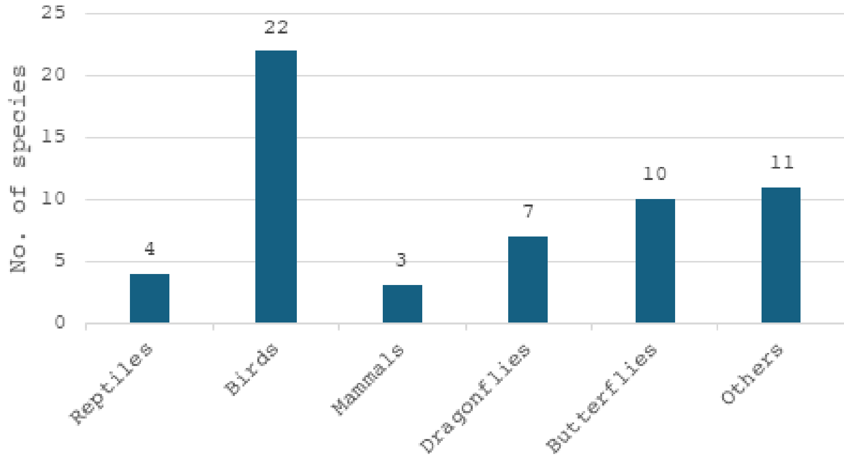


Fig..6.3. Faunal diversity of the campus

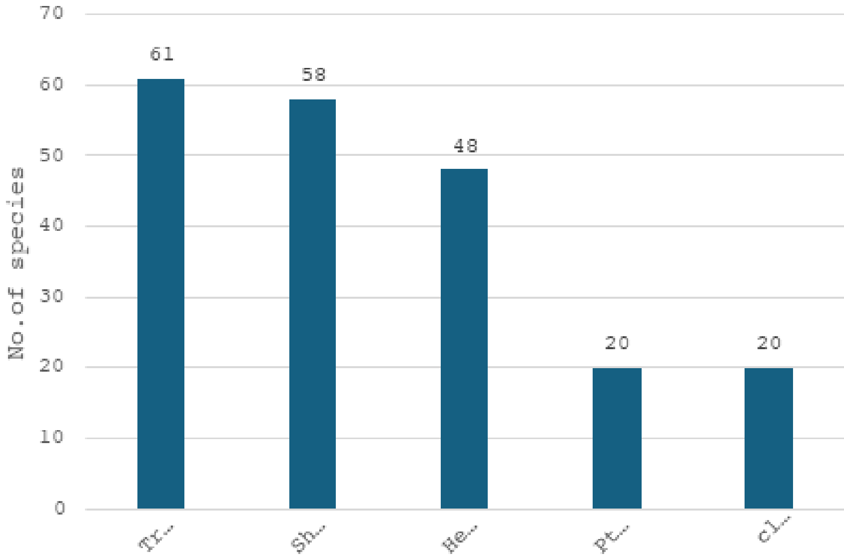


Fig. 6.4. Floral diversity of the campus

SL.NO	TAXA	SIMPSON INDEX	BIODIVERSITY VALUE
1	Trees	0.02	Moderate diversity
2	Shrubs	0.66	Low diversity
3	Herbs	0.09	High diversity
4	climbers	0.14	High diversity
5	Pteridophytes	0.10	High diversity
6	Birds	0.13	High diversity
7	Dragonflies	0.35	Moderate diversity
8	Mammals	0.38	Moderate diversity
9	Reptiles	0.25	Moderate diversity
10	Butterflies	0.66	Low diversity
11	Other fauna	0.33	Moderate diversity

Table 6.15

The assessment reveals that the campus suffers from a lack of biodiversity due to its central location in a metropolitan area, which imposes space limitations and adversely affects building design. The campus has an almost 90% built-up spaces and green spaces are less the 2%. While the college demonstrates an abundance of diverse flora, the variety of fauna is notably limited in comparison. Acknowledging this deficiency, propose the implementation of a Biodiversity Management System Policy aimed at increasing the greenery of the campus through green initiatives such as the restoration of native flora.

6.5.CONCLUSION

- The college campus shows a comparatively increased abundance of flora than fauna, while the Simpson index for diversity is higher for fauna, in which arthropods are the highest.
- A major portion of the floral diversity comprises trees followed by shrubs, herbs, climbers and grasses.
- Arthropods (0.31) and Birds (0.16) have comparatively higher Simpson Index values, indicating relatively better biodiversity. However, both are still categorised as "Low," implying room for ecological improvement.
- The college campus exhibits low species diversity and an imbalanced distribution due to its location within a densely populated metropolitan area.
- Low biodiversity can signal habitat degradation, monoculture practices, or environmental stressors, and therefore, efforts should focus on enhancing plant diversity and protecting faunal habitats. Regular biodiversity assessments can help track changes and guide restoration strategies.

6.6.RECOMMENDATION

- Introduce native trees, shrubs, herbs, and climbers suited to the local climate, which can add to the overall biodiversity of the campus. more over planting them improves ecological resilience, reduces maintenance needs, and enhances biodiversity naturally.

- Establish butterfly gardens, bird-friendly zones, and pollinator patches to attract butterflies and other insects, which play a crucial role in pollination and ecosystem health.

- Use water features like ponds or birdbaths to attract amphibians and birds. Water bodies offer drinking, bathing, and breeding spaces for birds, frogs, and insects. Even small features like birdbaths or mini ponds can significantly boost faunal diversity.

- Use vertical gardens on walls and rooftops to increase plant cover in limited space, which can provide urban campuses with limited ground space, greenery, reduce heat, and offer habitats for insects and small birds.

- Promote organic vegetable gardening practices.

- Launch biodiversity clubs and citizen science projects by engaging students and faculty in biodiversity initiatives fosters awareness, encourages stewardship, and generates valuable data through species monitoring and habitat care.

- Encourage research, documentation, and monitoring of campus species which includes regular surveys and documentation that help to track biodiversity trends, identify threats, and guide conservation efforts. It also provides learning opportunities for students.

- Organize workshops, nature walks, and eco-events to build ecological literacy Educational activities can raise awareness about local ecosystems, promote sustainable practices, and inspire community involvement in conservation.

- Conduct biodiversity audits and develop a long-term conservation plan. A formal audit assesses current biodiversity levels and identifies gaps. A strategic plan ensures sustained efforts, sets measurable goals, and aligns with broader environmental policies.

6.7.BIODIVERSITY MANAGEMENT PLAN

6.7.1. Biodiversity Management Committee Team

The Biodiversity Management Committee (BMC) is constituted with faculty members, administrative staff, and student representatives. This team collaborates with the Internal Quality Assurance Cell (IQAC) to oversee biodiversity conservation, documentation, and sustainable campus practices. Regular meetings are scheduled to evaluate and improve biodiversity initiatives in alignment with the College Green Protocol and SDGs.

6.7.2 Comprehensive strategy for sustainable biodiversity management

- Incorporate biodiversity-focused modules into curricula, embed conservation-oriented projects in research, and adopt eco-friendly practices in campus operations.
- Enhance the campus's green cover by enriching native biodiversity and utilizing innovative strategies for planting.
- Strengthen community linkages for biodiversity conservation and fortify knowledge sharing.
- Synchronise institutional biodiversity management with national missions and frameworks.
- Build academic and institutional partnerships for intensifying research, training, and best practice exchange.

6.7.3.Implement Effective Methods to Attain Set Objectives

- Introduce course components and student projects on biodiversity; establish biodiversity clubs; conduct workshops, awareness campaigns, and green audits involving students and faculty.
- Organize plantation drives of native species; install rooftop/vertical gardens wherever possible; encourage adoption of potted plants in classrooms and offices; monitor soil health improvement.
- Mobilize students and faculty participation for TROP activities; partner with local governing bodies and respective communities to create/update biodiversity registers; conduct conservation awareness sessions and citizen science programs.
- Map activities to Green India Mission goals; submit progress to national biodiversity databases; participate in government-led greening campaigns and biodiversity day observances.
- Establish MoUs with universities, research centres, and NGOs; engage in joint biodiversity research projects; facilitate student/faculty exchange and collaborative workshops.

6.7.4.Communication

- Biodiversity-related updates will be shared via official social media platforms, emails, the college website, campus notice boards, community radio, and public media.
- Department Heads and class teachers will ensure the dissemination of information reaches all students. Ensure transparency in communication through WhatsApp, mail, and other social media platforms
- BMC members will be allocated specific responsibilities and resources (green spaces, species registers, research initiatives, outreach).
- Biodiversity-related reports will be submitted to the IQAC and BMC at the end of each year for documentation.

6.7.5.Set Short-Term and Long-Term Targets

6.7.5.1.Short-Term Goals:

- Establish the BMC and finalize Terms of Reference.
- Conduct a baseline biodiversity survey and prepare a species register.
- Plant native trees and introduce indoor greenery in classrooms/verandahs.
- Initiate one community outreach program (tree planting, eco-literacy).

6.7.5.2.Long-Term Goals:

- Achieve 100% organic inputs (fertilizers, pesticides) across campus.
- Maintain at least two fully functional conservation zones.
- Establish a mini forest with fast-growing native plants, providing habitat for local fauna.
- Implement organic composting and mulching to improve soil health, supporting flora and soil fauna.
- Compile and prepare a comprehensive annual biodiversity report.

6.7.6.Monitoring and Regular Evaluation

- Annual updates of species registers and biodiversity documentation to reframe the checklist of campus flora and fauna
- Annual biodiversity audits will be conducted by the Internal Auditor and the Internal Quality Assurance Cell (IQAC) to assess and evaluate the campus's ecological health.
- Feedback and suggestions from students and faculty will be actively incorporated into ongoing biodiversity initiatives to enhance engagement and effectiveness.
- An adaptive management approach will be employed to refine biodiversity practices, utilizing monitoring outcomes and expert recommendations to continually improve our strategies.

6.7.7.Comprehensive Evaluation and Follow-up Procedure

- At the end of each academic year, the BMC will conduct a comprehensive review of completed Biodiversity initiatives, focusing on their impact, curriculum integration effectiveness, student project outcomes, community engagement results, and progress toward short- and long-term targets. A detailed report will then be compiled and submitted to the Principal and IQAC.
- To address the policy gaps or non-compliance identified during the review, the BMC will implement awareness programs, corrective actions, and necessary revisions to the plan.

6.7.8.Conclusion

St. Teresa's College remains committed to protecting and enriching biodiversity on its campus and beyond. Through systematic planning, continuous monitoring, and strong community partnerships, the institution strives to serve as a model for sustainable biodiversity conservation and environmental stewardship.

6.8.ACTIVITES CONDUCTED

Swachhtapakhwada: Tree Sapling Distribution

In line with the SwachhtaPakhwada initiative, NSS Unit 41 of St. Teresa's College organized a tree sapling distribution event at the Arts Auditorium on 10th july 2024. The chief guest of the programme was Ms. Bindu R, Deputy General Manager of H.R at Indian Oil Corporation who addressed the audience on the importance of environmental cleanliness and conservation. Highlighting the event, NSS volunteers also performed a flashmob advocating for the protection of Mother Earth. The event culminated with the distribution of 500 fruit tree saplings to St. Teresa's College students.

Plantation Drive at St.Mary's Higher Secondary School

On 12th July 2024, NSS Unit 41 volunteers from St. Teresa's College visited their adopted school, St. Mary's Higher Secondary School, Valarpadam, as part of their community outreach initiative. The activity focused on promoting environmental sustainability through seed planting.With seeds sponsored by C-Head, the volunteers prepared the soil and sowed seeds within the school premises. The initiative aimed to foster environmental awareness and encourage sustainable practices among students. The volunteers demonstrated teamwork and dedication throughout the activity.This visit reinforced the ongoing partnership between St. Teresa's College and St. Mary's Higher Secondary School, highlighting the NSS unit's commitment to service, environmental stewardship, and community development.

Community garden and microgreens awareness initiatives

On 16th January 2025, NSS Unit 41 of St. Teresa's College (Autonomous), Ernakulam, in collaboration with S.L.A.T.E. and the Department of Botany, conducted a series of impactful outreach programs across three educational institutions—GVHSS Ambalamukal, NIVHS Marampilly, and GHSS Ezhppuram. These sessions were organized as part of a broader effort to raise awareness about community gardening, sustainable agriculture, microgreens, and the Sustainable Development Goals (SDGs), aiming to equip students with both theoretical knowledge and hands-on experience. The interactive session was followed by a hands-on gardening activity, where students were guided through soil preparation, loosening, and systematic seed planting. Seeds of a wide range of vegetables

Floristic analysis of Aster Medicity campus

The floristic diversity of the campus was authentically documented through a structured taxonomic field study, providing students with valuable lab-to-field experience. As part of the programme, the plants within the campus were scientifically categorized and listed, culminating in a comprehensive report that was submitted to the hospital administration. This initiative not only enriched the subject knowledge of the participating students but also equipped them with practical skills in vegetation documentation and botanical classification.

6.9.SUMMARY

- The college showcases an abundance of flora; however, the variety of fauna is comparatively limited. It is essential to focus on initiatives aimed at enhancing campus biodiversity.
- The area exhibits a high diversity of herbs, climbing plants, pteridophytes, and bird species. There is a moderate diversity of mammals, reptiles, and other taxa, while the diversity of butterflies and shrubs is relatively low.

Sustainable development is the development that meets the needs of the present without compromising the ability of future generations to meet their own needs

- Gro Harlem Brundtland -

Chapter VII

WASTE MANAGEMENT SYSTEM (WMS): AUDIT REPORT

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ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925

WASTE MANAGEMENT COMMITTEE
(WMC 2025)

Ms. Maya Menon
Dr. Sunitha T.R
Ms. Sonia Maria Lobo
Assistant Professors

Meritta Mariam Mathew
Laya P.S
Sharon Achu Mathai
Anarkali. R. Koyithara
Fathimathu Sadiya
Zaya Ziraj
Lincy Lauju
Feby AB
Vaishnavi Rajesh Nair
Students

7

Waste Management System Audit Report

7.1 INTRODUCTION

Solid waste management (SWM) poses a significant challenge for governments and local authorities, particularly in developing countries where poor management systems exacerbate social, environmental, and health problems. Globally, around 2.01 billion tons of waste are generated annually, with the East Asia and Pacific region contributing 468 million tons each year, a weight comparable to that of 46,337 Eiffel Towers or 4.5 million blue whales. The growing volume and complexity of waste, driven by modern consumption patterns and economic growth, present serious threats to ecosystems and public health. The breakdown of organic waste is responsible for nearly 5% of global greenhouse gas emissions. India, noted as one of the fastest-growing economies, produces 62 million tons of waste annually; however, only 70% of this waste is collected, and merely 12 million tons are treated. As a result, 31 million tons end up in landfills, causing considerable air, water, and soil contamination. Forecasts suggest that municipal solid waste (MSW) generation in India could soar to 165 million tons by 2030, influenced by shifting consumption behaviours and rapid urbanization. Major challenges include ineffective collection systems, open and unhygienic landfills, and a lack of adequate treatment facilities. E-waste, which contains toxic materials, is an urgent concern, with significant increases expected in both developed and developing countries.

In India, the informal sector plays an essential role in extracting value from waste. However, inefficiencies in the collection, sorting, and recycling processes lead to considerable amounts of recyclable materials being sent to landfills. Urban regions, which are home to 377 million people, produce large quantities of waste, yet only 43 million tons are collected yearly, leaving a vast quantity untreated. The infrastructure's inadequacy is apparent, with only 21 million waste collectors compared to China's 700 million. Furthermore, merely 30% of waste is sorted effectively.

In India, the responsibility for solid waste management lies with the Union Ministry of Environment, Forests, and Climate Change, guided by the principles of "sustainable development," "precaution," and "polluter pays." The Environmental Protection Act of 1986 lays the legal groundwork for waste management regulation, highlighting the responsibility of cities and businesses to reduce environmental harm and embrace sustainable practices. On educational campuses, the Municipal Solid Waste (MSW) generated includes materials such as stationery, organic waste, food scraps, metals, packaging, hazardous material containers, and electronic waste. Sustainable waste management efforts in these institutions concentrate on MSW as well as initiatives aimed at effectively managing liquid waste through water audits. Higher Education Institutions (HEIs) have a critical role in promoting sustainability by combining knowledge with community engagement and driving societal progress through research and innovation.

The ISO 14001 standard, recognised internationally as a framework for environmental management systems, offers guidelines for developing and maintaining effective waste management practices. This framework assists institutions in reducing waste, lowering environmental impacts, and enhancing overall efficiency. It assesses the performance of waste management systems, encourages the effective use of resources, and identifies improvement opportunities to guarantee ongoing advancements in waste reduction and sustainability initiatives.

7.1.1 What is Waste Management Audit?

A waste audit involves a thorough examination of all waste produced within an organisation. It provides insight into what is being discarded, the quantity, and the common contaminants generated by people. This process assesses the effectiveness of the existing waste management system and highlights opportunities for introducing new strategies.

- A comprehensive inventory of the various types of waste generated across the college campus from different sources (such as canteens, hostels, classrooms, offices, and laboratories).
- An in-depth assessment of the current waste management practices at each source point (evaluation of existing methods) and their effects on the environment and the health of stakeholders.
- The establishment of an effective scientific waste management system on campus to improve waste management practices and support environmental conservation (including behavioural changes, the installation of a biogas plant, composting units, and material recovery facilities, etc.).

7.1.2 Need for Waste Management Audit

The goals of waste management and environmental policy are to educate and raise awareness among stakeholders about environmental compliance in a clean setting. This policy applies to all faculty and students at the college/university, promoting an environmentally friendly atmosphere. The Waste Management Policy focuses on keeping the campus clean through appropriate waste disposal methods and guidelines for recycling biodegradable materials, along with the use of eco-friendly supplies to ensure the campus is free from hazardous waste and pollutants (Cardenas and Halman, 2016). The idea of an eco-friendly culture is promoted among students and the surrounding rural community through various awareness initiatives. The organization's leadership, including Department Heads and Senior Managers/Management Representatives, is responsible for overseeing the college/university's waste management efforts and maintaining a clean campus, while everyone in the organization is expected to follow the policy. Waste Management can enhance the campus's green initiatives, contributing to the preservation of the planet for future generations. Conducting a Waste Management audit every three years is essential, as it helps both students and staff understand the importance of Waste Management and its positive impact on promoting the 'Go green concept,' which supports the institution in serving as an environmental role model for the community. Effective Waste Management serves as a vital strategy for organizations to assess how and where they can maintain an eco-friendly campus (Kaseva and Gupta, 1996).

7.1.3. Waste Management in a College in alignment with SDGs

Effective waste management in educational institutions entails minimizing, reusing, and recycling the waste produced on campus through education, proper separation, and sustainable methods. This supports the achievement of Sustainable Development Goals (SDGs) such as:

- SDG 11: Sustainable Cities and Communities
- SDG 12: Responsible Consumption and Production
- SDG 13: Climate Action

Establishing environmentally friendly waste management systems contributes to a cleaner campus and fosters a sense of environmental responsibility among students.

7.2 WASTE MANAGEMENT POLICY

At St. Teresa's College, effective waste management is crucial not only for environmental sustainability but also for promoting a culture of responsibility and awareness among students, staff, and faculty.

Our institution generates a wide variety of waste, including paper, food waste, electronic waste, plastics, and hazardous materials. Responsible management will mitigate the factors contribute to pollution, environmental degradation, and the depletion of natural resources. Therefore, a comprehensive waste management policy addresses the entire waste lifecycle from generation to disposal while encouraging practices such as waste reduction, recycling, reuse, and responsible disposal. A well-structured waste management policy is therefore essential to reduce the environmental footprint of the institution and ensure compliance with local and global regulations. This policy serves as a roadmap for reducing waste generation, promoting recycling, and minimizing the institution's overall environmental impact.

7.2.1 Statement of Commitment

St. Teresa's College (Autonomous) is committed to advancing the United Nations Sustainable Development Goals (SDGs) through a transformative waste management policy that prioritizes waste minimization, resource efficiency, and circular economy principles. This policy aligns with SDG 11 (Sustainable Cities), SDG 12 (Responsible Consumption and Production), and SDG 13 (Climate Action), recognizing that effective waste management is foundational to global sustainability efforts.

7.2.2 Goals

Maintain full compliance of waste management practices with environmental legislation and best practices. Establish ambitious ordeal to maximize source segregation, significantly increase landfill diversion via recycling/composting, foster individual waste reduction behaviours, and achieve a substantial overall reduction in campus waste within five years.

7.2.3 Objectives

- To ensure all waste management activities comply with current and future environmental legislation and best practices.
- To reduce total campus waste generation by 40% over five years.
- To achieve at least 80% segregation at source and 70% diversion from landfill through recycling and composting.
- To eliminate single-use plastics on campus by 2027.
- To promote environmental awareness, encouraging waste minimization, reuse, and recycling among all campus users.

7. 2.4. Resource Management

7.2.4.1.Bio-waste Management: The institution employs systematic practices for managing bio-waste. Organic materials, encompassing food scraps and vegetable matter, are collected daily from campus food service areas (hostels, messes, canteens) and staff rooms. Adherence to source segregation protocols guarantees the quality of feedstock directed to the campus biogas facilities. This collected wet waste undergoes anaerobic digestion in strategically sited fixed-dome or modular biogas plants. This process yields biogas (primarily methane and carbon dioxide) and a nutrient-dense residual slurry. The slurry is subsequently applied as organic fertilizer to campus gardens, lawns, and green spaces, thereby fostering a circular economy and minimising the need for synthetic fertilisers. The deployment of these biogas units enables sustainable wet waste processing, renewable energy capture, and enhancement of soil fertility, and provides tangible opportunities for environmental education and community engagement.

7.2.4.2.Waste Stream Segregation Implementation: Waste segregation is strictly implemented across the institution. Standardised, colour-coded bins, clearly labelled for specific waste categories (e.g., Biodegradable, Recyclable/Dry, Hazardous), are situated in all academic facilities, residential hostels, dining areas, and administrative offices. This practice is fundamental to enabling efficient collection, handling, and effective processing of different waste streams.

7.2.4.3.External Partnerships for Dry Waste Management: The institution collaborates with certified external bodies and agencies to manage dry waste streams. These partnerships facilitate the regular collection and appropriate recycling or disposal of materials such as paper, plastics, glass, metals, electronic waste (e-waste), and batteries, ensuring their removal from campus and environmentally sound processing.

7. 2.5 Curriculum integration

St. Teresa's College (Autonomous) has a charitable and literary organisation formed by students and faculty named STEP, which stands for Society of Teresians for Environmental Protection. STEP focuses on environmental protection and awareness, including initiatives fabric crafts and pouches, training local groups, and promoting sustainable practices.

Apart, the institution aims at integrating waste management and sustainability topics into core and elective courses across disciplines, encouraging student research, projects, and internships focused on campus waste audits, recycling innovation, and circular economy principles.

- Paper/Cloth Bag Making: organises skill-development workshops where students learn to make paper or cloth bags, replacing single-use plastics. This not only teaches practical skills but also fosters creativity and environmental responsibility.
- Awareness Drives: College continues to host regular workshops, seminars, and poster campaigns to educate the campus community on the environmental impacts of plastic waste and the benefits of sustainable alternatives.
- Reusable Food Container Schemes: Our Institution encourages the use of reusable containers in canteen/dining halls and food courts. By mandating the use of reusable containers at all departmental events, the institution ensures that sustainability is not just a policy but an everyday practice.
- Green protocol: Each department is responsible for ensuring that all food served at events (seminars, meetings, festivals, etc.) uses only approved reusable containers. Event organisers coordinate with the campus Bhoomitra Sena team to estimate container needs and arrange for distribution and collection.

7. 2.6 Green initiatives

Specific initiatives and programs are established to ensure optimal resource utilisation, thereby fostering campus sustainability. Voluntary efforts facilitate effective waste segregation, contributing to significant waste reduction. The college rigorously enforces a green protocol for every event and integrates the Reduce, Recycle, and Reuse framework throughout its actions. Implements policies to minimise single-use plastics, such as plastic bags, straws, and bottled water, by providing steel tumblers near the water dispensers. Cloth bags are also made on the campus and supplied free of cost on special occasions. The cloth bags are also easily made available for sale during seminars, exhibitions or any such event.

7.2.6.1.Promotion of Reusables: The college actively encourages the campus community (students and staff) to utilise reusable bags, food containers, and personal water bottles to reduce waste.

7.2.6.2.Regular Donation & Reuse Programs: Established programs facilitate the regular donation and reuse of gently used items, including clothing, furniture, electronics, and books.

7.2.6.3.Creative Material Repurposing: Initiatives support the creative repurposing of materials, exemplified by student projects that transform items like discarded boxes or bottles into functional objects, such as planters.

7.2.6.4.Campus Greening and Soil Enrichment: The college cultivates diverse gardens, including floral, medicinal, and vegetable plots, in suitable locations throughout the campus. Kitchen waste, specifically vegetable peels and eggshells from various campus sources (kitchens, canteens, hostels), is systematically collected and utilised as natural manure to enrich the soil in these gardens.

7.2.6.5.Product Development & Materials: The club specialises in designing and producing compact, reusable bags in a variety of styles (e.g., ball bag, strawberry bag, zip bag) as sustainable alternatives to single-use plastic carry bags. As part of this initiative, we also create zero-cost bags repurposed from T-shirts. By cultivating a culture of eco-friendly practices and emphasising the principles of reduction and upcycling, these bags are crafted from upcycled textile waste.

7.2.6.6.Awareness & Behavioural Change Initiative: The Bhoomitra Sena (College club in alignment with SD Goals) is implementing a project across seven schools, two Gram Panchayats, and our own college (Kochi Corporation) aimed at increasing awareness of the detrimental effects of plastic waste and fostering sustained behavioural change among youth to adopt reusable alternatives.

7.2.6.7.Training & Resource Development: Students act as lead trainers, sharing expertise on eco-friendly alternatives to plastic bags in support of the Government of Kerala's ‹Haritha Kerala› Mission. They have developed instructional video tutorials for creating various cloth bags and produced an awareness documentary detailing the hazards of plastic waste. These resources have been made publicly accessible on the Suchitwa Mission of Kerala website.

7.2.6.8.Community Outreach & Skill Development: Students have successfully trained over 1,000 members of Kudumbasree across 80 Panchayats in Ernakulam District, as well as members of various Self-Help Groups (SHGs) in other districts of Kerala, on the techniques for producing these reusable bags. A key strategy, particularly in rural areas, is encouraging residents to utilize the paid services of these SHGs to upcycle their own used clothing into practical and appealing bags at affordable rates.

7.2.6.9.Organic Waste Management: Food scraps generated in the college hostel are processed through an on-site composting system. Furthermore, yard waste such as dry leaves and trimmings is managed through sustainable practices like composting or soil incorporation to enhance soil fertility.

7.2.6.10.Enhanced Recycling Infrastructure: The college plans to expand its recycling program by installing clearly identifiable, color-coded bins for paper, plastic, glass, and metal. These bins will be strategically placed for accessibility across the campus.

7.2.6.11.Internal Waste Audit: A dedicated team, operating under the purview of the Internal Quality Assurance Cell (IQAC), conducts regular waste audits. These audits aim to systematically identify opportunities for enhancing waste management efficiency and sustainability practices on campus.

7. 2.7 Purchasing and Procurement

Purchasing and procurement policies can significantly impact sustainability. Hence the college has policies which encourage the purchase of environmentally friendly products. Some strategies include:

7.2.7.1.Prioritization of Sustainable Materials: The college selects products made from sustainable and recycled materials where feasible.

7.2.7.2.Student-Led Production: College organizations and clubs manufacture items, such as cloth bags, utilizing recycled materials like waste cloth.

7.2.7.3.Circular Economy Promotion (Thrift Sales): Student clubs and committees operate regular, year-round "Pre-loved" thrift sales for clothing. Items are collected at designated points and resold. Similar thrift initiatives are conducted for books, with options for resale or donation to the college library.

7.2.7.4.Responsible E-Waste Management: Periodic collection drives (1-2 times per year) gather electronic waste (e.g., batteries, chargers) for transfer to certified vendors, ensuring proper reuse or disposal protocols are followed.

7. 2.8 Research and innovation

7.2.8.1.Promote Engagement in Advanced Recycling: Encourage active participation from students and staff in exploring and utilising advanced recycling technologies, particularly those capable of processing complex materials or producing high-quality recycles, in their research pursuits (projects; doctoral thesis work).

7.2.8.2.Support Sustainable Campus Initiatives: The institution is collaboratively developing grant proposals to secure funding for sustainable waste management practices on campus and to accelerate its transformation into a green campus.

7.2.8.3.Foster Research and Professional Development: Provide opportunities for students and faculty to engage in research publication, project design, and participation in international conferences, seminars, and conclaves. These activities should focus on presenting emerging trends and innovative techniques that advance sustainability initiatives for a greener future.

7. 2.9 Community engagement

7.2.9.1.STEP Activities: The Society of Teresians for Environmental Protection (STEP), a faculty-student group, spearheads environmental conservation efforts. A primary focus is mitigating plastic waste, informed by research highlighting its prevalence.

7.2.9.2.Eco-Friendly Alternatives: STEP operates a social enterprise producing cloth bags ("Prakrithi Sanchis," "Bhoomithram Sanchis") from recycled textile waste collected locally. This initiative promotes biodegradables, diverts waste from incineration, and offers a sustainable alternative to plastic bags.

7.2.9.3.Social and Educational Benefits: This project creates employment for Kudumbasree women and provides entrepreneurial training and potential self-employment pathways for female students.

7.2.9.4.Campus Integration: The college implements a "Green Protocol," providing students with eco-friendly bags, including those made by STEP, to foster sustainable practices.

7.2.9.5.Household Sustainability ('Ente Haritha Bhavanam'): In partnership with the District Administration and Suchitwa Mission, the 'Ente Haritha Bhavanam' project promotes green habits (green protocol) within 1,000 student households, aiming for 5,000 within a year. This offers students a direct platform for contributing to environmental sustainability.

7.2.9.6.Government Collaboration: Students further engage in environmental action through participation in state government initiatives addressing solid waste issues.

7. 2.10 Monitoring and Reporting

7.2.10.1.Waste Management Oversight and Coordination: The Waste Management Committee oversees the implementation and effectiveness of institutional waste management initiatives, Key responsibilities include assigning designated auditors to coordinate waste data collection and reporting, particularly for hazardous and laboratory waste streams.

7.2.10.2.Data Collection and Performance Tracking: Waste quantities and types (e.g., paper, plastic, bio-waste, e-waste) are documented via checklists during collections from various blocks and sub-locations, conducted three times weekly. This data allows for the calculation of total waste generation and the identification of high-generation areas. Annually, key performance indicators such as recycling rates, landfill diversion rates, and hazardous waste management figures are tracked and updated.

7.2.10.3.Reporting and Incident Management: An annual report is compiled by the Committee, outlining achievements, challenges, and progress relative to environmental performance indicators, is disseminated to stakeholders, including students, staff, and external partners. Furthermore, all incidents, including hazardous waste spills or non-compliance events, require prompt investigation and documentation. Reports detailing the incident, corrective actions, and preventive measures must be submitted to the relevant competent authority.

7. 2.11 Compliance and Review

7.2.11.1.Green Campus Initiative: Ensure campus transformation initiatives align with all applicable internal, national, state, and UGC standards for sustainability.

7.2.11.2.Assessment Monitoring: Regularly review internal assessment progress and utilize technical support to effectively monitor checklist compliance.

7.2.11.3.Policy Updates: To maintain relevance, policies will undergo an internal update every three years to align with future requirements, address institutional demands, and remove any superseded clauses.

7. 2.12 Leadership and Accountability

7.2.12.1.Waste Management Overview : Department Heads bear the primary responsibility for implementing and enforcing waste management protocols within their departments. This scope includes ensuring correct waste segregation procedures are followed, overseeing departmental reporting, and allocating resources for effective data collection.

7.2.12.2.Communication channel: A framework for transparency and collaboration is maintained through scheduled inter-group and intra-group meetings focused on waste management. Key discussion points, ideas, and challenges identified are documented in meeting minutes and shared accordingly. The Waste Management System (WMS) Coordinator communicates essential information regarding waste management procedures and green protocols via official channels, such as departmental email or general announcements, depending on the specific context.

7.2.12.3.College Community Engagement: Students and Faculty contribute significantly by monitoring waste segregation practices throughout the campus and participating in data collection efforts. Their active involvement in sustainability initiatives, including campaigns and events, is crucial for success. They are encouraged to provide input and support for refining and improving waste management processes.

7.2.12.4.Expanding Sustainability Efforts: To enhance student and faculty involvement in environmental stewardship, the college is developing plans for Green Clubs and Sustainability Clubs.

7. 2.13 Conclusion

Effective waste management is essential for maintaining a clean, healthy, and sustainable campus environment at St. Teresa's College. By adopting a comprehensive waste management policy that emphasizes waste reduction, segregation at source, recycling, and environmentally sound disposal, the college can significantly reduce its environmental footprint and promote public health. The commitment of every member of the college community-students, faculty, staff, and visitors-is crucial to the success of this policy. Through education, awareness, and active participation, ABC College can foster responsible waste handling practices that not only comply with legal requirements but also contribute to broader sustainability goals. Ultimately, this policy will help transform waste into valuable resources, support a circular economy, and ensure a cleaner, greener campus for current and future generations.

7.3 METHODOLOGY

Proper waste management is essential for upholding tidy surroundings, diminishing pollution, preserving resources, and safeguarding public health. An established Waste Management Group, consisting of 12 members (including 9 student representatives and 3 faculty members), oversees these initiatives according to a detailed policy. This policy delineates specific goals, action plans, and strategies, which are consistently evaluated and improved during group meetings to guarantee maximum effectiveness.

7.3.1. Internal audit training

Green audit training promotes a sense of ownership and involvement within the institution by utilizing thorough, participatory methods. To prepare the college for this endeavor, the existing Environmental Management System (EMS) chooses students and faculty to participate in internal audit training. This one-day course certifies participants as internal auditors, enabling them to carry out a waste audit. The internal waste audit process consists of several crucial phases: evaluation, risk assessment, data gathering, policy development, and the creation of registers and initiatives for waste management.

7.3.2. Data sampling and categorisation of waste

The annual waste management audit evaluates the generation of different types of waste, including food waste, plastics, litter, and electronic waste. Individual records are kept for each waste category, noting the amounts produced in key locations like the canteen and throughout the campus. Collected waste is sorted and organized into six separate streams: (1) Plastic and Paper, (2) Bio-waste, (3) E-waste, (4) Chemical Waste (Chemical samples, stain, dye, cultured media contaminated substance) and (5) Other Waste (Mat, glass wares cutleries, desk chair, bench instruments) which includes items such as broken glass, construction debris, textiles, packaging, and office supplies. Analysing the gathered data offers important insights into the annual waste generation trends on campus, differentiating between times such as regular working days, holidays, and semi-holidays.

7.3.3. Registers and documents to monitor the process

Detailed records of waste disposal are kept, monitoring the amounts sent to recycling centres, composting sites, and other disposal methods. Student representatives are responsible for overseeing the documentation linked to recycling centres and waste processing facilities.

7.3.4. External audit

External auditors come to the college to assess compliance with waste management audit standards and pinpoint any discrepancies. Should only minor discrepancies be identified, the external auditor may grant the institution certification in line with applicable ISO standards.

7.3.5. Assumption

The generation of waste presents an increasing challenge at global, regional, and local levels. Traditional waste management techniques, such as incineration and landfilling, often lead to negative environmental effects through emissions and contaminations of soil, air, and water, which contribute to pollution and damage to ecosystems. These issues are exacerbated by unsustainable production and consumption models alongside rapid global urbanization. The significant financial resources required for effective and environmentally friendly waste management may be seen as a barrier, encouraging inadequate disposal methods that threaten both human health and environmental integrity. On a worldwide scale, waste management practices vary greatly: developed nations, particularly those in the OECD, usually maintain strong management systems, while non-OECD countries often struggle with dependence on unregulated landfills and insufficient waste sorting systems. In many countries, waste management policies still tend to support incineration or landfilling, a trend often reinforced by industrial growth. Conversely, the last few decades have seen the emergence of 'Integrated Waste Management.' This approach, guided by the principles of the Waste Hierarchy and in alignment with standards like ISO 14001, emphasizes prevention, reuse, recycling, and recovery over disposal, thus creating a more sustainable and environmentally responsible method for handling waste.

7.3.6. Stages of waste management audit

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

7.3.6.1. 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.); bio-wastes (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

7.3.6.2. 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

7.3.6.3. 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.

7.3.7 Steps of waste management audit

7.3.7.1. 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

7.3.7.2. 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

7.3.7. 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.

Fig.7.1. Source segregation

7.3.7.4. Schedule and work plan of the waste management system audit

Date to date	Weekly Work Plan
01/07/2025-08/07/2025	A meeting was held to discuss objectives of the team and chart out the plan of action to collect data on WM practices • Every team member is asked to go through the manual to help make the action plan • Collected the map of the college campus • The college campus is divided into 4 blocks and each group is assigned a block for the survey • The internal audit team is divided into 3 groups • Each team to identify and speak to housekeeping staff from the various blocks to understand current practices • Handed over the data sheets and each group to start the data collection from the next week onwards
09/07/2025-16/07/2025	Identify major waste sources (cafeteria, classrooms, hostels, offices) Each group is asked to understand current waste handling procedure in their assigned area • Arts Block team to collect data from canteen/cafe/campus and academic blocks • Central Block team to collect data from Academic blocks/ Hostel & Hostel Mess • Science Block team to collect data from the academic blocks, labs & cafe
17/07/2025-23/07/2025	Observe how waste is segregated (organic, recyclables, hazardous) • Each team is assigned to place registers in required areas like canteen and hostel, where maximum waste is generated daily, for efficient data collection • Each team to identify the different waste handling machines - biogas plant, incinerators, dumping yard etc in their assigned areas • To make a note of machines not working. • The teams to collect data on waste like paper and plastic given to external agencies
24/07/2025-31/07/2025	Understand current waste handling & challenges Observe waste disposal frequency & areas of non-compliance Ensure all registers and documents are completed

Table 7.1. Schedule of waste management audit

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	Three-week, one time a day of sampling	Three working day ;14/07/2025,21/07/2025,28/07/2025 holidays (Sunday; 13/07/2025, 20/07/2025, 27/07/2025 Three semi holiday Saturday ;19/07/2025, 26/07/2025,2/08/2025	Entry in the given format

Table 7.2. Work plan of waste management audit

7.4. RESULTS AND DISCUSSION

The internal auditor team assesses the quantity of waste generated in different zones based on the records and registers available.

7.4.1. Analysis of waste generation data : survey findings

7.4.1.1. Central block

Paper waste		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	0.81	162±50.32
Holiday	0.58	40.37±11.32
Semi holiday	0.58	54.78±15.36
Values are Mean ± S.D.		

Table No. 7.3. Average amount of paper waste generated in Central Block

A significant amount of paper waste is observed on working days, followed by a semi-holiday. The Central block is a comparatively smaller block which comprises mostly classrooms. The working highlights the quantity proportional to the regular operation of the institution. Semi-holiday observed a lower amount due to the limited functions of the department and staff room, which resulted in less paper waste quantity.

Plastic waste		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	1.88	375.47±31.34
Holiday	0.82	57.56±7.43
Semi holiday	0.82	78.12±10.8
Values are Mean ± S.D.		

Table No. 7.4. Average amount of Plastic waste generated in the Central block

Plastic waste is more concentrated on working days, depending on the regular functioning of the college, the possibility of external events or maybe due to the use of plastic products such as stationery, food containers, packaging, and office essentials. In order to control the spike, the college has a system to be employed by Bumithra Sena, who takes the voluntary action for those who violate green protocol rules, such as remitting a fixed amount of fine for using plastic. Semi-holiday and holiday generated a lower quantity of waste, depending on the operation.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	0.33	66.67±115.47
Holiday	0	0
Semi holiday	0	0

Table No. 7.5. Average amount of Bio waste generated in the Central block (Mean ± S.D.)

Bio-waste generation is recorded high on working days, depending on the regular functioning of the college. The

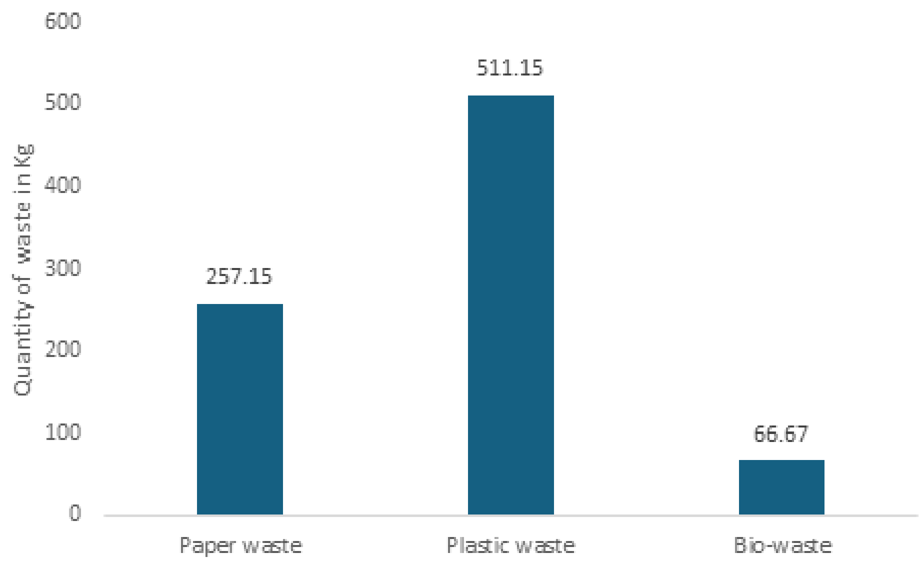

Fig. No.7.3. Average quantity of waste (in Kg.) produced per year in Central Block

biowaste rate depends on the strength of the college community. Semi-holiday and holiday generated zero waste due the partial or non-functionality of the college.

A significant amount of plastic waste is produced in the Central block, followed by paper and biowaste. The major contribution of plastic may be due increased use of packaged items, which include food and other stationery utensils. The reliance on traditional examination methods in colleges is the major contributor to paper waste. Even though plastic is strictly prohibited for events and decorations, there is an increased usage of plastic in daily used items. The amount of bio-waste is relatively low because colleges operate on a shift system; the morning sessions run from 8:30 AM to 1:30 PM and the afternoon sessions from 2:00 PM to 6:00 PM. Therefore, students have limited opportunities to eat lunch on campus, as they might leave after their classes.

7.4.1.2. Science block

Paper waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	19.18	3836.67±2715.89
Holiday	0	0
Semi holiday	0	0

Table No. 7.6. Average amount of Paper waste generated in Science block

A considerable volume of paper waste is noted during weekdays, with zero waste produced during semi-holidays and holidays. The Science block comprises mostly of classrooms and laboratories, open auditorium and conference room cafeteria. Activities during regular workdays indicate a higher amount of waste due to the usual operations of the institution. On semi-holidays and holidays there is no waste observed because of the partial or complete shutdown of the college campus.

Plastic waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	5.57	1113.33±535.29
Holiday	0	0
Semi holiday	0	0

Table No. 7.7. Average amount of Plastic waste generated in the Science block

Plastic waste tends to be more prevalent on weekdays, influenced by the college's regular activities, events in the auditorium or seminar hall, or perhaps due to the usage of plastic items like stationery, food containers, packaging, and office supplies. Additionally, there is no plastic waste observed during semi-holidays and holidays, indicating limited perations during these periods.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	5	1000±577.35
Holiday	0	0
Semi holiday	0	0

Table No. 7.8. Average amount of Bio waste generated in Science block

The quantity of bio-waste is notably high during weekdays, influenced by the normal operations of the college. The amount of bio waste produced correlates with the size of the college community. On semi-holidays and holidays, the waste generated is comparatively lower due to the reduced activities of the college.

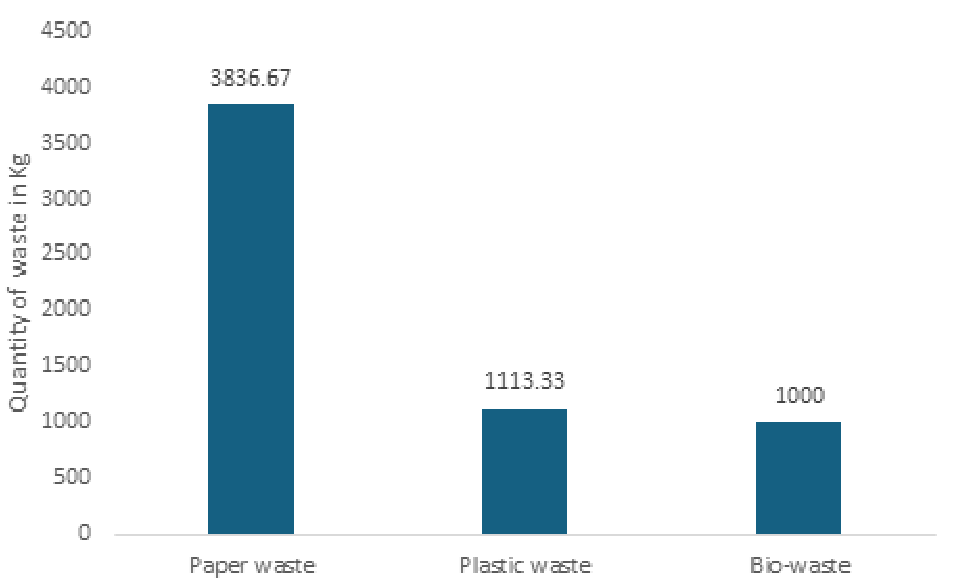

Fig. No.7.4. Average quantity of waste (in Kg.) produced per year in Science Block

Fig. No.7.5. Waste collection chamber

A substantial quantity of paper waste is generated in the Science block, followed by plastic and biowaste. This is largely attributed to the continued use of traditional examination practices in colleges, which significantly increases paper consumption. While plastic is officially banned for use in events and decorations, this restriction has inadvertently led to a rise in paper usage, further contributing to paper waste. The bulk of plastic waste likely stems from the growing reliance on packaged products, including food and various stationery items. Biowaste levels remain relatively low due to the college's shift-based schedule, where morning classes run from 8:30 AM to 1:30 PM, and afternoon sessions from 2:00 PM to 6:00 PM, limiting students' chances to have lunch on campus, as many depart once their classes end.

7.4.1.3. Arts block

Paper waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	142.62	28523.33±6662.69
Holiday	0.001	0.07±00
Semi holiday	0.001	0.095±0

Table No. 7.9. Average amount of Paper waste generated in Arts block (Mean ± S.D.)

A significant amount of paper waste is observed during weekdays, with a decrease noted on semi-holidays, followed by holidays. The arts block contains an administrative office, main auditorium, classroom, staffroom, and

During regular working days, there is a greater production of waste, depending on the paper usage in the classroom, staffroom, departmental programs, and college events. Arts block is the main campus and administrative centre majority of the programs in the college are held at the Arts block, stationery materials, packaging, and purchases and procurements. On semi-holidays, waste reduction is observed due to fewer activities in the office and staff room, resulting in less paper being discarded.

Plastic waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	131.32	26264.53±5287.64
Holiday	9.67	676.76±329.09
Semi holiday	30	2850±1111.40

Table No. 7.10. Average amount of Plastic waste generated in Arts block (Mean ± S.D.)

A significant amount of plastic waste is observed during weekdays, with a decrease noted on semi-holidays. In comparison to the Central and science blocks, the arts block shows waste production even during semi-holidays and holidays. This may be due to Departmental activities, including sports practice or other open stage programs conducted during these days, student staff in the Arts block and stay back involvement associated with any programs of students. College also encourages exhibition, collaboration with various brands for marketing, and hosts the presence of outsiders. On semi-holidays and holidays, waste reduction is observed due to fewer activities in the college, resulting in less paper being discarded.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year
Working day	12	2400±0
Holiday	0	0
Semi holiday	12	1140±0

Table No. 7.11. Average amount of Bio waste generated in Arts block (Mean ± S.D.)

The quantity of bio-waste is significantly greater on weekdays, primarily due to the regular activities of the college. The level of bio-waste generated is directly related to the size of the college population. During semi semi-holidays, the amount of waste produced is decreased due to the minimal activities of the college and during holidays, zero waste is observed due to the non-functionality of the college.

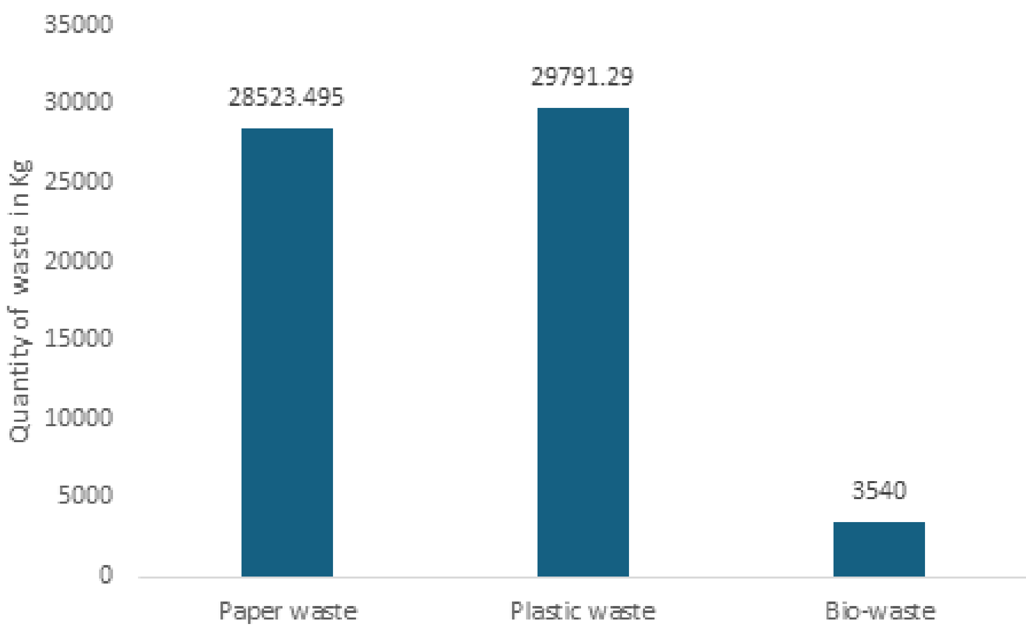

Fig. No.7.6. Average quantity of waste (in Kg.) produced per year in Arts Block

Plastic waste is the most prevalent waste type in the Arts block, outweighing paper and biowaste. The Arts block primarily comprises an administrative office, a classroom, staffroom, and laboratories. The amount of plastic waste generated is directly proportional to the number of occupants. The college's green protocol and the voluntary practices of the Bhumithra Sena are working diligently to reduce plastic usage in campus. Additionally, paper waste is produced lesser than plastic as the college is maximising digital and paperless methods for both academic and administrative purposes.

7.4.4.Total paper waste generated in three locations

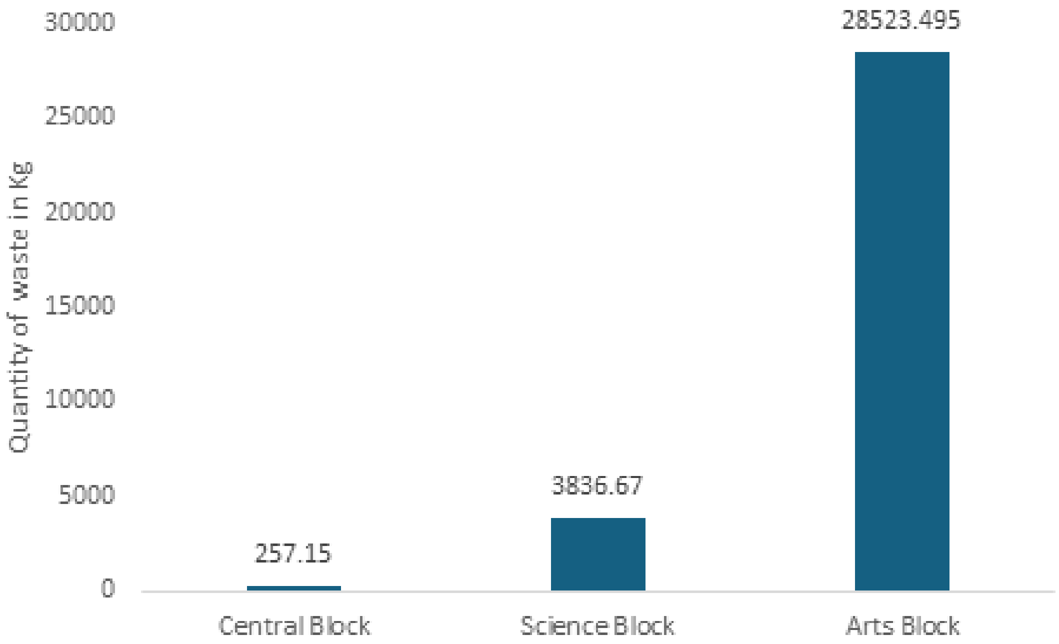

Fig. No.7.7. Total quantity of paper waste (in Kg.) produced per year in each block

The heightened potential of paper waste is observed in the arts block compared to the science and central block. The Arts block is the central administrative block, library, and office area. Major events and programs mostly take place here. Arts and related courses are more in this block; the college usually follows the traditional method of examination, like paper and, booklet. Due to the controlled use of plastic, paper usage has significantly risen due to various demands, for instance, the purchase of electronics (like computers, laptops, printers, and appliances). These products are almost always packaged in paper or cardboard boxes; all these are contributing factors to paper waste.

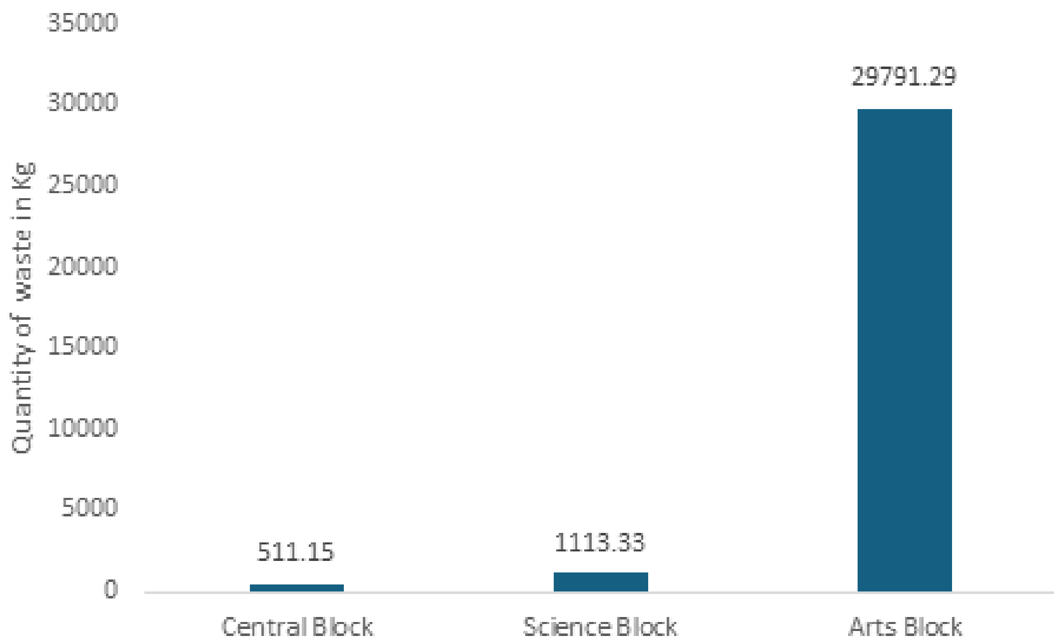

Fig. No.7.8. Total quantity of plastic waste (in Kg.) produced per year in each block

The heightened potential of plastic waste is observed in the arts block when compared to the science and central block. Voluntary steps are introduced in college to control plastic use of plastic even though plastic usage in the present in college depends upon the requirements. The lowest amount of plastic waste is produced from the central block which is the smallest building in the campus.

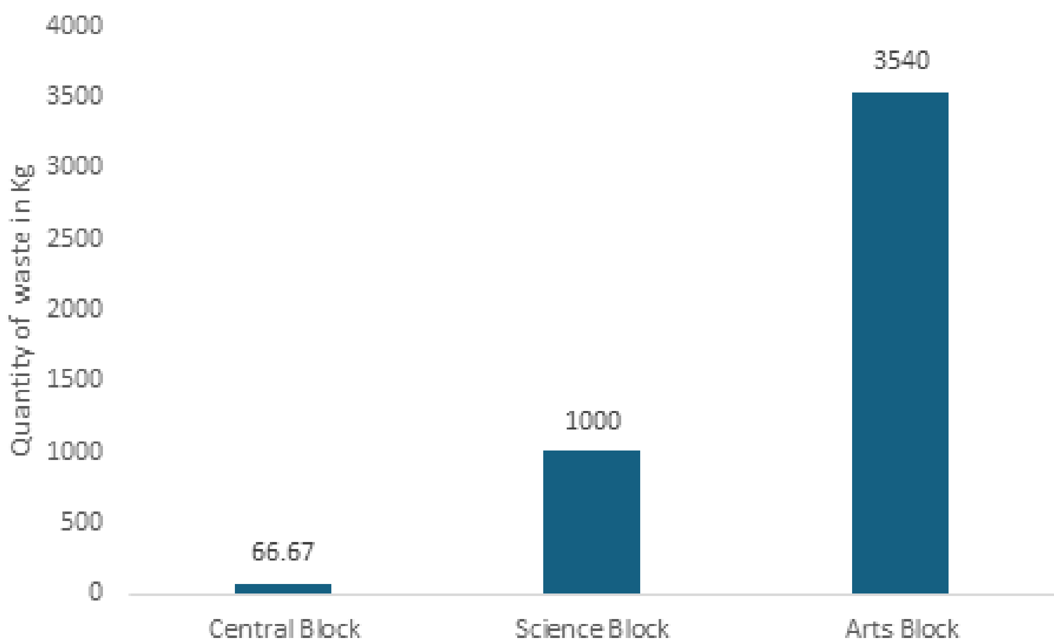

Fig. No.7.9. Total quantity of Bio waste (in Kg.) produced per year in each block

The highest concentration of bio-waste is observed in the Arts block, followed by the Science and Central blocks. This distribution is likely attributable to the presence of key facilities, including the main canteen, cafeteria, and administrative offices in the Arts block, which functions as the central campus and accommodates a higher density of staff, thereby contributing to increased waste generation. In the Science block and central the majority of classes are conducted under a shift system with limited opportunities for students and faculty to take lunch breaks, resulting in minimal food waste; additionally, the presence of only one cafeteria may contribute to the lower volume of bio-waste generated in this area. In the Central block, the quantity of bio-waste is primarily influenced by the number of occupants present.

Fig.No.7.10.Bio gas plant present in Arts block. (Solely used by hostel and one plant present in Science block is under maintenance.)

7.4.1.4. Central block

Paper		
Sampling days	Quantity in (Kg)	Quantity per year (Kg.)
Working day	0.8	160.00 ±20
Semi holiday	1.33	126.67 ± 0.002
Holiday	1.33	93.33 ±16.54

Table No. 7.12. Paper waste quantity of hostel (Mean ± S.D.)

n working days, paper waste is generated in large quantities, while during semi-holidays and holidays, paper waste is influenced by ongoing academic necessities such as books, papers, and stationery items.

Plastic		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	2.9	580.00 ± 124.90
Semi holiday	1.73	164.67± 29.02
Holiday	1.73	121.33± 21.39

Table No. 7.13. Plastic waste quantity of hostel (Mean ± S.D.)

On working days, plastic waste is generated in significant quantities, while during semi-holidays and holidays, the amount of plastic waste is largely influenced by ongoing academic necessities, such as stationery products, food items, and lifestyle products.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	10.37	2073.33± 824.70
Semi holiday	8.50	807.50± 125.67
Holiday	8.50	595.00± 92.60

Table No. 7.14. Bio- waste quantity of hostel (Mean ± S.D.)

On regular working days, a significant quantity of waste is observed, as the college operates at full capacity. In contrast, during semi-holidays and holidays, the number of residents in the hostel decreases, as many students leave for the weekend.

7.4.1.5. Science block

Paper		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	4.33	866.67 ± 122.202
Semi holiday	4.42	419.58± 13.71
Holiday	3.47	242.67± 45.00

Table No. 7.15. Paper waste quantity of hostel (Mean ± S.D.)

On working days, paper waste is generated in large quantities, while during semi-holidays and holidays, the amount of paper waste depends on ongoing academic necessities, such as books, papers, and stationery items.

Plastic		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	1.87	373.33± 151.44
Semi holiday	3.58	340.42± 130.80
Holiday	3.30	231± 59.81

Table No. 7.16. Plastic waste quantity of hostel (Mean ± S.D.)

On regular working days, plastic waste is generated in significant quantities, while during semi-holidays and holidays, plastic waste production varies based on ongoing academic necessities, such as stationery, food items, and lifestyle products.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	1.37	273.33± 127.02
Semi holiday	2.33	221.67± 27.42
Holiday	3	210.00±0

Table No. 7.17. Bio-waste quantity of hostel (Mean ± S.D.)

During regular working days, a significant amount of waste is generated due to the full occupancy of the college hostel. In contrast, on semi-holidays and holidays, the number of residents decreases as many inmates leave for the weekend, resulting in reduced waste production.

Fig. 7.11. Incinerator

7.4.1.6.Arts

Paper		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	6	1200±0
Semi holiday	0	0±0
Holiday	0	0±0

Table No. 7.18. Paper quantity of hostel (Mean ± S.D.)

During working days, paper waste is generated in significant quantities. In contrast, paper waste on semi-holidays and holidays varies based on ongoing academic needs, such as books, papers, and stationery items.

Plastic		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	2.50	500.00± 173.21
Semi holiday	3.17	300.83± 27.42
Holiday	1.67	116.67± 80.83

Table No. 7.19. Plastic quantity of hostel (Mean ± S.D.)

On working days, plastic waste is generated in substantial quantities, while on semi-holidays and holidays, the amount of plastic waste fluctuates based on ongoing academic requirements, such as stationery products, food items, and lifestyle products.

Bio-waste		
Sampling days	Quantity in (kg)	Quantity per year (Kg.)
Working day	0.375	75.00±0
Semi holiday	0.375	35.63±0
Holiday	0.375	55.31±0

Table No. 7.20. Bio- quantity of hostel (Mean ± S.D.)

During working days, a significant amount of waste is generated, reflecting the college's regular operations. In contrast, on semi-holidays and holidays, the number of residents in the hostel decreases as many inmates leave for the weekend.

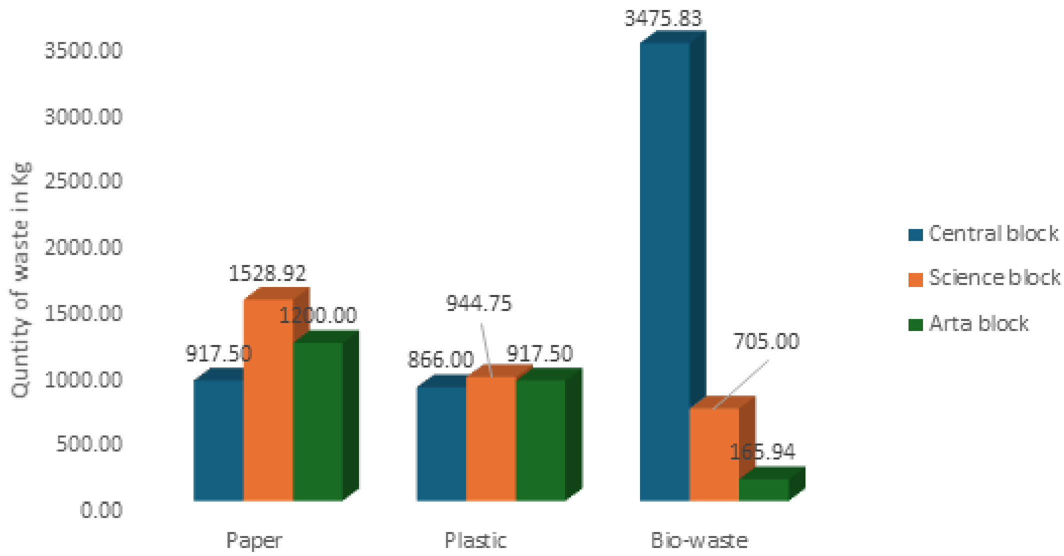

Fig.7.12 Waste streams generated in the three hostels (in Kg)

In the Central Block, the generation of bio waste is significantly higher than in the Science Block. This discrepancy is influenced by the student population and their waste management habits, notably their food preparation practices. The Science and Arts Block hostel is equipped with a biogas plant with a capacity of 5,000 litres, although it is currently undergoing maintenance in the Science Block According to the hostel warden, the plant processes over 15 kg of waste daily, with amounts fluctuating based on daily submissions. The bio-mass generated is utilized as fuel for cooking, while the resulting manure is employed for gardening purposes.

To enhance waste management, a comprehensive plan will be implemented to maintain a register documenting the amount of waste deposited in the plant. This data will be recorded by designated hostel members and housekeeping staff, who will also report waste disposal to the local authorities (Kochin cooperation). It is important to note that there is no biogas plant in the Central Block, meaning that waste is directly sent to the Kochi Corporation instead. Additionally, paper waste is more prevalent in the Science Block than in the Arts Block, largely due to the higher academic activity levels of science students, which include projects and exhibitions. The Science Block demonstrates a notably high volume of plastic waste, closely followed by the Arts and Central Blocks, reflecting the consumption patterns of both students and staff residing in the hostel. The precise quantities of other waste types and e-waste are challenging to ascertain, as these materials are mixed with general college waste before being processed by an external agency. Waste management will implement a registry to record the waste generated in each hostel separately. Harith Karma Sena is tasked with the collection of plastic waste, while paper, general waste, and e-waste are managed by designated waste management agencies. Furthermore, construction waste is repurposed for landfilling activities.. Despite the college's commitment to reducing plastic use, the demand for plastic products remains significant, particularly among college students, who favour convenience and affordability in their purchasing decisions.

7.4.1.7.Total waste generation trends in college

Type of waste	Total quantity of waste in (kg)	Per capita waste generation per year (Kg.)
Paper	36565.91	9.04
Plastic	34144.02	8.44
Bio-waste	8953.44	2.21
Other waste	25.00	0.01
Chemical waste (solid)	95.7	0.02
Chemical waste (Solvent)	334 ml	0.08 ml
E -waste	3.5 Kg.	0.0009 Kg

Table No. 7.21. Total quantity of wastes generated in the college.

The most significant waste streams are paper (36565.91), followed by plastic, biowaste, e-waste, and other waste. Paper waste is the result of commercial purchases, stationery products, and paper booklets for educational purposes. All this paper waste is not put for burning, instead segregated into respective containers and handed over to W Kerala waste management college, which has signed an MoU with the respective institution for the annual collection of Paper waste, other waste, and e-waste. The second contributing factor is plastic. The minimal trends observed may be attributed to the volunteer initiative of Bumithra Sena, which aims to reduce the use of single-use plastics and impose penalties on departments that continue to use them. This initiative includes promoting cloth carry bags and encouraging the reuse of materials. Furthermore, the college is actively working to minimize plastic waste by introducing alternative products, such as distributing stainless steel bottles to faculty members and encouraging students to purchase cloth bags at reasonable prices. A relatively smaller quantity of bio-waste, but it had a significant portion that depended on the inmate's strength. Additionally, college functions in two shifts: the first session from 8 AM to 1 PM, and the next session from 2 PM to 6 PM. Possibility of having lunch for students but teaching and non-teaching staff to be their full-time time, all this attributed to a lower quantity. For other small quantities, the data were generated from the personal interview with the college authority and housekeeping staff. Food waste in college is collected by Kochin Cooperation's food waste collector regularly. Hostel waste of up to 15kg is filled in the biogas plant. In the case of other waste, the data is shared by the college authorities and housekeeping staff; however, there is no record to estimate the quantity of waste per year. Construction waste is used for land filling, and scrap dealers collect the remaining material

Chemical usage quantities were determined for each laboratory through personal interviews with the respective lab in-charges. The chemistry lab generates approximately 2 kg of powder and 2 L of solvent per week, which amounts to roughly 84 kg of powder and 84 L of solvent annually. The botany lab uses 10 g of powder and 250 mL of solvent per week, leading to an annual total of 0.42 kg. Meanwhile, the zoology lab generates less than 0.005 kg of powder per week, or about 0.21 kg per year. The food technology lab generates less than 0.025 kg per week, totaling around 1.05 kg annually. The home science lab produced around 0.1 kg, which amounts to approximately 4.2 kg each year.

7.4.2. Chemistry lab

Chemical waste from practical sessions and experiments is the major waste generated from the lab. As current waste management practices, the department actively minimises waste generation using a method called Microscale Analysis, where experiments are conducted using minimal quantities of chemicals. This significantly reduces hazardous waste output and ensures a safer lab environment.

The department has signed a Memorandum of Understanding (MoU) with the Science Centre, Kodungallur. With this collaboration, a system is being developed wherein chemical waste is converted into solid form through controlled heating. The system uses thermal treatment such as pyrolysis, gasification, or low-temperature calcination to convert chemical waste into a stable, solid form. This process can immobilize hazardous constituents and reduce the volume of waste. The solidified waste is then disposed of following proper environmental and safety guidelines. The department shows commendable initiative in adopting innovative waste management techniques. Collaboration with external agencies is a progressive step toward sustainable waste treatment.

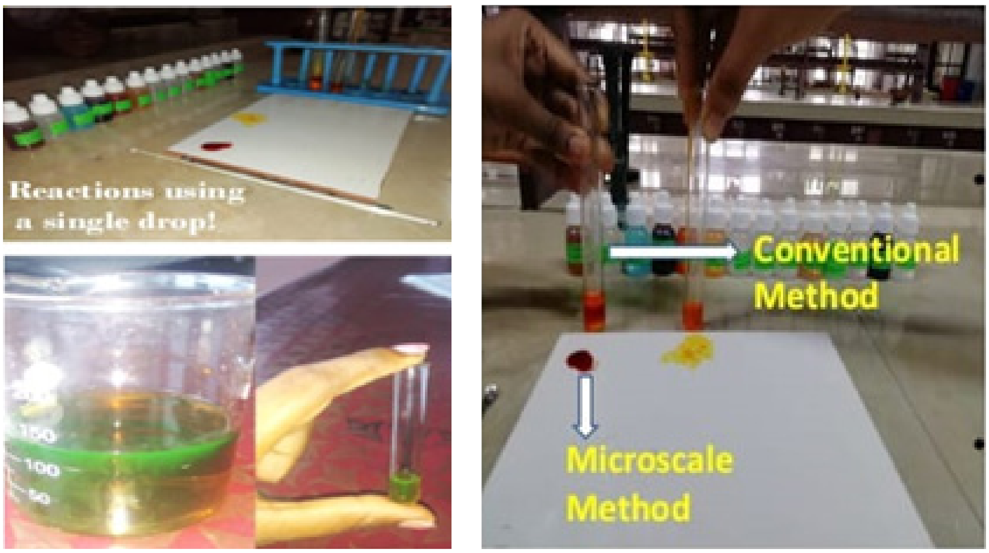

Fig.No.7.13.Microscale method adapted for chemical usage in labs

7.4.3. Botany lab

Minor chemical waste from botanical experiments. Use of synthetic dyes in botanical sample preparations is the major waste generated from the lab. In current waste management practices, the department has made conscious efforts to substitute synthetic dyes with natural dyes, thus minimising chemical waste. Preference is given to biodegradable and non-toxic materials during practical sessions. Biodegradable materials are collected alongside bio waste; however, there is currently no record in place to quantify the amount generated. A strong inclination toward green chemistry practices is evident. The substitution of harmful chemicals with natural alternatives significantly enhances environmental responsibility.

Fig.No.7.14. Using natural dyes in Botany Lab

7.4.4. Zoology lab

Biological waste (animal tissue, samples, etc.), Minor microbiological waste are the major waste generated from the lab. In current waste management practices, biological waste is disposed of through the common waste disposal system of the college (Bio waste). Quantified data is absent to substantiate. Microorganisms are decontaminated before disposal, ensuring biohazard safety. Very minimal chemical waste is generated in the Zoology lab.

7.4.5. Food technology lab

The primary waste generated in the laboratory consists of organic and food waste during lab sessions and practical activities. Currently, the volume of chemical waste produced is minimal, and disposal is managed through the college's centralized disposal system. However, despite this low volume, the department would benefit from establishing protocols for the segregation and documentation of chemical waste.

7.4.6. Home science – biochemistry lab

Minor chemical waste from the Biochemistry lab. In current waste management practices, the quantity of chemical waste is extremely low. Waste is discarded via the college's centralised disposal system. Although minimal, the department could benefit from implementing protocols for segregation and documentation of chemical waste. The institution demonstrates a growing commitment to sustainable practices in academic departments. The adoption of microscale chemistry, the use of natural substitutes, safe disposal of biological materials, and systematic food waste handling are all commendable steps.

Fig.No.7.15.Waste bins placed in the campus.

7.4.7. Current waste management strategies

Type of waste	Factors Contributing to Waste Growth	Method of treating	Waste Reduction Strategies in Practice
Paper waste	Paper waste is the most dominant type of waste on campus due to several factors. The institution's reliance on a booklet-based examination system generates a large volume of question papers and answer scripts. Moreover, strict regulations against plastic have led to paper being used as a replacement for event and program materials.	The college has implemented a paper waste collection system where labeled bins are placed in various corners. The waste from these bins is collected, segregated, and securely stored in a room until it is transferred to the W Kerala Waste Management annually.	• Digitalize the communication • Promoting virtual courses • Promoting digital library services • Digital platform for the college community to report attendance, college payments, and exam results • Moodle platform for assignment, project notes circulation
Plastic Waste	Plastic is the second largest contributor. The institution has the possibility of purchasing and procurement of daily items, such as stationery materials, equipment, and infrastructure maintenance	Plastic is collected monthly by Haritha Karama Sena	• Bumithra Sena is responsible for maintaining the Green Protocol. • As a part of the green protocol, control the use of plastic, and ban single-use plastic in the department, classroom, canteen, and cafeteria.
Bio-waste	Bio-waste is the third contributor, a comparatively minimal amount of waste, corresponding to the strength of the college community	Bio-waste is segregated and collected by Hari Karam Sena daily	• The college flow shift system first session from forenoon to noon, the second session from the afternoon to the evening, so there is no specific lunch break. The chance of taking lunch is limited among students
Other waste (steel, mat, infrastructure, and construction waste	Other waste was also generated in a limited quantity, depending on the college's requirements	Construction waste is reused for landfilling, and the remaining waste is collected by scrap dealers	

E-waste	The institution follows two distinct procedures for e-waste management. E-waste from students is collected and transferred to scrap dealers, whereas departmental e-waste is stored on-site. The college's electronic equipment, which was primarily purchased with government funds, must be retained for auditing and cannot be removed.	E-waste collected from students is handed over to scrap dealers	
Chemical waste		The department is currently implementing waste management practices that focus on reducing waste production through a technique known as Microscale Analysis, which involves carrying out experiments with very small amounts of chemicals. In partnership with others, a system is being created to transform chemical waste into solid form using a controlled heating process.	• Microscale analysis • Encourage the use of natural dye • The system employs thermal methods like pyrolysis, gasification, or low-temperature calcination to transform chemical waste into a stable, solid state. This procedure can trap hazardous components and diminish the overall waste volume.

Table No. 7.22.Waste management strategies in College.

The institution successfully manages various waste streams, with paper waste constituting the most significant share, followed closely by plastic. The effective segregation and disposal practices for paper waste, including collaboration with scrap dealers, reflect a commitment to recycling and reducing environmental impact.

The proactive measures taken by the Bumithra Sena concentrate more on reducing rather than upcycling initiatives to minimize the use of single-use plastics, coupled with the promotion of alternative materials, have had a noticeable effect on the reduction of plastic waste. However, continued vigilance is necessary to maintain these efforts and further decrease plastic reliance across all departments.

The study indicates a decrease in the amount of bio-waste, as reported by the housekeeping staff. This decline in food waste is attributed to the implementation of a new shift system, which runs from 8:00 AM to 12:45 PM and 1:00 PM to 6:00 PM, making it impractical to provide lunch during these hours. However, accurate data regarding the food waste handed over to the Kochi Corporation is currently lacking. According to the hostel warden, approximately 15 kg of food waste generated in the Science Block hostel is directed to a biogas plant. Moving forward, the Waste Management Committee will assign housekeeping staff the responsibility of recording the quantity of waste generated each year in a designated register.

In terms of laboratory waste, the various departments exhibit commendable strategies for minimizing chemical waste, especially in chemistry and botany, with innovative practices like Microscale Analysis and the adoption of natural alternatives to synthetic dyes. However, there is room for improvement in documenting chemical waste across all labs to ensure comprehensive tracking and compliance with environmental safety standards.

The institution exhibits a noteworthy commitment to sustainable waste management practices, with collaborative efforts and innovative strategies leading the way toward minimizing environmental impact. Continued emphasis on education, awareness, and stringent waste management practices will strengthen these initiatives and promote a culture of sustainability within the college community. Regular assessments and improvements based on recorded data will further enhance the effectiveness of these practices in reducing waste and ensuring environmental stewardship.

7.5. CONCLUSION

- The institution demonstrates a commendable commitment to sustainable waste management, achieving notable success in addressing its primary waste streams, paper and plastic, through effective recycling programs and proactive reduction initiatives. These efforts include strategies to reduce and upcycle plastic products, as well as the initial stages of binding wastepaper, which have recently been implemented by the college's stationery management. Additionally, the institution is promoting the use of steel alternatives to plastic by encouraging students to bring their own utensils for meals and beverages outside the campus. The college has also developed a model for participation in state and national exhibitions and is fostering community engagement through the initiative "STEP" (Society for Teresian Environment Protection) as part of the Bhomithra Sena's volunteer action.
- Innovative strategies have been introduced to minimise hazardous waste in laboratories by employing micro-scale analysis, utilising natural dyes, and collaborating with expert agencies to implement novel approaches such as thermal heating processes. Nevertheless, a key area for improvement lies in the systematic and comprehensive collection of data. Establishing registers to accurately record the quantity of waste generated is essential for effective assessment in hostels and on campus. While there are positive trends, such as a reduction in bio-waste, the absence of formal quantitative records for both bio-waste and chemical disposal limits the ability to fully evaluate the program's impact.
- By prioritising the proposed next steps, namely, the establishment of a formal register for all waste streams and improved documentation, the institution can build on its solid foundation, enhance accountability, and make informed, data-driven decisions to further strengthen its position as a leader in environmental stewardship.

7.6. RECOMMENDATION

The campus has designated a location for the storage of electronic waste; however, due to the absence of a dedicated storage room, e-waste is currently placed within the department. The department and hostel in charge has systematically documented the quantities of e-waste and other waste generated annually, both on campus and in the hostel.

Promptly develop the necessary steps to complete the maintenance of the bio-gas plant in the science block. A register will be maintained to accurately document the quantity of waste generated and utilised by the bio-gas plant, ensuring proper handover to the municipality by both the college and the hostel.

The hostel is encouraged to explore the establishment of a vegetable garden and to ensure its ongoing maintenance in collaboration with the convent.

Enhance the Bhmithre initiative, by proposing implementing comprehensive strategies that go beyond mere reduction and upcycling. This includes establishing a brand and marketing our efforts by collaborating with other organisations to create a lifestyle brand focused on effective waste management strategies.

7.7. WASTE MANAGEMENT PLAN

St. Teresa's College (Autonomous), Ernakulam, has coordinated and established an efficient Waste Management Team. which is responsible for the implementation and oversight of the Water Efficiency Management Policy. This team is responsible for waste management, reducing the environmental footprint of the institution, and ensuring compliance with local and global regulations. This policy serves as a roadmap for reducing waste generation, promoting recycling, and minimizing the institution's overall environmental impact.

7.7.1.Establish an adopt waste management team

- To ensure the effective implementation of its Waste Management Policy, St. Teresa's College has constituted a dedicated Waste Management System Committee (WMS). This committee plays a pivotal role in the planning, execution, and continuous monitoring of all waste-related initiatives across campus.
- The committee includes: Three faculty members, including the Head of the Green Audit Team (EMS), eleven student representatives (Waste Ambassadors) across departments and housekeeping staff are responsible for collection and reporting.
- The designated waste collection partner the 'W kerala Waste Management' ensures compliance with external waste handling protocols and facilitates proper disposal and recycling.
- The WMS meets once a month to review progress, address challenges, and plan upcoming activities.
- Detailed reports are submitted every quarter to the Internal Quality Assurance Cell (IQAC), outlining achievements, metrics, and recommendations for improvement.
- The committee ensures smooth communication and collaboration among all stakeholders which include faculty, students, staff, and external partners to maintain a cohesive and responsive waste management system.

7.7.2.Formulate a comprehensive strategy for sustainable waste management

- The Waste Management Plan articulates a comprehensive strategy centered on source segregation, sustainable processing, collaboration with authorized recycling agencies, and ongoing awareness initiatives.
- Central to this plan are several key strategies which include the implementation of a three-bin system across campus for the segregation of waste into biodegradable, recyclable, and hazardous categories
- Composting unit and bio gasification units are established to effectively process biodegradable waste
- The college collaborate with certified recycling facilities for the responsible handling of paper, plastic, glass, and metals.
- The plan emphasizes the safe handling and disposal of hazardous waste in accordance with government regulations
- Periodic training sessions, workshops, and awareness campaigns aimed at educating both students and staff on sustainable practices.
- Waste management principles are integrated into the academic curriculum to foster long-term behavioural change and environmental literacy.
- Students are encouraged to undertake research projects focused on innovative waste reduction and resource recovery strategies.
- The plan promotes creative approaches such as upcycling, zero-waste events, and circular economy

models to build a culture of sustainability within the college community.

7.7.3.Implement effective methods to attain set objectives

- The Waste Management Committee (WMC) employs a range of practical and actionable strategies.
- A three-bin system is used that feature colour codes and pictorial instructions to facilitate proper waste segregation.
- Trained housekeeping staff conduct daily collections of segregated waste to ensure efficient management.
- To prevent leakage and contamination during transportation, covered vehicles are utilized for waste disposal.
- The campus also supports on-site composting and bio gasification processes for biodegradable waste.
- The WMC has established recycling partnerships with authorised agencies for the responsible processing of paper, plastics, and metals.
- The committee is exploring long-term solutions, such as the implementation of a crushing unit for recyclables and waste-to-energy initiatives

7.7.4.Establish a robust communication channel and governing body

- The governance structure is designed to uphold accountability, transparency, and effective communication within the organisation.
- This system comprises a core leadership team from the Waste Management Committee (WMC), bolstered by departmental coordinators and student ambassadors.
- Regular reporting to the Internal Quality Assurance Cell (IQAC), ensures that feedback is disseminated across all departments.
- Suggestion and grievance mechanisms are facilitated through the use of feedback forms and digital platforms, allowing for constructive input from all stakeholders.
- To raise awareness, the committee conducts informative drives utilising posters, digital signage, and targeted communication within class groups.
- The committee collaborates actively with student clubs such as NSS, NCC, Bhoomithra Sena, and STEP to enhance the reach and impact of sustainability campaigns.

7.7.5.Set both long-term and short-term goals

7.7.5.1.Short-Term Goals:

- Monthly monitoring of waste collection and segregation efficiency.
- Quarterly awareness and sensitisation workshops
- Enhance the Bhumithre Sena initiative by integrating comprehensive audit practices and aligning it with the Sustainable Development Goals (SDGs) to foster resource conservation, maximise optimal utilisation, and contribute to the development of sustainable, clean communities.
- Quarterly reports on waste reduction progress shared with IQAC.
- Ensure proper segregation at the disposal point by utilising clearly labelled and colour-coded bins.
- Designate a storeroom for the storage of various waste materials, including general waste and electronic waste.
- Transforming college into a green campus by practice green protocol

7.7.5.2.Long-Term Goals:

- Establish a permanent crushing unit for recyclables within the campus.
- Scale up composting and bio-methanation units.
- Introduce waste-to-energy initiatives where feasible.

- Achieve zero waste to landfill status.
- Develop research projects and student innovations on sustainable waste management.

7.7.6. Continuously monitor and enhance the system

- The Waste Management Committee (WMC) employs a systematic monitoring framework to ensure compliance and drive continuous improvement.
- Comprehensive checklist-based audits are conducted every six months to evaluate segregation and disposal practices.
- The committee maintains meticulous records of the quantities of waste collected, recycled, and disposed of, thereby facilitating transparency and accountability.
- Penalties are imposed for non-compliance with established waste management regulations to reinforce the importance of adherence.
- To gather insights and recommendations, the WMIC collects feedback quarterly from committee members and staff.
- Regular review meetings are held with the Internal Quality Assurance Cell (IQAC) to discuss findings and implement necessary corrective measures.

7.7.7.Conclude and conduct follow-up on the system

- The Waste Management Plan is structured as a dynamic and adaptive framework, ensuring its relevance in an ever-changing landscape.
- The Waste Management Implementation Committee (WMIC) undertakes annual reviews of the policy to incorporate feedback, emerging technologies, and updated regulations.
- To align with our green protocols, we are working to discourage the use of single-use plastics. As an initial step, we have distributed reusable steel bottles to faculty members, with plans to extend this initiative to students in collaboration with other funding agencies.
- The college has partnered with Kudumbashree (80) and Suchitwa Mission to conduct training sessions in nearby villages. This initiative has expanded to various areas within the district, allowing for the division of regions into clusters and enabling the accommodation of one village each year.
- Key follow-up measures include the publication of an annual report that highlights achievements, challenges, and future strategies
- Sensitisation programs and awareness campaigns are conducted regularly to maintain engagement and promote sustainable practices among students and staff.
- The committee collaborates with external organisations such as Suchitwa Mission and Kudumbashree to enhance community outreach
- Student-led innovations are integrated into campus-wide waste management practices to encourage creativity and ownership.

The Waste Management Policy is periodically revised to ensure it remains responsive and prepared for future sustainability challenges.

7.8.ACTIVITIES CONDUCTED

Garbage Cleanup Campaign

On 10th July 2023, the Department of Physics at St. Teresa's College, in collaboration with I-CONNECT (Initiatives for the Conservation of Nature and Energy Coordinated by Teresians), organized a Waste Management Awareness Program at the Arts Block of the college. The event, attended by 95 internal student participants, aimed to educate students on vermicomposting and vector-borne diseases as part of a broader capability enhancement initiative. The program featured a mime and a flash mob performed by Physics students, effectively capturing attention and conveying key messages on proper waste disposal. Additionally, students showcased posters and placards with impactful illustrations and slogans promoting responsible waste management practices. The event successfully combined education and creative expression to foster environmental awareness among the campus community.

7.10.SUMMARY

- The primary waste streams identified are as follows: Paper (32,617.32 kg), Plastic (31,415.69 kg), Bio-waste (4,606.68 kg), Other waste (25.00 kg), Chemical waste (solid) (95.7 kg), Chemical waste (solvent) (334 ml), and E-waste (3.5 kg). Additionally, the college hostel is equipped with a biogas plant that has a capacity of 5,000 litres, along with a dedicated waste management system overseen by Bhumithra Sena.
- The college implements effective waste management practices through the initiatives of Bhumithra Sena, emphasising the principle of minimising waste generation on campus while adhering to green protocols.

Fig.No.7.16.Ecoproducts exhibition by Bhumithrasena

Chapter VIII

OCCUPATIONAL HEALTH & SAFETY MANAGEMENT SYSTEM (OHS) : AUDIT REPORT

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ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925

OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM COMMITTEE (2025)

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Sr. Jane CSST
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(Students)

8 Occupational Health & Safety Management System Audit Report

8.1 INTRODUCTION

A review of Occupational Health and Safety (OHS) practices was carried out at St Tersa's college, Ernakulam, aimed at evaluating the institution's adherence to established safety standards and pinpointing possible hazards within the campus setting. The audit, conducted based on ISO 45001 guidelines, concentrated on assessing infrastructure, readiness for emergencies, management of chemicals, waste disposal, and the general awareness of safety measures among both staff and students. This report outlines the primary findings, observations, and recommendations designed to improve the safety and health of all individuals on campus.

ISO 45001 acts as the international standard for Occupational Health and Safety (OH&S) management systems. It emphasizes risk prevention, encourages creativity, and fosters continuous improvement, thus providing organizations with a framework to boost their resilience and operational efficiency. Achieving this global standard not only enhances an organization's ability to effectively manage OH&S but also promotes greater engagement among students, faculty, and staff by visibly demonstrating a pledge to sustainable practices aimed at creating a secure and healthy environment. Furthermore, conducting health and safety audits helps institutions assess the effectiveness of their internal safety protocols, providing a thorough understanding of their internal controls. These audits allow for the early detection of risks, enabling the swift implementation of corrective measures to mitigate hazards, which subsequently decreases the likelihood of accidents and unforeseen incidents. This proactive approach reduces potential disruptions, enhances the motivation of stakeholders, and strengthens the institution's reputation while protecting it from negative publicity that could impact its operations or collaborations.

ISO 45001 aligns an organization's occupational health and safety management systems with its strategic objectives, improving performance in occupational health and safety while demonstrating a strong commitment to employee welfare to customers, investors, and stakeholders. Moreover, its connection to the United Nations Sustainable Development Goals (SDGs) further highlights its importance. By adopting ISO 45001, organizations can exhibit their leadership in sustainable development and their unwavering commitment to protecting and valuing their workforce.

8.1.1 What is health and safety audit?

A health and safety audit involve assessing an organization's systems, procedures, and policies related to the health and safety of both students and staff to confirm compliance with existing regulations. The purpose of the audit is to identify possible health or safety hazards, evaluate the effectiveness of internal controls for managing risks, and ensure adherence to regulatory standards.

8.1.2 Need of occupational health and safety audit

Recognizing flaws and shortcomings in an organization's safety protocols, assessing adherence to regulatory laws, and suggesting enhancements to protect the health and safety of its employees. Furthermore, confirming that machinery, equipment, and facilities comply with safety standards through comprehensive inspections.

8.2 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM POLICY

8.2.1 Statement of commitment:

St. Teresa's College (Autonomous), Ernakulam, is committed to providing a safe and healthy environment for all faculty, staff, students, and visitors. This Occupational Health and Safety (OHS) Policy is established in accordance with ISO 45001:2018 (Occupational Health & Safety Management System), the International Labour Organization (ILO) Guidelines on Occupational Safety and Health, and the University Grants Commission (UGC) regulations on campus safety. This policy aims to promote a culture of safety, ensure compliance with national and international regulations, and mitigate risks associated with occupational hazards in an educational setting.

8.2.2 Goal

To establish and maintain a safe, healthy, and resilient campus environment by ensuring adherence to statutory safety regulations, proactively identifying and mitigating risks, fostering a culture of safety awareness, and equipping students and staff with the knowledge and resources necessary for effective health and safety practices, including disaster management and response.

8.2.3 Objectives

- To establish a proactive approach to occupational health and safety in alignment with international standards.
- To prevent injuries, illnesses, and accidents by identifying and mitigating hazards.
- To ensure compliance with legal and regulatory OHS requirements applicable to higher education institutions.
- To develop a culture of health and safety through awareness, training, and active participation.
- To integrate health and safety measures into all academic, research, and administrative activities.

8.2.4 Responsibilities and governance

8.2.4.1.The College Management:

The College Management, comprising the Principal and Governing Council, is committed to implementing and maintaining the health and safety policy across all departments. Regular safety drills, and first aid response protocols are disseminated to students and staff through WhatsApp groups and official announcements.

8.2.4.1.1. Provision of Training and Resources: St. Teresa's College conducts CPR training, fire safety training, and disaster preparedness workshops for students, faculty, and non-teaching staff. The institution also ensures that adequate safety equipment and learning materials are available to promote awareness and readiness in emergency situations.

8.2.4.1. 2. Wellbeing and Holistic Development Programs: The college promotes physical and mental wellness through regular yoga sessions, stress management workshops, and access to professional counselling services. Student wellness is a priority, with structured interventions planned throughout the academic year to address psychological and emotional health.

8.2.4.1. 3. Support Systems and Committees for Student Welfare: The College has instituted a range of dedicated cells and committees including:

✓ Women Cell for gender equity and empowerment initiatives

- ✓ Anti-Ragging Cell to ensure a safe and respectful campus environment
- ✓ Mentoring Cell to offer academic and personal guidance
- ✓ Counselling Cell to render services to those who need.
- ✓ Grievance Redressal Cell for addressing students and faculties concerns sensitively and promptly

8.2.4.1.4. Accessibility and Inclusive Infrastructure: The management ensures the campus is accessible for all, with ramps equipped with handrails and non-slip surfaces, prioritizing the needs of students and staff with disabilities. Classrooms, pathways, and restrooms are regularly reviewed for compliance with accessibility norms.

8.2.4.1.5. Periodic Review and Legislative Compliance: The health and safety policies are periodically reviewed and revised in accordance with evolving institutional needs and changes in government regulations. The College Management actively monitors compliance with all applicable legal and safety standards, ensuring a secure and accountable learning environment.

8.2.4.1.6. Oversight of Institutional Safety Protocols: The IQAC and Occupational Health and Safety Committee work collaboratively to enforce and monitor all safety protocols within the college. This includes ensuring availability of first aid kits, fire extinguishers, and emergency signage in all departments, and coordinating safety drills and mock evacuation exercises in collaboration with the local fire department and disaster response agencies.

8.2.4.1.7.Periodic Risk Assessments: The committee is responsible for conducting scheduled risk assessments across departments (laboratories, library, canteen, restrooms, classrooms, hostels, and administrative blocks) to identify potential hazards.

8.2.4.1.8. Training and Capacity Building: To build a culture of safety, the committee conducts awareness campaigns, orientation sessions, and skill-based training such as: Workshops on first aid, CPR, and basic fire safety, informational drives on topics like chemical safety, e-waste disposal, and health hygiene, and distribution of educational material through college WhatsApp groups, email circulars, and campus announcements.

8.2.4.1.9.Incident Monitoring and Response: Committee is responsible for establishing a centralized incident reporting system to log accidents, or safety violations, facilitate immediate emergency response coordination—such as during medical crises or fire outbreaks—and ensure thorough documentation of incident investigations and corrective actions taken.

8.2.4.1.10.Communication: Committee must ensure safety updates, alerts, training notifications, and emergency instructions are circulated through institutional WhatsApp groups, emails, announcements, and display boards. Important safety instructions, event updates, and emergency notices shall be promptly shared via the official college WhatsApp groups. The Heads of Departments and Class Teachers will share official OHS-related messages in respective class and departmental WhatsApp groups, including those with students and parents. This ensures that all stakeholders—students, faculty, staff, and visitors—are well-informed and aware of safety procedures and expectations.

8.2.4.1.11.Monitor Student and Staff Wellbeing through Structured Support Systems: In alignment with its preventive and promotive responsibilities, the committee collaborates with IQAC to implement wellbeing initiatives, including, Health check-ups, yoga sessions, and mental health support services, Referrals to counselling support in coordination with the Counselling Centre and Feedback collection through student and faculty satisfaction surveys related to campus safety and wellbeing.

8.2.4.1.12. Documentation and Reporting: Detailed documentation of all safety-related activities—including training records, audit findings, risk assessment reports, and incident logs—must be maintained by the committees. All departments and designated areas (labs, infirmary, hostel, canteen, etc.) shall maintain updated registers such as the First Aid Register, Medical Records Register, Lab Equipment Register, and Risk Assessment Logbooks. To ensure accuracy and accountability, Occupational Health and Safety Committee members shall review these registers every two months. The inspection will focus on verifying entries, identifying gaps in record-keeping, and ensuring that action items from previous inspections have been addressed. All reports of health and safety activities conducted by the departments and the

OHS Committee — including training sessions, awareness campaigns, safety audits, and risk mitigation efforts — shall be submitted to the Internal Quality Assurance Cell (IQAC) at the end of every semester.

8.2.4.2. The Faculty & Staff:

- Adhere to all institutional health and safety procedures, including those communicated via official channels such as circulars, WhatsApp groups, or email notifications.
- Promptly report any hazards, incidents, or unsafe conditions the Occupational Health and Safety Committee, through the official WhatsApp group.
- Actively participate in safety training programs such as fire safety drills, first aid workshops, and disaster preparedness sessions organized by the college.
- Utilize personal protective equipment (PPE) such as lab coats, gloves, or face shields when required, particularly in laboratories and fieldwork settings.
- Ensure safety practices are maintained in classrooms, labs, offices, and shared spaces, and assist in guiding students during emergency drills or safety procedures.

8.2.4.3. The Students & Visitors:

- Comply with all campus safety guidelines, especially during practical sessions in science laboratories, field visits, or co-curricular activities.
- Participate in college-organized safety initiatives, including fire drills, first aid training, and sessions on lab safety and responsible equipment handling.
- Report any hazards, unsafe conditions, or injuries to faculty members, class mentors, or designated safety officers without delay.
- Respect signage, evacuation routes, and safety protocols displayed in laboratories, hostels, and common areas.
- Actively engage in health and wellness programs, including counselling services, yoga, and awareness campaigns coordinated by the Occupational Health and Safety Committee.

8.2.5 Risk management

- Conduct periodic and department-specific risk assessments to identify potential hazards in science laboratories, kitchens, hostels, construction zones, and electrical systems. Maintenance registers are updated regularly, and routine checks are carried out on lab equipment, plug points, power cables, and high-use appliances.
- Ensure that indoor environments such as classrooms, offices, and food preparation areas are well-ventilated, adequately lit, and maintain appropriate temperature and humidity. Cleanliness, sufficient space, and hygiene standards are maintained to support a safe academic and working environment.
- Doors, windows, and glass panels are clearly marked with visibility stickers and constructed using safe, durable materials to prevent accidental injuries.
- Implement effective control measures to mitigate identified risks. Each department is equipped with a prominently placed, well-stocked first aid kit, and responsible staff are trained to respond during emergencies.
- Maintain comprehensive documentation of risk assessments and corresponding safety measures. Clear signage and warning labels are placed near hazardous machines, electrical units, and chemical storage areas to caution users. Students are instructed in the safe handling of laboratory equipment and encouraged to use personal protective equipment (PPE) like gloves, lab coats, and goggles during experiments.
- Maintain floors, corridors, and staircases to prevent slips and falls. Regular inspections are done to check for water leaks, uneven surfaces, and structural weaknesses. Stairwells and balconies are fitted with sturdy railings, and extra safeguards are installed in areas accessed by younger students.
- Ensure that all emergency protocols—such as fire evacuation procedures and medical response guidelines—are visibly displayed and communicated regularly through student orientations, announcements, and safety drills organized by the OHS Committee.

8.2.6 Awarness and educating

8.2.6.1. Mandatory Occupational Health and Safety (OHS) Training: To ensure a safe and informed campus environment, mandatory OHS training shall be provided to all faculty, non-teaching staff, and students at the beginning of each academic year or during orientation. This includes first aid response training, fire evacuation procedures, and safe handling of laboratory chemicals and electrical equipment. Training modules are tailored to specific roles and are delivered through in-person sessions, demonstrations, and e-learning formats, with attendance tracked by the Occupational Health and Safety Committee.

8.2.6.2. Specialized Workplace Safety Training: For high-risk or technical roles, specialized safety training shall be conducted regularly:

- Laboratory personnel shall receive advanced instruction on the safe usage, storage, and disposal of hazardous chemicals, along with chemical spill protocols and use of safety equipment like fume hoods and emergency showers.
- Maintenance staff shall be trained on electrical safety, ladder usage, equipment operation, and confined space entry procedures.
- Security personnel shall undergo crisis response training, including fire response, handling medical emergencies, crowd control, and ensuring perimeter safety.

These sessions shall be delivered in collaboration with industry professionals and certified safety trainers.

8.2.6.6. Mental Health, Ergonomics & Wellness Awareness: The college recognizes that a safe environment includes emotional and physical well-being. As part of the capacity building framework, regular awareness campaigns will be organized on:

- Mental health literacy, including signs of stress, anxiety, and depression, and how to seek support.
- Stress management techniques, such as time management, relaxation exercises, and healthy lifestyle habits.
- Workplace ergonomics, addressing posture correction, optimal workstation setup, and prevention of repetitive strain injuries.

These programs are facilitated by the Counseling Cell, Women's Cell, and external wellness experts, ensuring inclusive and proactive care for all campus stakeholders.

8.2.6.7. Evaluation & Continuous Improvement: Feedback from training sessions is collected and reviewed periodically by the IQAC and OHS Committee to assess effectiveness and update content. Certificates of participation are issued where applicable, and refresher courses are scheduled annually or in response to new policy mandates.

8.2.6.8. Environmental Initiatives: To address environmental health concerns such as noise and air pollution, the committee observes a "No Vehicle Day" on the first Wednesday of every month, encouraging staff and students to avoid using motor vehicles on campus. This initiative promotes eco-friendly practices, reduces vehicular noise, and fosters awareness about sustainable living among the campus community.

8.2.7 Health and wellbeing

8.2.7.1. Compliance with Standards and Regulations: St. Teresa's College is committed to adhering to the guidelines of ISO 45001:2018 – Occupational Health and Safety Management Systems along with relevant Indian occupational safety laws and regulatory frameworks. This ensures a structured and proactive approach to minimizing workplace risks, enhancing well-being, and fostering a safety-conscious culture across the institution.

8.2.7.2. Fire Safety and Emergency Preparedness: Fire safety systems, including fire extinguishers, alarms, and clearly marked fire exits, are installed and routinely inspected across all academic blocks, hostels, and administrative offices. Fire drills are conducted periodically in coordination with local fire authorities to educate and prepare students, faculty, and staff for emergency response.

8.2.7.3. Health and Hygiene: The college ensures the provision of clean drinking water, functional washrooms, and sanitary disposal units across campus. Housekeeping staff are assigned regular schedules to monitor cleanliness, while bio-waste and chemical waste (from laboratories) are disposed of following environmentally safe and government-approved protocols. Handwashing stations and menstrual hygiene products are made readily accessible in female restrooms.

8.2.7.4. Laboratory and Workshop Safety: Science laboratories and skill-based learning spaces like kitchens are equipped with necessary Personal Protective Equipment (PPE) like gloves, aprons, and lab coats. Students and staff are instructed to strictly follow safety protocols during practical sessions. Standard Operating Procedures (SOPs) and cautionary signage are displayed in labs. Emergency eyewash stations and first-aid kits are installed in each lab.

8.2.7.5. Mental Health and Well-being: Recognizing the psychological challenges faced by students and staff, the college offers free counselling services through a professionally staffed Counselling Cell. Yoga, mindfulness sessions, and life skills workshops are conducted regularly to promote mental wellness. Confidential access to counsellors is available both in-person and online, with referrals made for those needing specialized support.

8.2.7.6. Hostel and Campus Security: The college ensures the safety of resident students by maintaining 24/7 security patrols, CCTV surveillance, and restricted access gates in hostel premises. Identity verification at campus entry points is mandatory for visitors. Emergency helpdesks are functional during night shifts, and wardens are trained in safety response protocols. Awareness sessions on personal safety, cyber safety, and community vigilance are conducted periodically.

8.2.8 Accident and incident management

8.2.8.1. Confidential Incident Reporting System: St. Teresa's College shall establish a centralized and confidential reporting mechanism for all workplace injuries, accidents, near misses, and potential hazards. This may include physical report forms available in each department and a dedicated digital platform accessible via college email. Clear guidelines will be shared with all stakeholders to encourage timely and transparent reporting without fear of reprisal.

8.2.7.2. Incident Investigation and Corrective Action: All reported incidents shall be documented and investigated thoroughly by the Occupational Health and Safety (OHS) Committee in coordination with relevant department heads. The investigation process will focus on identifying root causes rather than assigning blame. Corrective and preventive actions will be implemented promptly to address identified risks, and follow-up reviews will ensure the effectiveness of these measures.

8.2.9 Emergency procedure

An Incident Response Team (IRT) comprising trained faculty, administrative staff, and student representatives shall be constituted. This team will be responsible for:

8.2.9.1 Incident Response Team (IRT) and Emergency Preparedness: Immediate coordination and response during emergencies such as fire outbreaks, medical emergencies, chemical spills, or building hazards.

8.2.9.2. Emergency Management and Response Framework: To ensure comprehensive emergency preparedness, will maintain readily accessible first-aid kits in each department. A register is utilized and regularly monitored to track and manage the expiry dates of all supplies. A designated Healthcare Assistant is available to administer basic first aid. Furthermore, selected students receive fire extinguisher training in collaboration with the Kerala Fire Force team. Emergency contact directories and evacuation maps are prominently displayed on notice boards

8.2.9.3. Campus Safety: Incident Response and Emergency Protocols: Conducting mock drills and simulations periodically under physical education department to ensure preparedness across departments.

8.2.9.4 Incident Response and Emergency Support Systems: On-call medical support is available for students. In instances requiring further medical attention, students are transferred to a nearby general hospital, accompanied by the class prefect or the teacher in charge. Parents/guardians are then promptly notified and will oversee subsequent medical procedures at the hospital, with the class teacher present for support

8.2.10 Monitoring, review

8.2.10.1. Periodic OHS Audits and Safety Inspections: The IQAC in collaboration with the OHS Committee shall schedule regular internal audits and inspections to assess compliance with established safety protocols across classrooms, laboratories, kitchens, hostels, and office spaces. These inspections will include checks for electrical safety, structural hazards, cleanliness, ventilation, and usage of safety equipment.

- Annual Policy Review and Updates: The college's OHS Policy shall be reviewed annually to incorporate updates based on:
- New or emerging risks (e.g., changes in laboratory equipment, construction activity).
- Evolving government regulations and safety standards (including ISO 45001:2018 compliance).
- Insights from previous incident reports and post-audit findings. Revisions shall be communicated to all stakeholders through email circulars, notice boards, and departmental meetings.

8.2.11 Communication

Ensuring Comprehensive Safety Communication: Actively utilize multiple communication platforms, such as company-wide announcements, WhatsApp groups, email, and official notice boards, for the timely sharing of safety information and to encourage robust, transparent dialogue on safety matters.

8.2.12 Compliance & review

8.2.12.1. Stakeholder Engagement & Continuous Improvement : St. Teresa's College recognizes the value of stakeholder participation in improving safety. Structured feedback mechanisms such as surveys, suggestion boxes, and open forums will be implemented to gather inputs from faculty, students, and staff. Feedback will be discussed in IQAC-OHS joint meetings and considered for strategic improvements to infrastructure, training, and policy.

8.2.12.2. Policy Communication & Onboarding: This policy will be disseminated to all stakeholders. It shall be included in the induction program for new faculty, staff, and students, and further communicated via established departmental messaging platforms or relevant internal communication systems

8.2.12.3. Accountability & Enforcement: Violations of this policy may lead to disciplinary action, in accordance with institutional regulations; the ultimate decision will be handled by the College Council

8.2.12.4. Oversight & Responsibility : The IQAC & OHS Committee shall be responsible for the effective implementation and review of this policy.

8.3 METHODOLOGY

The OHS Management Committee acts as the internal audit team consists of three faculties and fourteen students, including three faculty members and forty student representatives. A thorough register and documentation system has been implemented to enable regular assessment and monitoring of safety practices for staff, students, and visitors to the campus. This system comprises two registers and four key documents. It functions by the institution's OHS policy, which outlines specific goals, action plans, and strategies for safety management. The committee convenes regularly to review progress and verify the effectiveness of these safety initiatives.

8.3.1 Internal audit training

Green audit training fosters institutional commitment and involvement through extensive, collaborative methods. In preparation for this, the college's Environmental Management System (EMS) identifies students and faculty members to participate in a one-day internal audit program. This program certifies them as internal auditors capable of performing an Occupational Health and Safety audit, which includes evaluating, analysing risks, collecting data, developing policies, and document.

8.3.2 List of register and document to monitor OHS

A review was conducted to evaluate the organisation's Occupational Health and Safety (OHS) framework, covering policies, procedures, and records of compliance. This evaluation involved examining: (1) safety protocols, (2) methods of communication, (3) plans for emergency response, and (4) reports of incidents. Various potential hazards were pinpointed across different campus locations, specifically: practices for storing chemicals in laboratories, physical dangers in workshops/laboratories and general activity spaces; issues related to food safety, sanitation, and hygiene; management of vehicle traffic and pedestrian movement on and around the campus; and ergonomic issues in campus settings.

8.3.3 Respondent's comments and observation

The Internal Audit team performed thorough examinations of campus facilities to evaluate safety practices, maintenance status, and adherence to safety regulations. At the same time, the team interacted with staff, faculty, and students to collect their insights on health and safety experiences and perceptions. The audit also involved an in-depth analysis of current risk control measures, assessing their effectiveness in addressing identified hazards, as well as an evaluation of the documentation concerning health and safety training procedures for both staff and students.

8.3.4 Campus Noise & Tree Mitigation Study

The assessment measures fluctuations in noise levels across the college campus employing a systematic sampling approach. Sound levels were recorded at ten chosen sites, which included noisy zones near roadways and spaces next to prominent trees, utilizing a portable digital sound level meter. The data is captured in Decibels (dB). Noise levels will be recorded in sets of three (covering minimum and maximum readings) during the morning, midday, and evening. The main goal is to pinpoint areas with high noise levels on campus and analyse the findings to determine the effectiveness of urban trees in reducing noise.

8.3.5 External Audit

An external auditor assesses compliance with Occupational Health and Safety management standards. If only minor discrepancies are identified, the organization may receive approval for ISO certification.

8.3.6 Assumption

Establishing strong occupational health and safety (OHS) protocols is vital for the long-term success and reputation of educational institutions. The overall well-being—both physical and mental—of staff and students is closely tied to the performance of the institution, both now and in the future. Implementing a structured OHS management system, especially one accredited to the ISO 45001 standard, offers a basis for cultivating safe, engaging, and efficient environments.

Such systems actively work to reduce risks, with the goal of preventing injuries and health issues among all personnel and students. This dedication results in a range of benefits: a clearly safe learning atmosphere, guaranteed compliance with local and national laws as well as specific regulations of the sector, diminished institutional liability and legal risks, increased operational effectiveness, and an improved public image as a responsible and sustainable institution.

By conducting thorough OHS audits, significant areas that need improvement—including laboratory and classroom safety, ergonomic risks, handling chemical and biological hazards, fire safety, emergency preparedness, and slip/fall prevention—are systematically pinpointed and addressed. This cultivates a widespread safety culture that positively influences employee morale, job satisfaction, and attendance rates. Tangible results often include fewer compensation claims from staff and students, enhanced trust from the community, better talent retention, and heightened productivity.

Realizing these results involves the active engagement of all stakeholders: Administration spearheads the creation and enforcement of policies; faculty and staff ensure compliance with safety procedures and report hazards; and students adhere to safety protocols. Ongoing improvement is fuelled by evaluating OHS performance, performing regular risk assessments, recognizing various hazards, putting in place controls (including equipment and training), delivering initial OHS orientations, providing continuous education (with specialized training when necessary), and maintaining comprehensive, practiced emergency response plans. Ultimately, prioritizing OHS is crucial for protecting individuals, meeting regulatory obligations, and cultivating a successful, reputable educational institution.

8.3.7 Stages of Occupational Health and Safety Management Audit

Occupational health and safety 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 the 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 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 emergency health and safety management systems and enhancement suggestions

8.3.7.3. Post 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 & 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; Identification of risks and their nature, category etc.: recording existing practices and provisions regarding OH&S system in the college.

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.

Fig.8.1. Risk assessment

8.3.9. Work plan and schedule of occupational health and safety report

Date to date	Work Plan
Date to Date 01/07/2025-08/07/2025	A meeting was held to discuss objectives of the team and chart out the plan of action to collect data on WM practices • Every team member is asked to go through the manual to help make the action plan • Collected the map of the college campus • The college campus is divided into 4 blocks and each group is assigned a block for the survey • The internal audit team is divided into 3 groups • Each team to identify and speak to housekeeping staff from the various blocks to understand current practices • Handed over the data sheets and each group to start the data collection from the next week onwards
09/07/2025-16/07/2025	Identify major waste sources (cafeteria, classrooms, hostels, offices) Each group is asked to understand current waste handling procedure in their assigned area • Arts Block team to collect data from canteen/cafe/campus and academic blocks • Central Block team to collect data from Academic blocks/ Hostel & Hostel Mess • Science Block team to collect data from the academic blocks, labs & cafe
17/07/2025-24/07/2025	Observe how waste is segregated (organic, recyclables, hazardous) • Each team is assigned to place registers in required areas like canteen and hostel, where maximum waste is generated daily, for efficient data collection • Each team to identify the different waste handling machines - biogas plant, incinerators, dumping yard etc in their assigned areas • To make a note of machines not working. • The teams to collect data on waste like paper and plastic given to external agencies
25/07/2025-01/08/2025	Understand current waste handling & challenges Observe waste disposal frequency & areas of non-compliance Ensure all registers and documents are completed

Table 8.1. Schedule of occupational health and safety audit

Activities	Frequency	Dates of study	Mode of data collection
Sound recording data	9 days; three times a day	Three working day ; 16/07/2025, 17/07/2025, 18/07/2025	Entry in the given format

Table 8.2. Workplan of occupational health and safety audit

8.4 RESULT AND DISCUSSION

Ensuring campus safety is an essential legal obligation for academic institutions, governed by Occupational Health and Safety (OHS) regulations. Non-compliance can result in severe repercussions, including lawsuits and damage to reputation. Conversely, adherence to OHS guidelines not only provides legal protection but also fosters essential trust within the community. This commitment is paramount in protecting students, particularly minors, from potential harm by ensuring well-maintained facilities and a secure workplace for all staff, which in turn enhances morale and productivity. Ultimately, promoting a robust safety culture is both legally and ethically imperative; it also reassures parents, strengthens community relationships, and improves the institution's reputation and enrolment prospects.

8.4.1.OHS System of the College

To promote a safe and productive environment for its community, the college implements an Occupational Health and Safety (OHS) management system that complies with ISO 45001 standards. This comprehensive framework facilitates systematic efforts to monitor health hazards, ensure the operational safety and reliability of resources such as laboratory equipment, canteen provisions, and first-aid supplies, and effectively manage visitor access to enhance security.

Well-defined emergency protocols are established to ensure safety and fortify the institution's credibility. In alignment with international guidelines (EU-OSHA, HSE, OSHA), the college actively integrates OHS principles into the educational experience through a "whole-institute" model. This approach includes embedding risk awareness, health promotion, and respect initiatives into the curriculum and campus culture, thereby fostering a comprehensive understanding of safety that transcends isolated discussions. Collaboration with relevant authorities further supports this integrated strategy.

8.4.2.Risk Assessment Report

Sl No	Location	Block	RISK	Assessment findings	Remarks
1	Cafeteira	Arts Block	Whether mandatory certification of health, FSSAI, and water quality report are available	Has a valid FSSAI certification and yearly water quality report	Nil
2	Canteen	Arts Block	Hygiene and sanitation status at the mess hall, tables, floor; kitchen floor	Decent level of safety and health standards	No bouffant caps
	Canteen	Arts Block	LPG cylinder connection-safe plumbing, fittings safe storage etc.	LPG cylinders are securely stored in a well-ventilated outdoor area adjacent to the canteen and cafeteria, and are also kept in a secure room for laboratory use.	There is currently no designated storage room for plumbing and fitting materials, and a bulk quantity was not identified during the assessment. This indicates that the materials used to meet requirements will be sufficient, and any remaining waste will be handed over to an external agency.

3	Block A- Ground floor	Arts Block		Good electrical and infrastructure safety conditions	first aid products
4	Block A- First floor	Arts Block			Exposed wiring, expired first aid kit
5	Block A- Second &Third floor	Arts Block		Meets basic safety conditions	nil
6	Block A- Fourth floor	Arts Block			water leakage in staff room wash basin, Inoperable intercom, exposed wiring, poor area maintenance
7	Block A- Fifth floor	Arts Block		Meets basic safety standards.	Exposed wiring with a loose electrical switchboard.
8	Central Block, ground floor	Central Block		Good infrastructure and security measures, proper ventilation, and wheelchair accessibility in the washrooms	Poor hygiene, no proper signboards, absence of sanitary waste disposal, absence of fan regulators in classrooms (100,101,102,103,104), locked fire exit doors
9	Central Block First floor	Central Block		Good infrastructure and clean classroom	unclean washrooms, and no washroom for the differently abled
10	Central Block, Second floor	Central Block		Good infrastructure, proper ventilation, and clean rooms	Poor wiring condition in 112, improper storage and disposal of chemicals, chemicals in the laboratory not recorded, unhygienic restrooms, absence of caution signs, no washrooms for the disabled, no fire extinguisher or smoke detectors in the food processing lab, no fan regulators in any class
11	Central Block Third floor	Central Block		Good infrastructure and wiring condition	Expired first aid kit, no fan regulators in 114 and 115, no washroom signage for the differently abled

12	Central Block, Fourth floor	Central Block		Good infrastructure, proper ventilation	Electrical duct bot not stuck, poor wiring condition in 118, first aid kit not available, unclean restrooms, no washrooms for disabled, leakage and improper storage of chemicals, absence of sanitary waste disposal, fire extinguisher wire not attached
13	Central Block Fifth floor	Central Block		Good infrastructure with proper ventilation	Fire evacuation plan not intact, no fan regulators in 123,125, no first aid kit, no sanitary disposal, unhygienic restrooms, no facility for the disabled
14	Central Block, Sixth floor	Central Block		Good infrastructure	No fire extinguisher, no caution sign for high voltage areas, no first aid, no restrooms or facilities for the disabled
15	The hostel's sixth floor	Centenary Block		Proper fire extinguishers, hygienic and ventilated rooms, a disposal facility for sanitary pads, CCTV surveillance for security	Absence of a smoke detector, suspended iron rods from the stairs above the 6^{th} floor
16	Hostel Fifth floor	Centenary Block		No issues with hostel rooms and restrooms	Absence of a fire exit sign and evacuation display boards
17	Hostel Fourth floor	Centenary Block		Proper ventilation and lighting, well-maintained rooms	Loose wires in room C-403
18	Hostel Third floor	Centenary Block		Proper drinking water station	Unrepaired ceiling in the restroom and the hall, locked fire exit door
19	Hostel Second floor	Centenary Block		Clean and well-ventilated	Nil

20	Hostel First floor	Centenary Block		Clean and well-ventilated, the kitchen was equipped with proper functioning appliances, a proper drinking water station	Damaged switchboard, expiry date on fire extinguisher unclear
21	Block B Ground Floor	Science Block		CCTV surveillance for security	No ventilation and poor lighting (82,83,84), no emergency exit, no signage, no accessibility for the differently abled
22	Block B First Floor	Science Block		The chemical register is maintained properly	No trained personnel for first aid, absence of further accessibility for the differently abled, and exclusion left
23	Block B Second Floor	Science Block		Chemicals and electrical safety are maintained properly	Lights not working in the textile lab, no fire exit and emergency signage, and no accessibility for the differently abled
24	Block B Third Floor	Science Block			Small cracks and loose fixtures
25	Block A First floor	Science Block		Good infrastructure and proper circuit breaker functionality	No proper ventilation and lighting, no fire exit, no accessibility for the differently abled
26	Block A Second floor	Science Block		Proper labs and ergonomics	No proper ventilation and lighting, no fire exit,1 fan not working in the staffroom,
27	Block B Fourth floor	Science Block		Good condition of the building	1 fan not working in room 73,74, no regulator in room 79, no first aid kit and trained personal, no accessibility for differently abled, old wiring and regulators, leakage of water in restrooms

28	Block B Gound floor	Science Block		Classes have proper infrastructure with safety conditions	Non-working lights in toilet (1) lab(1)and corridor (2), expired first aid kit, no accessibility for the differently abled, outdated wiring with improper insulation, poor ventilation and dark hallways.
		Road infrastructure	The college is a decentralized campus situated in two locations, requiring the use of a main road to access the second campus. The internal roadways lack designated pedestrian walkways, and there is an absence of standard signage to effectively manage traffic.	The current road safety system is inadequate. Access to the second campus relies on a main road, which is congested between the buildings and the canal. Although there is a footpath adjacent to the canal, it lacks protective fencing, posing a risk of accidental falls into the canal.	Possibility of road accidents and unsafety condition for pedestrians

Table 8.3. Summary of risk assessments results

An assessment of campus facilities was conducted across four key zones: the Arts Block, the Science Block, the Central Block, and the Centenary Block. The evaluation revealed significant inconsistencies in safety standards, accessibility, and infrastructure across the campus. A primary recommendation is the expansion and standardization of facility management services to address these disparities and meet the needs of a large, diverse campus community.

The older buildings, namely the Arts and Science Blocks, exhibit critical deficiencies. In the Arts Block, immediate safety hazards were identified, including exposed wiring, loose electrical switches, and unmarked emergency exits, While the FSSAI-certified canteen maintains good hygiene, staff lack uniform headwear. Furthermore, the block is not equipped for individuals with disabilities; lift and wheelchair facilities are provided, but there are no accessible toilets, and the surrounding area lacks pedestrian and traffic infrastructure. The Science Block presents a similar safety risk with a single entry/exit point for emergencies, and Accessibility in this building is also severely limited.

In stark contrast, the newly constructed Central and Centenary Blocks are equipped with modern facilities, including proper ventilation, multiple emergency exits, and comprehensive accessibility features like lifts and specially designed washrooms. However, a crucial oversight common to both new buildings is the lack of adequate signage. The excellent services and facilities they contain are not clearly communicated or signposted, preventing users from easily locating and utilizing them. It is imperative to install clear, visible signage to maximize the benefit of these investments.

8.4.3.Risk areas of the college and existing ohs facilities:

Sl.No.	Risk Area	Type of risk	Hazards	Existing OHS system
1	Chemistry, Zoology, Botany, and Biochemistry laboratories	Chemical, physical, biological	Toxins Burning chemicals Pathogenic organisms	In all laboratories, it is mandatory for students to wear white lab coats while performing practical work involving biological or chemical materials to ensure personal protection and prevent contamination. Exhaust ventilation systems must be switched on before the commencement of any experiment to ensure adequate airflow and fume extraction. Microbiology procedures are carried out exclusively within Laminar Air Flow (LAF) bench to maintain sterile conditions and control the spread of aerosols. Following immunology sessions, bio-materials and consumables are discarded into a soap solution rinse, and all glassware and pipette tips are autoclaved before reuse or future use. Each laboratory is equipped with a fire extinguisher to ensure immediate response to accidental fires that may arise from the use of flammable chemicals or equipment.
2	Physics, computer and language laboratories	Electrical	Shock	In the Physics and Computer laboratories, all electrical installations are inspected to prevent faults and reduce the risk of electric shock. Circuit breakers are in place to manage electrical load safely. Safety instructions are communicated to the students before practical sessions. Emergency shut-off switches are installed for quick power disconnection during incidents.

3	Roads and campus safety	Vehicle accidents The existing road safety measures are insufficient. Reaching the second campus depends on a primary road that becomes congested between the buildings and the canal. While there is a footpath alongside the canal, it does not have any safety barriers, increasing the danger of accidental falls into the water. Inside roads have no pedestrian walk area. No signage too.	Health issues including fatality Road accident Falling into canal	The existing OHS system for roads and campus safety includes security personnel monitoring vehicle movement within the campus to prevent accidents. During peak hours, traffic police are stationed on the main roads outside the campus to manage congestion and ensure safe crossing. Entry and exit points are controlled to minimize traffic flow conflicts.
4	Canteen, Hostel mess and other food serving areas	Sanitation, hygiene and food safety issues; drinking water quality; LPG connection safety	Food poisoning; health issues Possibilities for leaking Fire and when in contact with intense heat	Campus canteen and hostel mess operate with valid health certificates and adhere to food safety standards. Packed food items are documented to monitor expiry dates, and raw materials are sourced from certified vendors. Mess and serving areas are cleaned regularly, and kitchen staff follow hygiene protocols including the use of gloves, hairnets, and aprons. Drinking water is filtered, tested periodically, and stored in clean, covered containers. Waste disposal is managed systematically to avoid contamination and maintain sanitary conditions.

5	General issues Water quality-related issues	Water-borne or water-related diseases	Infections; water-borne diseases	Filtered drinking water systems are installed across the campus, and regular testing is conducted to ensure water safety. Maintenance teams clean storage tanks to prevent contamination. Preventive measures, including water quality testing, cleaning of storage tanks, and maintenance of pipelines, are in place to reduce the risk of water-borne diseases and infections. A group of student volunteers, supervised by the Centre for Professional Studies, regularly assess water sources and usage areas in every department to identify potential risks and prevent the spread of water-related diseases.
	Electrical distribution system related	Improper earthing Unbalanced and a lack of harmonious	Shocks; damages to equipment	The electrical distribution system is inspected to detect and correct issues such as improper earthing and unbalanced loads. Safety devices, including circuit breakers are installed to prevent shocks and equipment damage.
	Ragging Sexual harassment Violence	Mental well being	Conflict between the college students	All students are required to sign an anti-ragging affidavit at the time of admission, as mandated by UGC guidelines. Anti-Ragging Cell are in place to address grievances related to harassment and student conflicts. Awareness programs and sensitization workshops are conducted regularly to promote respectful and safe campus interactions. A grievance redressal system is available for confidential reporting and timely intervention. Faculty and mentors are assigned to regularly interact with students and resolve issues before they escalate.
	Frequent health issues	Physical well being	Infections Diseases Accidents Mental stress	Every department is equipped with first aid kits for immediate response to injuries or accidents. A certified nurse is available at the Centre for Professional Studies during working hours to handle medical emergencies. The Physical Education department conducts regular fitness programs to promote physical well-being. The counselling cell offers mental health awareness sessions and provides individual counselling support to address stress and emotional concerns.

6	Women safety	Psychological well being	Safety Health Social support	A dedicated women's cell provides psychological and social support through regular workshops, mentoring, and grievance redressal mechanisms. Health check-up camps and awareness programs are conducted in collaboration with local healthcare providers. Counselling services are available to support emotional well-being and address issues like stress, anxiety, or harassment.
7	Emergency response system	Safety protocol	Diseases Disaster Medical emergency	In case of disease spread, affected areas are sanitized, and students/staff are advised to follow public health guidelines, including isolation when necessary. During natural disasters, designated assembly points are used for evacuation, and safety announcements are made through the public address system. For medical emergencies, immediate first aid is administered, and the patient is transported to the nearby General Hospital (500 meters away) using the college vehicle. Emergency contact numbers are displayed in all departments for quick access.
8	First Aid Frailties	Emergency medical support	Injuries Diseases Accident	In case of serious medical emergencies, patients are immediately taken to the General Hospital located 500 meters from the main campus. The college provides hospital transportation for quick access to medical care. First aid kits are maintained in all departments and accessible during working hours. Staff members are trained in basic first aid to manage minor injuries and health issues.
9	Infrastructure facilities	Outdoor and indoor facilities Hostel	Safety Emergency exit Recreation Networking	Gym plaza (Located in the Science Block) and recreational spaces are available to promote student well-being and physical activity. Common areas across the campus encourage peer interaction and social engagement. Hostel buildings are secured with surveillance and have wardens to ensure safety. Emergency exits are clearly marked and accessible in newly constructed buildings and main campus areas.

10	Register and documents	Safety Health Emergency	safety and security framework procedures for incident management, the implementation and practice of emergency protocols through regular drills, and the enforcement of campus access control measures.	Register for medical emergencies and first aid is maintained and systematically updated in all departments. Safety and incident registers document all reported events and actions taken, ensuring accountability and traceability. Campus access is regulated through ID-based entry and security supervision. All records are periodically reviewed to strengthen the safety and health management system.

Table 8.4. Analysis of identified risks and strategic mitigation measures

8.4.3.1.Health

- Laboratory Safety: Students are required to adhere to the established lab protocols, which include mandatory guidelines such as wearing white lab coats during practical activities involving biological or chemical materials. This practice is vital for ensuring personal safety and preventing contamination. Safety instructions are communicated to students prior to each practical session. A usage register is maintained in each lab to document the quantity of materials utilised. Lab attendants and faculty members are appointed to oversee and direct these sessions effectively.
- All Departments have a first aid kit under the custody of a faculty member to ensure a prompt response to injuries or accidents. A first aid register is maintained within each department, which is regularly monitored and updated to replace any expired supplies. The head of the department is responsible for the distribution of medications from the first aid kit. the college is divided into three blocks—Arts, Central, and Science—it is not feasible to centralise the first aid kits in a common area, as this could hinder timely access during emergencies. However, a mini-hospital facility is located in the Arts block, where a certified nurse is available at the Centre for Professional Studies during working hours to manage medical emergencies. Comprehensive medical support is provided, including a medical kit, facilities for treating injuries, and CPR beds. In case of a medical emergency, immediate first aid is administered, and patients are transported to the nearby General Hospital, located just 500 meters away, using the college vehicle. Emergency contact numbers are prominently displayed in all departments for easy reference. In the situation of disease outbreaks, affected areas are promptly sanitised, and students and staff are advised to adhere to public health guidelines, including sanitisation, the use of masks, and isolation when necessary. The college provides hospital transportation for quick access to medical care. First aid kits are maintained in all departments and are accessible during working hours. Register for medical emergencies and first aid is maintained and systematically updated in all departments. Safety and incident registers document all reported events and actions taken, ensuring accountability and traceability.

Fig. 8.2. Emergency medical facilities of the college

- The campus canteen and hostel mess operate in compliance with valid and renewed health certificates and health cards, adhering to stringent food safety standards. Packed food items are meticulously documented to track expiry dates, and raw materials are sourced exclusively from certified vendors. A risk assessment of occupational health and safety (OHS) indicates that while hair caps and proper cooking attire are utilised, gloves are not currently employed; instead, cutlery is used to serve food. Cashless payments are encouraged to ensure a hygienic dining experience.

Fig. 8.3. Arts block main canteen

- Annual water quality analysis is conducted to assess physical, chemical, and bacteriological parameters. The most recent assessment detected trace levels of E. coli bacteria. In accordance with established management strategies, corrective procedures, including enhanced chlorination and remediation of biofilm within the water distribution system, are being implemented to mitigate this finding and ensure the water remains safe for consumption
- Sick rooms are available at the Centre for Professional Studies to provide basic care for students or staff who are unwell. A certified nurse is stationed at the facility to offer medical assistance during emergencies and working hours in the Arts block, but it is not convenient to get access to other blocks, so they have to implement a centralised system to get access to all blocks

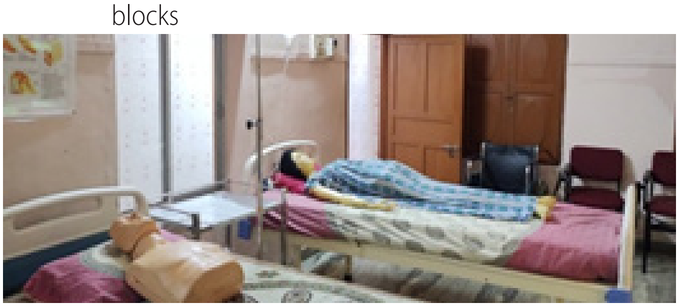


Fig. 8.4. Emergency medical room

8.4.3.2. Emergency management system

- Safety and incident registers document all reported events and actions taken, ensuring accountability and transparency. All records are periodically reviewed to strengthen the safety and health management system.
- Emergency exits are placed in the arts and central block and open passages on multiple sides during an emergency, but there is no emergency exit in the Science block, with only one entrance

Fig. 8.5. Wall falling facilities and open varanda

- Emergency communication, such as college dispersal due to emergency issues, spread of diseases, and any serious threat, is announced through a general announcement or circulated the notice through the department via mail or WhatsApp message

Fig. 8.6. Emergency fire exit

- Active NSS and NCC are strong supports in handling emergencies in college. Relief campus, supply of essential products is handled for the college community and the local community.
- As a women's college, the institution prioritises the holistic development of women by focusing on their mental and physical well-being, financial independence, rights, and legal security. The college has established a Women's Cell that collaborates with experts to conduct sessions on health, hygiene, lifestyle, fitness training, and workshops promoting healthy eating habits. Additionally, organises exhibitions for women entrepreneurs and hosts sessions with industry experts to introduce new technologies and marketing strategies. Furthermore, the college partners with legal experts to empower women regarding their rights and justice, as well as to provide resources for addressing situations of violence.

8.4.3.3.Environmental health

- The laboratory is equipped with a fire extinguisher to ensure immediate response to accidental fires that may arise from the use of flammable chemicals or equipment. Safety devices, including circuit breakers, are installed to prevent shocks and equipment damage during practical work. Signages have to be placed to deliver the message that emphasises the importance of wearing personal protective equipment
- Biomaterials and consumables materials are discarded into a soap solution rinse, and all glassware and pipette tips are autoclaved before reuse or future use following each immunology session to neutralise biological residues and reduce contamination risks before disposal.
- Chemical materials are handled with systematic management; it is not manually removed by non-teaching staff. First, they conduct micro-scaled analysis to minimise the use of chemicals. Now, the college has signed an MoU for treating chemicals and grey water with an agency. Grey water is treated through thermal heating and changed into solid form, all of which is taken by the agency, and further management methods are being processed

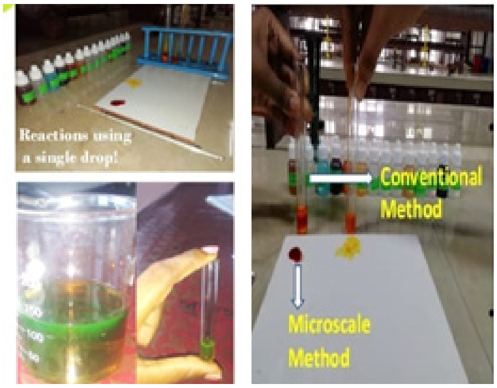


Fig. 8.7. Chemical treating

- The electrical distribution system is inspected to detect and correct issues such as improper earthing, unbalanced loads and other potential hazards that could compromise safety or equipment performance. Emergency exits are provided in the Main Campus as well as in the newly constructed Central and Centenary Blocks.

8.4.3.4.Facilities

- Labs are equipped with exhaust ventilation to ensure adequate airflow and fume extraction, and are switched on before the commencement of any experiment. Also, the microbiology procedures are carried out exclusively within Laminar Air Flow (LAF) bench to maintain sterile conditions and control the spread of aerosols.
- Autoclaving of all glassware and pipette tips is carried out after each immunology session to ensure complete sterilisation prior to reuse or future application. Meanwhile, biomaterials and consumables are disposed of by rinsing them in a soap solution, effectively neutralising contaminants and maintaining laboratory hygiene standards.

Fig. 8.8. Lab facilities

- Mess and serving areas are cleaned regularly, and kitchen staff follow hygiene protocols, including the use of hairnets and aprons. They are given training separately to manage the operation of cleanliness and sanitation.
- Filtered drinking water systems are installed across the campus, are tested periodically, and stored in clean, covered containers. Waste disposal is managed systematically to avoid contamination and maintain sanitary conditions.
- The Physical Education department conducts regular fitness programs to promote physical well-being such as basketball, badminton, and yoga training

Fig. 8.9. Volleball and batminton court

Fig. 8.10. College yoga session

- The physical environment is a significant factor influencing comfort. A well-designed campus integrates architectural features with human comfort considerations such as adequate spacing, colour, and building arrangement to enhance aesthetic beauty. St Teresa's College, one of Kerala's older educational institutions, with a hundred years of excellence legacy, retains historic infrastructure while concurrently undergoing modifications. These changes, including the development of versatile gathering spaces and improved ambience, aim to benefit the college community. For example, the main block features large windows, doors, and spacious white verandas that promote natural ventilation, lighting, and social interaction. The science block is a closed building structure, even though it has comfortable lighting during the day. To utilise the limited space, the rotary parking system is in the stage of construction
- Gym plaza (Located in the Science Block) and recreational spaces are available to faculty and students for physical activity. Areas across the campus encourage peer interaction and social engagement., Organise any events, and the basketball court is shaped in a structure like an amphitheatre

Fig. 8.11. Amphi theatre and basket ball court

- Hostel buildings are adjacent to the college building, but they are secured with surveillance and have wardens to ensure safety. College intimates only permitted to enter the hostel
- Campus access is strictly regulated through an ID-based entry system, ensuring that only authorised individuals can enter institutional premises. This system is reinforced by active security supervision, which monitors movement and maintains order across key access points. Outsiders have to report the purpose of their visit, which is maintained by security staff and OHS auditors who inspect annually.
- The college features a well-maintained canteen and cafeteria. The seating arrangement in the canteen is thoughtfully designed to maximise space efficiency, incorporating wall-mounted seating and adjustable options that can accommodate varying capacities. The areas for food distribution and dining are consistently kept clean and sanitised. Electric fly zappers are utilised to mitigate issues with fly presence. The food served is freshly prepared on a daily basis, with minimal reliance on packaged items. The expiration dates of food materials are diligently recorded and monitored by OHS auditors.
- The institution offers comprehensive academic facilities, featuring well-equipped classrooms, library enhanced with a digital bookshelf for convenient access, and automated kiosks that enable students and faculty to utilise library services at any time, thereby reducing reliance on human assistance. The institution boasts state-of-the-art laboratories and an IT lab, a Garment lab furnished with appropriate technology and adequate space for effective

Fig. 8.12. Arts block cafeteria

instruction and collaboration. Operational oversight is managed by a dedicated Energy Management Team, which focuses on infrastructure efficiency and technology risk assessments. The safety of laboratory environments is of utmost importance and is monitored by the Occupational Health and Safety (OHS) team, which implements clear signage, personal protective equipment (PPE) protocols, and stringent maintenance schedules. Comprehensive records, including purchase and expiry dates as well as calibration logs, are meticulously maintained for all laboratory equipment and chemicals.

- Dedicated housekeeping team, consisting of ten staff members, implements rigorous cleaning routines to maintain a hygienic environment and prevent the spread of infectious diseases. This commitment to cleanliness mitigates health risks associated with pathogens and minimizes physical hazards, such as slips and falls. To ensure accountability and consistent quality, a register is maintained in the Bursar's Office to log cleaning frequency and monitor staff performance. While a formal, standalone protocol is not in place, all job responsibilities and cleaning standards are clearly delineated in each employee's contract. Furthermore, prioritise sustainability by procuring the majority of the eco-friendly cleaning supplies from a local, ethical vendor.


Fig. 8.13. Computer lab

Fig. 8.14. Digital book shelf

Fig. 8.15. Automated kiosk in library

Fig. 8.16. Textile/garment lab

8.4.3.5.Training and awareness programme

- A group of student volunteers, supervised by the Centre for Professional Studies, regularly assess water sources and usage areas in every department to identify potential risks and prevent the spread of water-related diseases.
- Anti-Ragging Cell is in place to address grievances related to harassment and student conflicts, and all students are required to sign an anti-ragging affidavit at the time of admission, as mandated by UGC guidelines.

Fig. 8.17. Training program held at arts block

- Awareness programs and sensitisation workshops are conducted regularly to promote respectful and safe campus interactions. A grievance redressal system is available for confidential reporting and timely intervention. Faculty and mentors are assigned to regularly interact with students and resolve issues before they escalate.
- A dedicated women's cell provides psychological and social support through regular workshops, mentoring, and grievance redressal mechanisms. Health check-up camps and awareness programs are conducted in collaboration with local healthcare providers.
- The Jeevani Mental Health Program, launched by the Kerala Department of Collegiate Education, assigns a dedicated counsellor to each college annually to provide mental health support and counselling to students. Ms. Asawathy Pai, a qualified psychologist with an MSc in Counselling Psychology, has been appointed as the counsellor for this initiative, in accordance with government provisions. To maintain confidentiality, details of the

services are communicated through departmental groups, ensuring that information reaches the student body effectively. The circulated message includes an extensive overview of the counselling process, highlighting its benefits and outlining the procedure for booking appointments. Students can utilise an online booking system by scanning a QR code, allowing them to reserve a time slot for their sessions and confirm their appointments seamlessly.

- Orientation training is given to staff separately for teaching and non-teaching members in basic first aid to manage minor injuries and health issues, thus providing a safer and more responsive environment across the campus.
- The College prioritises the safety, health, and well-being of its students, staff, and visitors. It regularly conducts comprehensive training programs, which include yoga and physical exercise sessions led by experts in collaboration with NSS and NCC units. The College also partners with external agencies, such as the Kerala State Fire Force, to provide periodic and professional fire extinguisher training. A Memorandum of Understanding (MoU) has been established with Aster Hospital to offer CPR training sessions for both students and staff. Furthermore, specific safety protocols for laboratories covering the safe handling of chemicals and glassware, emergency procedures, and facility guidelines are officially communicated to Department Heads, who are then responsible for disseminating this information within their departments through established channels.

Fig. 8.18. Fire extinguisher

- To promote student well-being, the College implements a range of health programs tailored to specific needs. Recent initiatives include workshops focused on the use of menstrual cups and campaigns aimed at raising awareness about substance abuse. Physical safety on campus is enhanced through strategically placed signage that indicates emergency contact points, manages traffic flow with speed limits and speed bumps in designated areas, and alerts individuals to potential hazards, such as the prohibition of sitting on open balcony ledges.
- The College actively fosters community welfare and social responsibility through various service-oriented initiatives. Regularly scheduled events, including blood donation drives, medical camps, and hair donation programs, are organised on campus with the support of NSS and NCC. These activities not only provide significant benefits to the community but also encourage civic engagement and a strong sense of social responsibility among students.
- The institution provides encompassing sports facilities to promote a balanced and active student lifestyle. With resources available for basketball, football, cricket, and volleyball, students can improve their physical health, cultivate essential social skills, and acquire the principles of teamwork and leadership. These programs enhance student engagement and contribute to a vibrant and positive campus atmosphere.

8.4.3.6.Infrastructure assessment

- All electrical installations are inspected and monitored through a dedicated energy management team. to prevent faults and reduce the risk of electric shock in Physics and Computer laboratories and Circuit breakers are in place to manage electrical load safely. Emergency shut-off switches are installed for quick power disconnection during incidents.
- The existing OHS system for roads and campus safety includes security personnel monitoring vehicle movement within the campus to prevent accidents. During peak hours, traffic police are stationed on the main roads outside the campus to manage congestion and ensure safe crossing. Entry and exit points are controlled to minimise traffic flow conflicts outside the campus
- Space constraints within the college campus have resulted in a lack of designated pedestrian walkways. While construction of such pathways may not be feasible, implementing painted floor markings along with standardised traffic signage could effectively manage pedestrian and vehicular traffic within the campus.

Fig. 8.19. Indoor seating arrangement

- Water quality and water risk assessment are managed by the water efficiency management team. The water supplied from the corporation is filtered and reaches each tank. An additional filter to purify the water in the tank for the direct pipe. Ensure the chlorination of the tank after six months, and after water quality analysis, clean the water tank and the pumping fixture twice a month
- Surveillance cameras are strategically installed in various areas of the campus to provide continuous monitoring of campus activities, even in the absence of on-site security personnel. This ensures constant oversight and helps maintain adherence to the established norms of the college community, while enabling a prompt response to any emergencies that may occur.
- Adequate washroom facilities, featuring clear signage to ensure accessibility for all users, including those with disabilities. The facilities include pad vending machines and disposal units, accompanied by cautionary messages to discourage the flushing of inappropriate materials. The institution provides separate and adequate washroom facilities for both women and men. In the women's washrooms, designated disposal units for sanitary products and napkin vending machines are available. These facilities are regularly maintained by housekeeping staff to uphold hygiene standards and minimise odours. Information about these amenities is effectively communicated by non-teaching faculty and housekeeping personnel, and directional signage is strategically placed throughout the premises to guide users accordingly.

Fig. 8.20. Toilets for differently abled

Fig. 8.21. CCTV facilities

8.4.3.7.Empowering inclusive systems in college

- To foster an inclusive and barrier-free environment, the campus has implemented a range of infrastructure and support services designed to accommodate individuals with disabilities and ensure equitable access to facilities and academic resources. Like Rails, toilets and Talking library for the visually challenged, Ramps are installed at the key locations, including Central Block and Centenary Block, to support accessible movement.

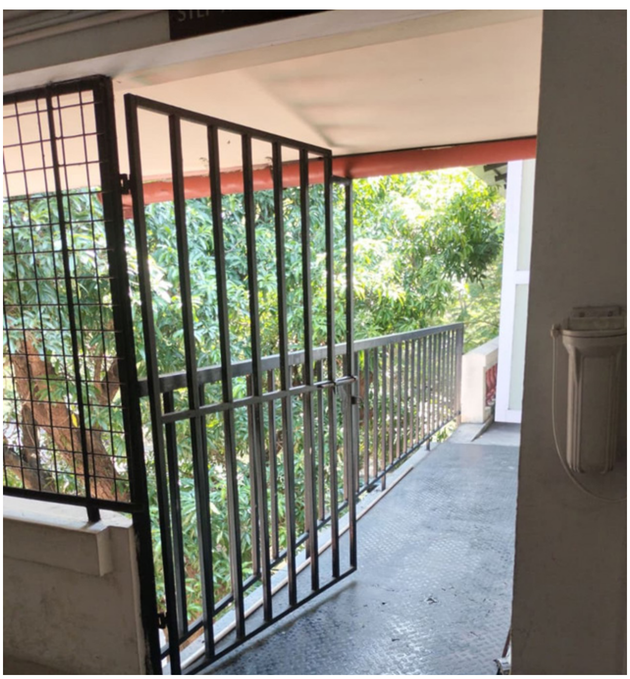


Fig. 8.22.Ramps facilities

- Multiple lifts are available in all major blocks, including Arts, Central, Centenary, and Science, ensuring easy access to classrooms, offices, auditorium and common areas across all floors
- Most rooms on campus are easily accessible to individuals with disabilities, as every building is equipped with elevators to support easy entry and exit. Doors are wide enough to accommodate wheelchairs, facilities are available upon request at the main campus and Central Block reception and currently five chairs are available on the campus.
- Accessible signages are installed across the campus with clear symbols, large fonts, and appropriate contrast to support easy navigation for individuals to aid orientation for individuals with visual impairments or cognitive challenges.
- Before the announcement of the semester exams, the Examination Control Office disseminates a notice via WhatsApp to the heads of departments (HODs), who then share it with all student groups. Students can access the service by clicking on the registration form included in the notice, which must be submitted along with the necessary supporting documents related to their requirements. After verifying the document, the exam cell allocates a scribe based on the specific needs of the students. For those who require additional time, an approved letter will be shared with the relevant individuals. These services will be available during the exam period, and the exams will be conducted in spaces arranged by the exam cell. The college has established a robust scribe pool to effectively meet these requirements.
- Students in need of assistance are referred to their

respective class teachers, who facilitate additional support and coordinate with the Occupational Health and Safety (OHS) coordinator as necessary. Minor issues are managed by the department head in conjunction with the class teacher.

Support through student volunteers is available upon request, and during programs and events, volunteers are strategically positioned in key areas to provide support and guidance.

Fig. 8.23. Central block lift


Fig. 8.24. Arts block lift

Fig. 8.25. Audio library for visually impired

8.4.3.8.Facilities Offered in the College

Sl No	Facilities offer	Location
1	Rails and Ramps	Installed at the Central Block, Arts block and Centenary Block to support accessible movement.
2	Lift	Available in all major blocks - Arts, Central, Centenary, and Science.
3	Accessible room	Most rooms on campus are easily accessible to individuals with disabilities, as every building is equipped with elevators to support easy entry and exit. Doors are wide enough to accommodate wheelchairs and to ensure smooth movement.
4	Emergency exit	Provided in the Main Campus as well as in the newly constructed Central and Centenary Blocks.
5	Transportation	School Buses are available on request (special cases)
6	Accessible signages	Accessible signages are installed across the campus with clear symbols, large fonts, and appropriate contrast to support easy navigation for individuals.
7	Scribe and examinations	Scribe support for examinations is provided through student volunteers upon request; students seeking this facility must submit a formal request signed by the Class Teacher and Head of the Department to the Controller of Examinations, along with valid reasons and supporting documents.
8	Essential support room	Sick rooms are available at the Centre for Professional Studies to provide basic care for students or staff who are unwell. A certified nurse is stationed at the facility to offer medical assistance during emergencies and working hours.
9	Human assistance	Human assistance is provided through student volunteers upon request, and for programmes and events, volunteers are stationed in primary areas to offer support and guidance.
10	Electric Examination Table	NA
11	Wheelchair facilities	Available upon request at the main campus and Central Block reception. Ten wheelchairs are available in the campus.
12	Fire Exit	Provided in the Main Campus as well as in the newly constructed Central and Centenary Blocks.

Table 8.5. List of facilities available

8.4.3.9.Fire Extinguishers

Sl No	Count	Capacity	Location
1	1	4 kg	Arts Block - Block A - Ground floor office reception
2	2	6 kg	Arts Block - Block A - Second Floor Library
3	1	6 kg	Arts Block - Block B - Entrance
4	1	6 kg	Arts Block - Block B - Second Floor English Department
5	1	6 kg	Arts Block - Block D - Ground Floor (America Hall)
6	1	6 kg	Arts Block - Block D - First Floor near Council Room

7	2	6 kg	Arts Block - Block D - Second Floor Elysium Hall
8	1	25 kg	Arts Block - Block D - Second Floor Elysium Hall
9	1	6 kg	Arts Block - Seminar Hall
10	1	6 kg	Arts Block - Ground Floor (Elysium Elevator)
11	2	6 kg	Arts Block - Arts Auditorium
12	2	4 kg	Central Block - Ground Floor - Near the lift and Water Cooler
13	2	4 kg	Central Block - First Floor - Near the lift and the Water Cooler
14	2	4 kg	Central Block - Second Floor - Near the lift and the Water Cooler
15	2	4 kg	Central Block - Third Floor - Near lift and Water Cooler
16	2	4 kg	Central Block - Fourth Floor - Near the lift and the Water Cooler
17	2	4 kg	Central Block - Fifth Floor - Near the lift and Water Cooler
18	2	6 kg	Centenary Block - Ground Floor - (Near the steps and office)
19	1	4 kg	Centenary Block - First Floor - Near the Steps
20	1	4 kg	Centenary Block - Second Floor - Near the Steps
21	1	4 kg	Centenary Block - Third Floor - Near the Steps
22	1	6 kg	Centenary Block - Fourth Floor - Near the Steps
23	1	4 kg	Centenary Block - Fifth Floor - Near the Steps
24	2	4 kg	Science Block - Chemistry Lab
25	2	2 kg + 5 kg	Science Block - M.Sc. Chemistry Lab
26	1	2 kg + 6 kg	Science Block - Chemistry Research Lab
27	1	6 kg	Science Block - Washroom and Ground Floor
28	1	4 kg	Science Block - Botany Dept Entrance
29	1	4 kg	Science Block - Zoology Dept Entrance
30	1	6 kg	Science Block - Physics Entrance
31	1	6 kg	Science Block - Maths Dept Entrance
32	2	4 kg	Science Block - Pg Hostel
33	1	6 kg	Science Block - Home Science Entrance
34	1	4 kg	Science Block - Home Science First Floor
35	1	6 kg	Science Block - Food Lab
36	1	6 kg	Science Block - Women's Study Centre

Table 8.6. Fire extinguisher strength

First, extinguishers are placed in thirty-six locations, commonly placed in the required area. A total of 36 locations are there, including three blocks.

8.4.4.Vehicle Details of the Institution

Status	Four-wheeler	Two-wheeler	Three-wheeler
Number of four-wheelers	151	0	0
Number of Two-wheeler	0	70	0
Number of electric two-wheeler vehicles	0	9	0
Number of electric four-wheelers	4	0	0
Number of four-wheelers saved	87	0	0
Number of two-wheelers saved	0	19	0
Number of three-wheelers	0	0	1

Table 8.7. Vehicle details

out of 151 four-wheelers, 87 shared vehicles have collectively saved 648,000 litres of fuel annually, including four electric vehicles. Among 70 two-wheelers, 19 shared units have saved 565,500 litres of fuel each year, with nine being electric models. These figures highlight the significant impact of shared and electric vehicles in reducing fuel consumption.

8.4.5 Sound Recording of The College

Sl No	Location	Sound (in dB)	
		Min	Max
1	Entrance	74.22 ± 17.64	76.96 ± 15.12
2	Back gate of Arts block	68.1 ± 12.12	71.52 ± 60.93
3	Another back gate of the arts block	68.83 ± 13.43	72.17 ± 17.43
4	Central block front gate	75.89 ± 12.67	228.83 ± 14.64
5	Centenary	72.62 ± 15.83	75.03 ± 16.28
6	Science front gate	71.62 ± 12.10	71.33 ± 13.15
7	Science lab	64.16 ± 15.92	66.2 ± 10.30
8	PG Hostel	66.32 ± 14.56	68.83 ± 15.49
9	Community college front gate	69.66 ± 15.95	71.77 ± 13.20

Central block, Entrance and centenary block highest sound recorded area.

Table 8.8. Sound recording at diiferent zones of the college

Detailed Findings:

8.4.5.1. Highest Sound Levels:

The Central Block of the campus registered the highest ambient noise levels, reaching a maximum of 228.83 ± 14.64 decibels. This was notably higher than the readings observed at the general entrance area, which recorded a peak sound level of 76.96 ± 15.12 decibels.

The elevated noise levels in these zones can be primarily attributed to their proximity to a busy roadway, where frequent vehicular movement and traffic congestion significantly contribute to acoustic disturbances, and the absence of trees or shrubs limits any potential reduction in the impact of sound.

8.4.5.2. Lowest Sound Levels:

The Science Laboratory was noted with the lowest ambient sound level, with a maximum reading of 66.2 ± 10.30 decibels. This relatively quiet aural environment can be attributed to its location away from high-traffic roads, minimising exposure to vehicular noise. Moreover, the building is surrounded by noticeable tree cover and is adjacent to a botanical garden, both of which play a significant role in natural sound attenuation. The vegetation acts as a buffer, absorbing and diffusing sound waves, thereby contributing to the overall reduction in noise levels within this part of the campus.

8.4.5.3. Sound Level Variability

The central block of the campus exhibited a significant range in ambient noise levels, fluctuating from a minimum of 75.89 ± 12.67 decibels to a peak of 228.83 ± 14.64 decibels. This pronounced variability is closely correlated with the inconsistent flow of vehicular traffic on the adjacent roadway, suggesting that traffic density plays a pivotal role in influencing auditory conditions in this area. Meanwhile, the front gate of the Science Block maintained a relatively stable noise profile, indicating minimal external disturbances and a more controlled acoustic environment. This steadiness is attributed to limited traffic exposure and effective structural buffering from surrounding noise sources.

8.4.5.4. Contributing factors:

1. Vehicular traffic: Noise from the nearby roads, which varies with vehicular intensities.

2. Construction Activities: Noise from the machinery near the Central Block region, due to the construction activities on an occasional basis, contributes to elevated noise levels

8.4.5.5. Summary

The noise level recording at various parts of the college shows the highest observed noise at the Central Block front gate region, with a maximum of 228.83 ± 14.64 decibels and the lowest is noted at the Science Lab, 66.2 ± 10.30. The main contributing factor is found to be nearness to the roads where the noise intensity is fluctuating based on the vehicular traffic and due to the ongoing construction activities, which are held near the Central Block. It is noted that the reported level exceeds the WHO standards and the Indian National Standards and requires actions to minimise the sound level to an agreeable limit.

The recorded noise levels across different areas of the college campus reveal a clear-cut contrast in sound intensity. The highest level was observed at the Central Block front gate, reaching 228.83 ± 14.64 decibels, while the Science Laboratory registered the lowest at 66.2 ± 10.30 decibels. This variation is primarily attributed to the nearness of certain zones to busy roads, where vehicular traffic causes fluctuating noise levels throughout the day. Ongoing construction activities near the Central Block have significantly contributed to the elevated sound levels in that region.

The measured values surpass the permissible limits set by both the World Health Organisation (WHO) and the Indian National Standards, indicating a concern for environmental and auditory health. Immediate steps are necessary to reduce the noise to acceptable levels. These may include installing sound barriers, regulating traffic flow near sensitive zones, rescheduling construction work to quieter hours, utilising the space for trees and shrubs to act as a buffer to reduce the potential of sound levels and conducting regular noise monitoring to ensure compliance with safety standards.

8.5. CONCLUSION

- The institution demonstrates its commitment to ensuring the safety and well-being of its students and staff through a series of well-defined protocols and support systems. The adherence to lab safety protocols, provision of first aid resources, and the establishment of a mini-hospital facility are critical elements that facilitate prompt medical responses. The proactive management of health standards, including food safety in the canteen, regular water quality assessments, and systems for addressing disease outbreaks, is a testament to the college's dedication to maintaining a safe learning environment. Health resources are effectively distributed across the three campus blocks; there remains a necessity to introduce a centralised access system to improve the efficiency of medical assistance across all areas. This holistic approach not only promotes personal safety and accountability but also fosters an atmosphere of well-being conducive to academic success. Evaluations and adaptations of these strategies will be essential to address any emerging health and safety concerns, ensuring a consistently safe campus for everyone.

- The institution is to maintain a safe and accountable environment through thorough documentation of incidents and actions taken. The existence of safety and incident registers ensures transparency and facilitates ongoing improvements to the health and safety management system. A significant concern remains regarding the lack of emergency exits in the Science block, which poses a potential safety risk given its single point of access. The current emergency communication strategies, including announcements and digital notifications through departmental channels, demonstrate an effective approach to keeping the college community informed during critical situations. The active involvement of the National Service Scheme (NSS) and National Cadet Corps (NCC) plays a vital role in managing emergencies, providing essential supplies, and supporting both the college and local community. Moving forward, addressing the identified gap in emergency exits while continuing to leverage these strengths will further enhance the overall safety and preparedness of the institution. The laboratory is well-equipped for safety, featuring a fire extinguisher for immediate response to fires and safety devices like circuit breakers to prevent electrical shocks and damage during practical work. Signage is prominently displayed to emphasise the necessity of wearing personal protective equipment. Biomaterials and consumables are safely discarded in a soap solution rinse, with all glassware and pipette tips autoclaved post-immunology sessions to neutralise biological residues and minimise contamination risks. Chemical handling follows systematic management protocols to avoid excessive use by non-teaching staff, incorporating micro-scaled analysis. The college has also entered a Memorandum of Understanding (MoU) with an agency for the treatment of chemicals and grey water, which is processed through thermal heating and converted into solid form for further management. The electrical distribution system undergoes regular inspections to identify and rectify hazards such as improper earthing and unbalanced loads, ensuring both safety and optimal equipment performance. Emergency exits are available in the Main Campus and the newly built Central and Centenary Blocks, contributing to a comprehensive safety infrastructure.

- The institution demonstrates a strong commitment to fostering a safe, inclusive, and healthy environment for its students, staff, and the broader community. Through proactive initiatives such as regular assessments of water safety, the establishment of an Anti-Ragging Cell, and dedicated support services like the women's cell and Jeevani Mental Health Program, the college prioritizes the well-being and security of its constituents. Comprehensive training programs covering first aid, safety protocols, and mental health awareness, coupled with community service initiatives and sports facilities, contribute to a well-rounded and engaging campus experience. Nurturing a culture of respect, responsibility, and physical well-being, the college not only enhances student life but also cultivates a sense of social responsibility and community engagement that prepares students to become conscientious citizens. The holistic approach taken by the institution in addressing health, safety, and social concerns establishes a positive and supportive academic atmosphere conducive to personal growth and academic success.

- The institution has implemented a comprehensive approach to ensure the safety and well-being of all its campus users. Through vigilant monitoring of electrical installations and the proactive management of potential hazards in laboratories, the risk of accidents is significantly minimised. The occupational health and safety (OHS) measures, including the presence of security personnel and traffic management strategies, contribute to a secure environment for both pedestrians and vehicles. Recognizing the limitations posed by space constraints, the institution suggests practical solutions such as painted floor markings and standardised signage to enhance navigation and safety. Maintaining water quality through rigorous filtering, regular chlorination, and scheduled cleaning signifies a dedication to public health. Collectively, these initiatives reflect a strong commitment to fostering a safe, efficient, and health-conscious campus, ensuring a positive experience for students, faculty, and visitors alike.

- The campus is dedicated to creating an inclusive and accessible environment for all individuals, particularly those with disabilities. Through the thoughtful implementation of infrastructure such as ramps, wide doors, and elevators, coupled with accessible signage and support services, the institution actively promotes equitable access to educational resources and facilities. The systematic approach to examining accommodations ensures that students with diverse needs are supported throughout their academic journey, reflecting a genuine commitment to student welfare. The collaboration between faculty, support staff, and student volunteers highlights the community's shared responsibility in fostering an environment conducive to learning for everyone. This comprehensive framework exemplifies the institution's mission to break down barriers and empower all students, reinforcing a culture of inclusivity and support within the campus community.

- The noise level assessment across the college campus highlights significant discrepancies in sound intensity, which need urgent attention to address the elevated noise levels, particularly at the Central Block front gate, where measurements reached an alarming 228.83 ± 14.64 decibels. This level not only surpasses WHO standards and Indian National Standards but also poses potential health risks to students and staff. The observed variations in noise levels can be attributed primarily to proximity to busy roads and the impact of ongoing construction activities, which compound the issue. Measures must be implemented promptly to mitigate these noise disturbances, ensuring a conducive learning environment and prioritizing the well-being of the college community. Engaging in effective noise management strategies will be essential in maintaining a peaceful atmosphere conducive to education and productivity.

8.6. RECOMMENDATION

- Ensure Water Purity: It is imperative to rigorously adhere to the corrective chlorination and remediation protocols. Additionally, conducting follow-up water quality analyses is essential to verify the complete eradication of E. coli and to safeguard the long-term safety of our water supply.

- Strengthen Communication Channels: In alignment with recommendations, it is important to prominently display emergency contact information on the institutional website and in student handbooks, ensuring easy and universal access for all community members.

- Pedestrian Walking Facilities: Currently, there are no designated pedestrian walking facilities or restrictions on vehicular traffic within the campus. Due to spatial constraints, formal construction of such facilities is not feasible; therefore, we recommend marking the existing floor area with standard signage to effectively communicate this message.

- Targeted Improvements: Some areas of the college remain under construction. The authorities need to coordinate with the contractor to communicate the necessary rules and regulations for visitors. Furthermore, caution signs should be strategically placed in high-risk areas near pedestrian pathways to enhance safety.

- Occupational Health and Safety System: The recent audit emphasized the critical need for a comprehensive Occupational Health and Safety (OHS) management system. In response, the institution has established and implemented a foundational framework that systematically addresses emergency preparedness, response, and crisis management, encompassing physical, chemical, biological, and psychological hazards. The institution remains dedicated to the continuous improvement of this system, proactively adapting to emerging requirements to ensure the ongoing safety and inclusivity of the campus community.

- As per the guidelines set forth by the Indian Road Congress (IRC), planning and design standards for facilities such as zebra crossings and signage are essential to enhance pedestrian safety. The Motor Vehicles Act of 2017 mandates that drivers give way to pedestrians, underscoring the importance of their safety on the roads. The area connecting the main campus to the other two campuses experiences heavy traffic congestion, despite being a one-way street, and noise pollution is a significant concern. To address these issues, recommend advocating for the installation of zebra crossings and "Go Glow" standard boards, along with the implementation of a sound limit zone. The pedestrian walkway alongside the canal, located opposite the college building, is equipped with fencing to enhance safety. However, it requires regular maintenance by either the college or the local authority, or preferably both, to remove weeds and ensure the flooring is in good condition. Signage will be beneficial to encourage users to utilise the walkway effectively

8.7. OCCUPATIONAL HEALTH AND SAFETY PLAN

8.7.1. Occupational Health and Safety Management Committee Team

The Occupational Health and Safety (OHS) Committee is constituted with faculty members, administrative staff, and student representatives. This team collaborates with the Internal Quality Assurance Cell (IQAC) to oversee health and safety compliance. Regular meetings are scheduled to evaluate and improve the effectiveness of health and safety measures.

8.7.2.Objectives

- Ensure compliance with ISO 45001:2018 and national safety standards
- Promote a safe and healthy campus for all stakeholders
- Increase awareness of health, hygiene, and mental well-being
- Reduce safety risks and respond effectively to emergencies
- Foster a culture of proactive safety through training and counselling support

8.7.3.Implement Strategies to Accomplish the Objectives

- Safety Drills and Emergency Preparedness: Regularly conduct fire drills, first-aid demonstrations, and chemical safety training, especially in labs and workshops.
- Risk Monitoring and Record Management: Perform periodic inspections of registers, safety logs, and maintenance reports to identify recurring issues and preventive actions.
- Student Participation: Organize awareness campaigns such as "No Vehicle Day," "Dry Day," and "Health Week" to encourage student leadership and responsibility in safety practices.
- Mental Health Services: Provide easy access to qualified counsellors and schedule awareness programs on emotional well-being, stress management, and coping mechanisms.
- Transparency and Accountability: Keep registers and logs (medical, food safety, first-aid, visitor logs) updated and reviewed bi-monthly to ensure accountability.

8.7.4.Establish effective Communication channel and oversight authority

- Multi-Channel Communication: Urgent and routine safety-related information is shared through official WhatsApp groups, emails, and announcements on departmental notice boards.
- Faculty Oversight: Class teachers and Heads of Departments are responsible for ensuring that information reaches every student and, where necessary, their parents.
- Assigned Roles: Committee members have designated monitoring responsibilities for specific safety areas (labs, hostel, kitchen, classrooms).
- Reporting Protocol: All department heads are required to submit reports to the IQAC for review and institutional documentation at the end of each semester.

8.7.5 Set Short-Term and Long-Term Targets

Short-Term Goals:

- Replace expired medical supplies in the first-aid kits across campus.
- Install and update safety signage in critical areas such as staircases, laboratories, and power rooms.
- Conduct mental health awareness workshops prior to exam seasons.

Long-Term Goals:

- Strengthen infrastructure to ensure full accessibility for differently-abled individuals, including ramps, railings, and tactile paths.
- Integrate OHS orientation into the college induction programs for new students, faculty, and staff.
- Maintain a zero-major-incident policy across all departments through risk prevention and early intervention strategies.
- Develop a comprehensive Traffic Management and Pedestrian Safety Plan to reduce vehicular congestion and ensure safe pedestrian movement within the campus. This includes:
- Designating vehicle-free zones.
- Creating clearly marked pedestrian pathways.
- Installing additional signage and speed-control measures.
- Introducing regulated parking zones to prevent overcrowding.
- Promoting alternative modes of transport like bicycles or shared electric vehicles.

8.7.6 Implement ongoing Monitoring and refinement mechanism :

- Medical registers, first-aid logs, and incident reports are checked every two months to ensure accuracy and completeness.
- Feedback forms on mental health and counselling services are distributed anonymously to gather genuine responses and improve service delivery.
- Safety audits are conducted periodically in labs, kitchens, and hostels, with special attention to high-risk areas like electrical points and gas lines.
- All committee action reports are analysed and reflected in policy updates, ensuring practices evolve based on ground realities.

8.7.7.Conclude with a Comprehensive Evaluation and Follow-up Procedure

At the end of each semester, the OHS Committee conducts a thorough review of:

- All incidents and the corresponding follow-up actions.
- Effectiveness of training programs and awareness campaigns.
- Progress towards short-term and long-term targets.

A detailed report is compiled and submitted to the Principal and IQAC. In the case of policy violations, the committee collects documented evidence and refers it to the Principal for disciplinary action in alignment with institutional policies. The committee also ensures that minor violations are addressed through awareness sessions and counselling before escalating to punitive measures.

8.7.8.Conclusion:

St. Teresa's College remains committed to creating a safe and supportive environment for its students, faculty, and staff. Through robust planning, regular assessment, and a dedicated OHS team, the institution upholds its responsibility toward well-being and sustainable campus living.

8.8.ACTIVITES CONDUCTED

Sneha sparsham mega medical camp

Sneha Sparsham Mega medical camp is an initiative held at Bolgatty event centre on 3rd Sep, 2024 in Mulavukad Panchayath.A major highlight of the camp was empowering communities through Nutrition Counselling and Education by Food Science and Nutrition Students of the Department of Home Science. This initiative aimed to promote healthy eating habits, raise awareness about nutritional deficiencies, and provide personalized guidance to individuals from diverse backgrounds. Students prepared engaging educational materials, including wax models, danglers and working models. They conducted individualized dietary assessments and provided personalized guidance on healthy meal planning, portion control, and mindful eating.Addressed specific nutritional concerns, such as diabetes management, weight management, and pediatric nutrition.

A counseling counter for students with learning Disability was also organized by MSc Child Development Specialization along with an experienced Learning Disability Specialist.About 20 students were identified with learning disability for further support programme. The initiative reached over 1500 individuals, including children, adults, and elderly persons. Participants expressed gratitude for the valuable insights and practical tips received, which empowered them to make informed food choices. The students' enthusiasm, empathy, and expertise created a supportive environment, fostering a positive impact on the community's nutritional awareness and behaviours. This initiative served as a model for future community outreach programs, highlighting the significance of collaborative efforts between academic institutions, healthcare professionals, and community leaders in promoting public health and wellbeing. The camp had Allopathy Doctors, Homeo Doctors and Ayurveda Doctor A counseling counter for students with learning Disability was also organized by MSc Child Development Specialization along with an experienced Learning Disability Specialist.About 20 students were identified with learning disability for further support programme.They covered various segments including Eye support from Vasan Eye Hospital, Medical lab support from Key Hole Clinic, Aster Doctors for Consultation, Family and Community Health Centre Pharmacy for Free medication.

Awareness session on cyber security

This session on cyber security was conducted at St Mary's High School ,Vallarpadam for students of class 8, 9 and 10 each with three divisions. The main aim of this session was to provide the students with information about cyber-attacks and their various types. We believe this session was truly informative and useful to all the students present. Speakers of this session include Archana B Raj, Liyan Abraham, Malavika V, Anupama Rajendran, Meenakshi Lalji, Nivea Ann Sebi, and Nithya R Nair (Students of BCA (CT &ISM), St.Teresa's College (Autonomous), Ernakulam).

Students typically gain a foundational understanding of online safety, learning about key topics such as password security, safe browsing habits, the dangers of phishing, and the importance of privacy on social media. The session fosters awareness among young students about the potential risks associated with internet use and provides them with practical strategies to protect themselves online. Additionally, the peer-led format encourages engagement and helps bridge the gap between theoretical knowledge and real-world application, leaving students more confident and vigilant in navigating the digital world.

8.9.SUMMARY

- The Central Block of the campus demonstrated the highest ambient noise levels, with a maximum recorded peak of 228.83 ± 14.64 decibels, significantly exceeding the World Health Organisation's recommended sound pressure level, which indicates that external sources should not surpass 55 dB.

- Colleges implement a comprehensive system designed to ensure the safety and security of the college community, encompassing mental and physical well-being, emergency measures, medical assistance, and psychosocial support, aimed at fostering a better academic and work environment.

Chapter IX

CARBON FOOT PRINT : AUDIT REPORT

TIES

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM

ST. TERESA'S COLLEGE (AUTONOMOUS) ESTD 1925

> Sustainable Development is the pathway
> to the future we want for all it offers
> a framework to generate economic growth
> achieve social justice, exercise, environmental
> stewardship, and strengthen governance

- Ban Ki - Moon

EXECUTIVE SUMMARY

This report presents a comprehensive carbon footprint assessment for St. Teresa's College, Ernakulam, for the most recent reporting year. The analysis adheres to the internationally recognised Greenhouse Gas (GHG) Protocol Corporate Standard, quantifying emissions across Scope 1 (direct), Scope 2 (indirect - energy), and Scope 3 (indirect - value chain) categories. The primary objective is to establish a robust emissions baseline, identify key sources of environmental impact, and provide strategic, data-driven recommendations to guide the college towards its sustainability goals.

The total gross emissions for St. Teresa's College were calculated to be 1,118.84 tonnes of carbon dioxide equivalent (tCO_2e). The largest contributor to this footprint is Scope 3 emissions, primarily driven by the significant energy intensity of water consumption, followed by Scope 2 emissions from purchased electricity. The campus's vibrant biodiversity, particularly its 229 trees, provides a valuable ecological service by sequestering an estimated 51.98 tCO_2e annually.

After accounting for this biogenic carbon removal, the net institutional carbon footprint is 1,066.86 tCO_2e per year. Based on a total campus population of 4,284 individuals (students and staff), the per capita carbon footprint is 0.25 tCO_2e.

The distribution of emissions by source is illustrated below:

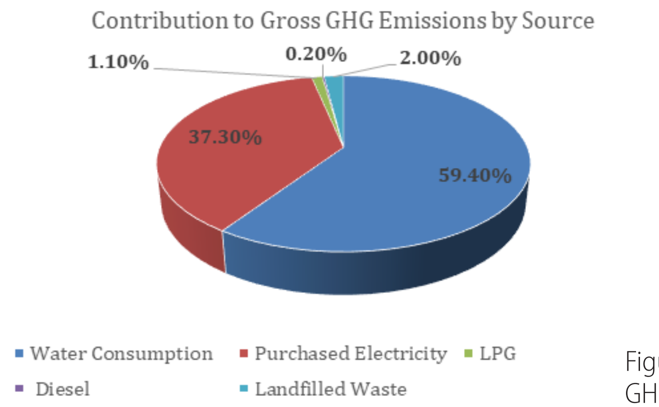


Figure 1: Contribution to Gross GHG Emissions by Source

Key strategic recommendations derived from this analysis include:

1. **Prioritize Water and Energy Data Integrity:** The most critical immediate action is to address significant discrepancies in water and energy metering. A comprehensive audit of the water metering system, particularly in the Science Block, is imperative to mitigate potential financial losses from leaks or billing errors. Similarly, establishing a centralised energy data management system will enhance accuracy and operational oversight.
2. **Expand On-Site Renewable Energy Generation:** While the existing solar infrastructure is commendable, it offsets only a fraction of the college's gross electricity consumption. A feasibility study for expanding solar capacity should be commissioned with the goal of significantly reducing reliance on grid electricity, the second-largest emissions source.
3. **Implement a Circular Waste Management Strategy:** The analysis reveals that biodegradable waste (paper, food, and bio-waste) sent to landfills is a notable source of methane emissions. The college should enhance its waste segregation program to divert 100% of this organic stream to the existing biogas plant or a new composting system, transforming a waste liability into a resource.
4. **Formalise a Carbon Neutrality Roadmap:** Using this report as a baseline, the college administration should establish a formal, science-based target for achieving institutional carbon neutrality, aligning with the Government of Kerala's ambitious climate goals.

This assessment provides St. Teresa's College with the foundational data necessary to embark on a structured and impactful sustainability journey, reinforcing its role as a leader in environmental stewardship within the higher education sector.

9.1. INTRODUCTION: FRAMEWORK FOR INSTITUTIONAL CARBON ACCOUNTING

9.1.1 The Imperative for Climate Action in Higher Education

Institutions of higher education hold a unique and influential position in society. As centres of research, innovation, and the cultivation of future leaders, they have a profound responsibility to model the principles of sustainability and environmental stewardship. For St. Teresa's College, an institution with a long history of academic excellence, undertaking a comprehensive carbon footprint analysis is more than a technical exercise; it is a strategic imperative. This process provides a quantitative foundation for enhancing operational efficiency, reducing long-term energy costs, and mitigating institutional risk associated with a changing climate and evolving regulations. Furthermore, it offers a powerful pedagogical tool, transforming the campus into a "living laboratory" where students can engage directly with real-world sustainability challenges. By transparently measuring and managing its environmental impact, the college demonstrates leadership, strengthens its reputation, and aligns its operations with the core educational mission of preparing students for a complex and sustainable future.

9.1.2 Methodological Approach: The GHG Protocol

To ensure a credible, consistent, and internationally comparable assessment, this report utilises the framework established by the Greenhouse Gas (GHG) Protocol Corporate Standard. This standard is the global benchmark for carbon accounting and reporting, categorizing an organisation's emissions into three distinct "scopes". This structured approach prevents double-counting and provides clarity on which emissions an organisation has direct control over versus those it influences through its value chain.

- **Scope 1: Direct Emissions**
  These are direct GHG emissions that occur from sources owned or controlled by the institution. They result from the on-site combustion of fossil fuels.

For St. Teresa's College, this includes emissions from the burning of Liquefied Petroleum Gas (LPG) in canteens and laboratories and the combustion of diesel in the backup power generator.2

- **Scope 2: Indirect Emissions from Purchased Energy**
  These are indirect emissions generated during the production of purchased energy. While these emissions occur at the power plant, they are a direct result of the college's energy consumption. This scope is primarily composed of emissions associated with the electricity purchased from the Kerala State Electricity Board (KSEB) grid.2

- **Scope 3: Other Indirect Emissions (Value Chain)**
  This is a broad category encompassing all other indirect emissions that occur in the college's value chain as a consequence of its activities, but from sources not owned or controlled by the college. For many organisations, Scope 3 emissions represent the largest portion of their carbon footprint.1 Based on the available data, this report quantifies two key Scope 3 categories:

  1. **Waste Generated in Operations:** Emissions, primarily methane, from the decomposition of college-generated solid waste disposed of in landfills.
  2. **Upstream Energy for Water:** Emissions associated with the energy required to extract, treat, and pump the water consumed by the college.

9.1.3 Data Sources, Assumptions, and Key Parameters

The calculations within this report are based on a combination of primary data provided by St. Teresa's College from its internal audits and secondary data from authoritative sources for emission factors and scientific constants. All assumptions made to address data gaps or inconsistencies are explicitly stated to ensure transparency and replicability. The key parameters, conversion factors, and constants used throughout this analysis are consolidated in Table 1 below.

Parameter / Factor	Value	Unit	Source / Justification
Global Warming Potential (GWP), 100-year			
Methane (CH_4)	28	tCO_2e / tCH_4	IPCC Fifth Assessment Report (AR5)
Electricity Emission Factor			
India Grid (Combined Margin, FY 2023-24)	0.000757	tCO_2e /kWh	Central Electricity Authority (CEA)
Scope 1 Emission Factors			
Liquefied Petroleum Gas (LPG)	2.9846	kg CO_2e / kg	Climatiq / CBAM
Diesel (for Stationary Combustion)	2.653	kg CO_2e / litre	GHG Protocol
Scope 3 Emission Factors & Parameters			
Energy Intensity of Urban Water Supply	0.7	kWh / m^3	Estimate based on Indian studies
Degradable Organic Carbon (DOC) - Paper	0.40	fraction	IPCC 2006 Guidelines
Degradable Organic Carbon (DOC) - Food/Bio-waste	0.15	fraction	IPCC 2006 Guidelines

Methane Correction Factor (MCF) - Unmanaged, Shallow	0.4	fraction	IPCC 2006 Guidelines
Fraction of DOC Dissimilated (DOCf)	0.5	fraction	IPCC 2006 Guidelines
Fraction of CH_4 in Landfill Gas (F)	0.5	fraction	IPCC 2006 Guidelines
Carbon Sequestration			
Average Sequestration Rate per Tree	0.227	tCO_2 / tree / year	Derived from Western Ghats study

Table 9.1: Key Parameters, Emission Factors, and Constants Used in the Assessment

9.2: ANALYSIS OF DIRECT EMISSIONS (SCOPE 1)

Scope 1 emissions are those generated directly on the college campus from the combustion of fossil fuels. The data provided allows for the quantification of emissions from two primary sources: Liquefied Petroleum Gas (LPG) and diesel fuel.

9.2.1 Emissions from Liquefied Petroleum Gas (LPG) Consumption

LPG is a key energy source for the college, utilised in canteens for cooking and in various laboratories for experimental purposes. The precise tracking of its consumption is a positive indicator of the college's resource management capabilities.

- **Activity Data:** The college reports an annual consumption of 4,089.6 kg of LPG.
- **Emission Factor:** The emission factor for LPG is 2.9846 kg CO_2e per kg. This factor accounts for the carbon dioxide equivalent emissions from the complete combustion of the fuel.
- **Calculation:** The total annual emissions from LPG are calculated as follows:
  LPG Emissions (tCO_2e) = [Annual LPG Consumption (kg) × Emission Factor (kg CO_2e/kg)] / 1000 (kg/t)

  LPG Emissions (tCO_2e) = [4,089.6 kg × 2.9846 kg CO_2e/kg] / 1000 = 12.20 tCO_2e
- **Analysis:** The annual emissions from LPG consumption amount to 12.20 tCO_2e. The fact that the college has already identified the potential for implementing biomass energy solutions indicates a strategic awareness of this emission source. This presents a clear and actionable pathway for reducing Scope 1 emissions, directly aligning with the institution's forward-thinking approach to sustainability. A formalised plan to transition away from this fossil fuel would be a significant step in the college's decarbonization journey.

9.2.2 Emissions from Diesel Fuel Consumption

Diesel fuel is used to power the on-campus Diesel Generator (DG) set, which serves as a critical backup during periods of grid power failure. Quantifying these emissions is essential for a complete Scope 1 inventory.

- **Activity Data:** The data provided states that "approximately 900 litres of diesel have been purchased." The use of an approximation highlights a gap in precise fuel monitoring.
- **Emission Factor:** The standard emission factor for diesel fuel used in stationary combustion is 2.653 kg CO_2e per litre.
- **Calculation:** The total annual emissions from diesel consumption are calculated as:
  Diesel Emissions (tCO_2e) = / 1000 (kg/t)

  Diesel Emissions (tCO_2e) = [900 litres × 2.653 kg CO_2e/litre] / 1000 = 2.39 tCO_2e
- **Analysis:** The estimated annual emissions from the DG set are 2.39 tCO_2e. The lack of precise

consumption data is a noteworthy finding. This is not merely a record-keeping issue but points to a potential operational and strategic vulnerability. Backup generators are essential for institutional resilience, particularly as climate change may increase the frequency of extreme weather events and potential grid instability. Without accurate fuel consumption data, the college cannot effectively budget for extended outages, assess the true environmental cost of grid failures, or accurately track its Scope 1 emissions. The installation of a simple, inexpensive fuel flow meter on the DG set is a critical and immediate recommendation to close this data gap and enhance both environmental accounting and operational preparedness.

9.3: ANALYSIS OF INDIRECT EMISSIONS FROM ENERGY PURCHASE (SCOPE 2)

Scope 2 emissions, which arise from the generation of purchased electricity, typically constitute the largest share of an educational institution's carbon footprint. This section analyses the college's electricity consumption, reconciles conflicting data sources, and quantifies the net emissions after accounting for the significant contribution of its on-site solar power generation.

9.3.1 Establishing a Baseline for Grid Electricity Consumption

A critical first step in calculating Scope 2 emissions is to establish a reliable figure for total annual electricity consumption. The provided data includes four different values, necessitating a careful reconciliation to select the most defensible baseline.

- **Data Reconciliation:** The four figures provided are:
  1. 111,653.40 kWh (from Infrastructure assessment)
  2. 11,640.00 kWh (from Mandatory Audit, noted as "total annual imported energy")
  3. 601,459.00 kWh (from KSEB Bill analysis)
  4. 78,184,076.70 kWh (from Energy Meter Reading Sample Study)
- **Justification for Selection:** The figure of 601,459.00 kWh derived from the "KSEB Bill analysis" is selected as the most robust and accurate representation of the college's gross annual electricity consumption from the grid. The rationale for this selection is as follows:
  - Utility bills (KSEB) represent an official, third-party, financially audited record of energy purchased over a full annual cycle. This makes them the gold standard for this type of analysis.
  - The "Infrastructure assessment" figure is likely a theoretical calculation based on the connected load of equipment rather than actual usage.
  - The "Mandatory Audit" figure of 11,640 kWh is explicitly defined as "imported energy." This strongly suggests it is a net consumption figure (imports minus exports), not the gross consumption needed for a full accounting.
  - The "Energy Meter Reading Sample Study" figure of over 78 million kWh is orders of magnitude larger than the others and is unequivocally an error, likely stemming from a unit conversion mistake (e.g., reporting in Joules or Watt-hours instead of kWh) or a misplaced decimal point.

This significant discrepancy among data sources underscores a critical operational need for the college to establish a centralised and verified energy data management system to ensure consistency and accuracy in future reporting and management efforts.

9.3.2 Calculating Net Electricity Consumption and the Impact of Solar Generation

St. Teresa's College has made a substantial investment in renewable energy with a total of 170 kW of on-grid solar capacity. This system not only reduces the electricity purchased from the grid but also exports surplus clean energy, benefiting the wider community.

- **On-Site Generation and Export:** The data indicates that the solar plants generate a significant amount of power, with a "total annual exported energy" of 52,680 kWh.

- **Net Consumption Calculation:** Scope 2 emissions are calculated based on the net amount of electricity the college purchases from the grid. This is determined by subtracting the exported solar energy from the gross consumption figure established above.
  Net Grid Consumption = Gross Consumption (from KSEB) - Exported Solar Energy
  Net Grid Consumption = 601,459 kWh - 52,680 kWh = 548,779 kWh
  This net figure of 548,779 kWh serves as the activity data for the Scope 2 emissions calculation.

9.3.3 Application of the Grid Emission Factor

The carbon intensity of the electricity consumed is determined by the emission factor of the regional grid from which it is drawn.

- **Emission Factor Selection:** The most current and appropriate factor for this analysis is the Combined Margin (CM) emission factor for the Indian national grid for the fiscal year 2023-24. This factor is 0.757 tCO_2/MWh, which is equivalent to 0.000757 tCO_2/kWh. The Combined Margin factor is the recommended metric as it blends the emissions from existing power plants (Operating Margin) with those of the most recently added power plants (Build Margin), providing a more dynamic and accurate picture of the grid's carbon intensity.

- **Calculation:** The total Scope 2 emissions are calculated by multiplying the net grid consumption by the grid emission factor.

  Scope 2 Emissions (tCO_2e) = Net Grid Consumption (kWh) × Grid Emission Factor (tCO_2/kWh)
  Scope 2 Emissions (tCO_2e) = 548,779 kWh × 0.000757 tCO_2/kWh = 415.42 tCO_2e

- **Analysis:** The college's annual Scope 2 emissions are 415.42 tCO_2e. It is crucial to recognize the dual benefit of the solar installation. Beyond reducing the college's own carbon footprint, the 52,680 kWh of exported clean energy actively displaces fossil fuel-generated power on the Keralan grid. This amount of electricity is sufficient to power approximately 44 average Indian urban households for an entire year. This transforms the college's role from that of a passive energy consumer to an active producer and a vital contributor to the regional energy transition. This narrative of community benefit is a powerful asset for the college's reputation and stakeholder engagement.

9.4: ANALYSIS OF VALUE CHAIN EMISSIONS (SCOPE 3)

Scope 3 emissions encompass the indirect environmental impacts that occur within an organisation's value chain. This section quantifies emissions from two significant sources for St. Teresa's College: the disposal of campus-generated waste and the energy embedded in its water supply.

9.4.1 Emissions from Waste Management

Solid waste disposed of in landfills undergoes anaerobic decomposition, a process that generates methane (CH_4), a potent greenhouse gas with a global warming potential 28 times that of carbon dioxide over a 100-year period.

- **Methodology:** The emissions from landfilled waste are calculated using the IPCC's Mass Balance (Default) Method. This approach provides a robust estimate of the total methane that will be generated over the lifetime of the waste deposited in a single year.

- **Activity Data:** The college has provided a detailed breakdown of its annual waste generation. For this calculation, only the biodegradable components sent to landfill are considered.
  - Paper Waste : 36,565.91 kg
  - Bio-waste : 8,953.44 kg
  - Food Waste : 1,575.94 kg (calculated as 705.00 kg + 165.94 kg + 705.00 kg)
  - Total Biodegradable Waste to Landfill: 36,565.91 + 8,953.44 + 1,575.94 = 47,095.29 kg or 47.10 tonnes.

  (Note: Plastic waste is considered largely inert in a landfill context and does not contribute significantly to methane generation.)

- **Calculation Parameters:**
  - Degradable Organic Carbon (DOC): The specific DOC content of the college's waste stream is calculated as a weighted average using IPCC default values.
    - Fraction of Paper : 36,565.91 / 47,095.29 = 0.776
    - Fraction of Food/Bio-waste : (8,953.44 + 1,575.94) / 47,095.29 = 0.224
    - DOC = (0.776 \times 0.40) + (0.224 \times 0.15) = 0.3104 + 0.0336 = 0.344
  - Methane Correction Factor (MCF): A value of 0.4 is used. This is the IPCC default for unmanaged, shallow (<5m deep) landfills, which is a conservative and appropriate assumption for typical municipal dumpsites in the region.
  - Other IPCC Defaults: Fraction of DOC Dissimilated (DOC_f) = 0.5; Fraction of CH_4 in Landfill Gas (F) = 0.5.
- **Calculation:**
  1. Methane Generation Potential (tCH_4):
     CH_4 (t) = (Waste (t) × DOC × DOCf × F × 16/12) × MCF
     CH_4 (t) = (47.10 × 0.344 × 0.5 × 0.5 × 1.333) × 0.4 = 2.16 tCH_4
  2. Total Waste Emissions (tCO_2e):
     Emissions (tCO_2e) = CH_4 (t) × GWP of CH_4
     Emissions (tCO_2e) = 2.16 × 28 = 22.18 tCO_2e
- **Analysis:** The annual Scope 3 emissions from landfilled waste are estimated to be 22.18 tCO_2e. A key finding from the data is that the college generates more paper waste (36.6 tonnes) than plastic waste (34.1 tonnes). While public awareness campaigns often focus on the visible pollution caused by plastics, this analysis reveals that from a climate change perspective, the decomposition of paper in landfills is a more significant issue for the institution due to its methane generation potential. This suggests that a sustainability strategy prioritising paper reduction (e.g., promoting digital workflows, enforcing double-sided printing) could yield greater GHG emission reductions than one focused solely on plastics.

9.4.2 Emissions from Water Consumption and Treatment

The supply of clean water to an urban campus is an energy-intensive process, involving extraction, purification, and extensive pumping. The emissions associated with this energy use are a component of the college's Scope 3 footprint.

- **Data Reconciliation:** The provided water consumption data presents a severe discrepancy. The "Manual discharge study" totals 7,163.4 kL, while the "Water flow meter data" totals 1,391,764.87 kL. The vast majority of the metered value (1,390,870.77 kL) is attributed to the Science Block, a figure that is implausibly high and strongly suggests a malfunctioning meter or a gross error in data recording (e.g., reading litres as kilolitres).
- **Activity Data Selection:** For this report, the total water consumption will be calculated by summing all available data points, resulting in 1,398,928.27 kL (or m^3). This figure is used with the explicit and strong caveat that it is likely inflated due to the erroneous Science Block reading. This data point represents the highest uncertainty in this entire assessment and must be addressed operationally by the college.
- **Energy Intensity Factor:** An energy intensity factor is required to convert water consumption into electricity consumption. Based on studies of Indian urban water systems, which are often reliant on energy-intensive groundwater pumping, a conservative estimate of 0.7 kWh/m^3 is applied.
- **Calculation:**
  1. Total Energy for Water:
     Energy (kWh) = Water Usage (m^3) × Energy Intensity (kWh/m^3)
     Energy (kWh) = 1,398,928.27 m^3 × 0.7 kWh/m^3 = 979,249.79 kWh
  2. Total Water-Related Emissions: This energy consumption is then converted to GHG

emissions using the same grid emission factor as in Scope 2.
Emissions (tCO_2e) = Energy (kWh) × Grid Emission Factor (tCO_2/kWh)
Emissions (tCO_2e) = 979,249.79 kWh × 0.000757 tCO_2/kWh = 664.44 tCO_2e

- **Analysis:** The estimated annual emissions from water consumption are 664.44 tCO_2e. The extreme discrepancy between the manual audit and the electronic meter data is the most critical operational finding of this report. It moves beyond a simple carbon accounting challenge and points to a systemic failure in resource management. This single data point suggests the college could be facing enormous financial exposure through undetected major water leaks or significant billing errors. The carbon footprint calculation, therefore, acts as a powerful diagnostic tool, uncovering a potentially severe operational and financial risk. An immediate and thorough audit of the campus water infrastructure, starting with the Science Block meter, is the highest priority recommendation.

9.4.3 Avoided Emissions from Transportation Initiatives

The college has actively promoted sustainable transportation, including vehicle sharing and the adoption of electric vehicles (EVs). These efforts result in "avoided emissions."

- Context: The data notes fuel savings of 565,500 L from two-wheeler sharing and 648,000 L from four-wheeler sharing, alongside the use of 13 EVs.
- Accounting Treatment: According to the GHG Protocol, avoided emissions are not subtracted from the primary Scope 1, 2, and 3 inventory total. Doing so would be equivalent to claiming an uncertified offset. However, it is best practice to quantify and report these positive actions separately to provide a complete picture of the institution's environmental performance.
- Limitation and Recommendation: A full Scope 3 inventory of transportation emissions, covering the daily commutes of all students and staff, is beyond the scope of this analysis due to a lack of data. Commuting is often one of the largest sources of emissions for a non-residential campus. Therefore, conducting a comprehensive campus-wide travel survey is strongly recommended as a priority for future sustainability work. This will provide the data needed to develop targeted policies to further reduce transport-related emissions.

9.5. CAMPUS BIODIVERSITY AND CARBON SEQUESTRATION

The green infrastructure of the St. Teresa's College campus, particularly its tree population, provides a vital ecosystem service by absorbing atmospheric carbon dioxide through photosynthesis and storing it as biomass. This process, known as carbon sequestration, creates a natural carbon sink that partially offsets the institution's emissions.

9.5.1. Quantifying the Campus Carbon Sink

This analysis quantifies the annual carbon sequestration provided by the trees on campus.

- **Activity Data:** The college's biodiversity management system report identifies a total of 229 trees within the campus boundaries.
- **Sequestration Rate:** To determine a scientifically credible sequestration rate, data from a study conducted in a comparable ecological zone—the Western Ghats region of Wayanad—was used. This study found that a sample of 610 trees sequestered a total of 138.367 tonnes of CO_2 annually. From this, an average per-tree sequestration rate can be derived.

  Average Sequestration per Tree = Total CO_2 Sequestered (t/year) / Number of Trees
  Average Sequestration per Tree = 138.367 tCO_2/year / 610 trees = 0.227 tCO_2/tree/year

- **Calculation:** The total annual carbon sequestration for the campus is calculated by multiplying the number of trees by this average rate.

  Total Annual Sequestration = Number of Trees × Average Sequestration per Tree
  Total Annual Sequestration = 229 trees × 0.227 tCO_2/tree/year = 51.98 tCO_2

- **Analysis:** The 229 trees on the St. Teresa's College campus act as a valuable carbon sink, removing an estimated 51.98 tonnes of CO_2 from the atmosphere each year. This ecological service also has a potential economic value; based on the voluntary carbon market in India, where prices have ranged from approximately ₹500 to ₹700 per tonne of CO_2, this sequestration could be valued at around ₹31,200 annually. The biodiversity data provides a deeper level of understanding of this asset. The report includes Simpson's Diversity Index values for various plant types, with the index for trees being extremely low at 0.02. A Simpson Index value close to 0 indicates a very high level of species diversity. This suggests that the college's tree population is not a monoculture but a rich and varied collection of different species. Ecologically, high biodiversity enhances the resilience of an ecosystem, making it less vulnerable to pests, diseases, and the stresses of a changing climate. Therefore, the calculated carbon sequestration value is not just an isolated number; it is a co-benefit of a successful and robust biodiversity management strategy that has cultivated a resilient urban ecosystem on campus.

9.6. CONSOLIDATED CARBON BALANCE AND PER CAPITA IMPACT

This section synthesizes the findings from the preceding analyses to present a clear and comprehensive overview of St. Teresa's College's overall climate impact. It establishes the final net institutional carbon footprint and calculates the per capita emissions, providing essential metrics for target setting and benchmarking.

9.6.1 Determining the Campus Population

To calculate the per capita footprint, a definitive figure for the total campus population (students and staff) is required.

- **Data Reconciliation:** The provided research materials contain slightly varying figures for student and staff counts. reports 4,040 students and 199 faculty; reports 4,030 students and 209 teachers; and reports 3,130 students, 187 teaching staff, and 57 non-teaching staff.

- **Justification:** The student and faculty numbers in and are highly consistent. To create the most comprehensive and accurate population figure, the higher student count from will be combined with the detailed staff breakdown from, which includes both teaching and non-teaching personnel.

- **Final Population:**

  Total Population = Students + Teaching Staff + Non-Teaching Staff
  Total Population = 4,040 + 187 + 57 = 4,284 individuals
  A total campus population of 4,284 will be used for all per capita calculations.

9.6.2 Net Institutional Carbon Footprint

The net carbon footprint is the ultimate measure of the college's climate impact, balancing its total emissions with the carbon sequestration provided by its campus greenery. Table 2 provides a detailed breakdown of emissions by source and scope, while Table 3 summarizes the final carbon balance.

Emission Source	GHG Protocol Scope	Activity Data	Emission Factor	Total Emissions (tCO2e)
Scope 1: Direct Emissions				14.59
LPG Consumption	Scope 1	4,089.6 kg	2.9846 kg CO_2e / kg	12.20
Diesel Consumption	Scope 1	900 litres	2.653 kg CO_2e / litre	2.39
Scope 2: Indirect Emissions				415.42
Purchased Electricity	Scope 2	548,779 kWh	0.000757 tCO_2 / kWh	415.42
Scope 3: Indirect Emissions				686.83
Landfilled Waste	Scope 3	47.10 tonnes	(Calculated)	22.18
Water Consumption	Scope 3	1,398,928.27 m^3	(Calculated)	664.44
Total Gross Emissions	Scope 1+2+3			1,118.84

Table 9.2 Annual GHG Emissions by Source and Scope (tCO_2e)

Component	Annual Impact (tCO2e)
Total Gross Emissions (Scope 1 + 2 + 3)	1,118.84
Less: Carbon Sequestration from Campus Trees	-51.98
Net Institutional Carbon Footprint	1,066.86

Table 9.3 Consolidated Carbon Footprint Summary

9.7. PER CAPITA CARBON FOOTPRINT AND BENCHMARKING

The per capita footprint contextualises the institution's overall impact on an individual basis, providing a relatable metric for the campus community.

- **Calculation:**
  Per Capita Footprint = Net Carbon Footprint / Total Campus Population
  Per Capita Footprint = 1,066.86 tCO_2e / 4,284 persons = 0.25 tCO_2e per person

- **Contextualization:** The per capita carbon footprint for St. Teresa's College is 0.25 tCO_2e. This figure can be compared to the average per capita emission for the state of Kerala, which was 0.41 tCO_2e in 2019.[21] While the college's per capita figure is favorably lower, this comparison requires careful interpretation. A state-level average includes the entire populace, including children and rural inhabitants who typically have lower consumption patterns. An institutional footprint, conversely, concentrates the energy-intensive operations of large buildings, laboratories, and infrastructure into a smaller population. The fact that the college's per capita footprint is lower than the state average, despite this concentration of activity, is a testament to the positive impact of its existing sustainability measures, particularly its investment in solar energy.

9.8. STRATEGIC PATHWAYS TO CARBON NEUTRALITY

This report's findings provide a clear, data-driven foundation for St. Teresa's College to develop a strategic and prioritised climate action plan. The following recommendations are structured into immediate, mid-term, and long-term actions to guide the college on a feasible path toward significant emission reductions and eventual carbon neutrality.

Recommendation	Targeted Source/ Scope	Timescale	Est. Impact	Lead Department(s)
Immediate Opportunities (0-12 months)				
Conduct full audit of water metering system	Water (Scope 3)	Short-Term	High	Administration, Facilities Management
Install fuel flow meter on Diesel Generator	Diesel (Scope 1)	Short-Term	Medium	Facilities Management
Launch campus-wide paper reduction campaign	Waste (Scope 3)	Short-Term	Medium	All Departments, Student Affairs
Establish centralized environmental data repository	All Scopes	Short-Term	High	IT Services, Administration
Mid-Term Investments (1-3 years)				
Commission feasibility study for solar capacity expansion	Electricity (Scope 2)	Mid-Term	High	Administration, Finance
Enhance waste segregation to divert all organic waste	Waste (Scope 3)	Mid-Term	Medium	Facilities Management, Canteen
Conduct comprehensive commuter travel survey	Transportation (Scope 3)	Mid-Term	High	Administration, Research Dept.
Plan for phased replacement of inefficient equipment	Electricity (Scope 2)	Mid-Term	Medium	Facilities Management, Finance
Long-Term Vision (3+ years)				

Develop a plan to phase out LPG consumption	LPG (Scope 1)	Long-Term	Medium	Administration, Science Depts.
Set a formal, science-based carbon neutrality target	All Scopes	Long-Term	High	Senior Leadership, Board
Integrate campus sustainability data into curriculum	All Scopes	Long-Term	High	Academic Council, All Depts.

Table 9. 4 Prioritised Recommendations for Emission Reduction

9.7.1 Immediate Opportunities (Low-Cost, High-Impact)

These actions can be implemented within the next year, require minimal capital investment, and focus on rectifying data gaps and leveraging behavioral change.

- **Data Management and Integrity:** The highest priority is to resolve the severe data quality issues identified in this report. An immediate and thorough audit of the campus water metering system, with a focus on the Science Block, is essential to identify potential leaks or billing errors that could represent significant financial waste. Concurrently, installing a fuel flow meter on the DG set and creating a centralized digital repository for all energy, water, fuel, and waste data will provide the accurate, reliable information needed for effective management and future reporting.
- **Behavioral Change Campaigns:** This analysis revealed that paper is a more significant source of GHG emissions than plastic for the college. A targeted campaign to reduce paper consumption through policy changes (e.g., mandatory digital submissions, default double-sided printing) and awareness can yield immediate results. This should be complemented by ongoing energy conservation campaigns to reduce electricity demand.

9.7.2 Mid-Term Investments (Strategic Planning)

These actions require planning and moderate investment, focusing on infrastructure improvements and deeper data collection.

- **Energy Infrastructure:** The college should commission a professional feasibility study to assess options for expanding its on-site solar capacity. The goal should be to offset a much larger percentage of the 601,459-kWh gross annual electricity consumption. A parallel plan should be developed for the phased replacement of older, inefficient equipment (such as pumps, lifts, and air conditioning units) with modern, energy-efficient models.
- **Circular Waste Management:** Building on the insight that over 10,000 kg of food and bio-waste are currently landfilled, the college should upgrade its waste management system to ensure 100% of this organic stream is diverted. This may involve expanding the capacity of the existing biogas plant or establishing a formal campus-wide composting program, thereby turning a waste product into a valuable resource (biogas or soil amendment).
- **Transportation Survey:** To address the largest remaining data gap, the college should design and execute a comprehensive travel survey for all students and staff. This will quantify Scope 3 emissions from commuting and provide the necessary data to develop effective policies, such as promoting public transport, improving cycling infrastructure, or facilitating carpooling.

9.7.3 Long-Term Vision (Transformational Change)

These actions represent a commitment to deep decarbonization and embedding sustainability into the core mission of the college.

- **Fossil Fuel Phase-Out:** The college should develop a long-term strategic plan to completely phase out on-campus fossil fuel use. This would begin with a detailed plan to replace LPG in canteens and labs with a solution like a large-scale biomass gasifier, an expanded biogas system, or electrification, as initially suggested in the college's own audit report.
- **Carbon Neutrality Goal:** Leveraging this report as the official baseline, the senior leadership should establish a formal, public, and science-based target for achieving institutional carbon neutrality by a specific year (e.g., 2040). This ambitious goal would align the college with the climate leadership demonstrated by the Government of Kerala, which aims for state-wide carbon neutrality by 2050.
- **The Campus as a Living Laboratory:** The ultimate step is to fully integrate this sustainability journey into the college's educational mission. The data from this report and from the recommended ongoing monitoring systems should be made available to faculty and students. This would create a powerful "living laboratory" for project-based learning in courses ranging from environmental science and engineering to data analytics, business management, and public policy, ensuring that the next generation of St. Teresa's graduates are equipped to lead in a sustainable world.

9.8. CONCLUSIONS

In conclusion, this audit establishes the net institutional carbon footprint of St. Teresa's College at 1,066.86 tonnes of CO_2e annually, with a per capita footprint of 0.25 tCO_2e. This figure results from gross emissions of 1,118.84 tCO_2e, which are partially offset by the 51.98 tCO_2e sequestered by the campus's vibrant and diverse tree population. The analysis pinpoints the energy intensity of water consumption and purchased electricity as the primary drivers of the college's environmental impact, while also revealing critical operational risks related to data integrity in resource metering.

More than just a static measurement, this report serves as a strategic compass, validating the positive impact of existing solar infrastructure and providing a clear, evidence-based roadmap for future action. The path toward enhanced sustainability is well-defined, prioritising the expansion of renewable energy, the implementation of a circular waste management system, and immediate improvements in data monitoring. By embracing these recommendations, St. Teresa's College can build upon its strong foundation, mitigate operational risks, and solidify its role as a leader in environmental stewardship, transforming its campus into a living model of climate action for its students and the wider community.

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

- Annie Leonardv

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

GENERAL CONCLUSION

10.1 SDG 3 Good Health and Well-being

The Occupational Health and Safety management system, aligned with ISO standards, establishes a comprehensive framework to ensure the safety and security of the college community. As part of this system, maintain an accurate register of available services and document their delivery to meet community needs. Additionally, communicate the availability of these services to the college community and implement them to effectively address emergency risk management, health and environmental concerns, and infrastructure facilities, while providing an inclusive community approach along with psychosocial support.

10.2 SDG 6 Clean Water and Sanitation

The college is equipped with an efficient water storage, infrastructure, and plumbing system designed to meet the water demands of its community. The primary sources of water supply are the public water system and two on-campus wells. Although the college has not experienced any water scarcity, the water management policy and plan emphasise the need for budgeting based on usage patterns. Currently, the college's water consumption exceeds the global standard limits. Plans are underway to integrate water conservation into the academic curriculum while supporting the community through water quality assessments. This initiative aims to promote effective methods for conserving freshwater resources, enhancing practical knowledge, and raising awareness of the importance of freshwater conservation within the college community.

10.3 SDG 7 Affordable and Clean Energy

The Energy Management System (EMS) policy and plan aim to create an efficient framework to achieve sustainability objectives while ensuring compliance with ISO standards. The audit evaluates the college's energy management practices, identifying opportunities for improvement in collaboration with expert agencies and addressing issues related to the electrical systems and safety protocols of the institution. To enhance energy efficiency, the college is actively collaborating with the Bureau of Energy Standards and Electrical Safety. This initiative encompasses upgrading energy conservation infrastructure, integrating renewable energy concepts into the curriculum, promoting the use of star-rated appliances, and partnering with external agencies to access additional expertise and support experiential learning opportunities. Furthermore, initiatives are underway to explore investment opportunities in alternative energy sources, with the ultimate goal of achieving a carbon-neutral campus.

10.4 SDG 12 Responsible Consumption and Production

The college is committed to a comprehensive waste management system, which is implemented through the collaborative efforts of the entire college community, adhering to a stringent green protocol supported by volunteer initiatives. Our primary focus encompasses waste reduction, recycling, and systematic documentation of waste generation. Recently, the college has broadened its efforts by integrating innovative strategies into the waste management framework, thereby enhancing academic development and fostering community engagement through participatory initiatives and a behavior change approach.

10.5 SDG 13 Climate Action & SDG 15 Life on Land

Biodiversity represents a critical area of concern for the institution, particularly due to the constraints imposed by the central urban location, which limits available green spaces. To address this challenge, the college needs to increase its investments in enhancing campus biodiversity and integrating climate resilience practices. Potential initiatives could include a planting campaign focused on shrubs with narrow canopies, alongside the preservation and maintenance of existing trees, to help mitigate the carbon footprint. Currently, the college's annual net institutional carbon footprint stands at 1,066.86 tonnes of CO_2e, translating to a per capita footprint of 0.25 tCO_2e. This figure is derived from gross emissions totalling 1,118.84 tCO_2e, partially offset by the 51.98 tCO_2e sequestered by the diverse tree population. Establishing native plant gardens can foster local ecosystems, enhancing biodiversity while optimising water usage and reducing maintenance needs compared to traditional landscaping. The creation of habitats for local wildlife, such as birdhouses, pollinator gardens, and wetlands, will promote species diversity and bolster ecological health. The development of community gardens and sustainable agricultural programs can also enhance food security, reduce carbon footprints, and further increase local biodiversity. Engaging in research projects aimed at understanding local ecosystems, identifying endangered species, and assessing the impacts of climate change will further reinforce the college’s commitment to biodiversity. Moreover, collaboration with local environmental organisations can advance conservation efforts, including species monitoring and habitat restoration initiatives. By prioritising these strategies, the institution can significantly enhance its biodiversity and resilience in the face of ongoing climate challenges.

GENERAL RECOMMENDATION

- The phased implementation of the Energy Management Plan (EnMS) should incorporate energy conservation measures and advocate for the use of energy-efficient equipment and infrastructure upgrades. Annually, identification and inspection of the earth pit, alternative source energy, and ensuring the safety of the electrical room in compliance with the Bureau of Energy Standards. Additionally, annual risk assessments should be conducted, and findings documented in the Energy Management System (EnMS) plan. Implementation should proceed in phases, with regular internal and external audits systematically conducted to monitor progress and compliance.

- Enhance Information, Education, and Communication (IEC) programs by actively involving all stakeholders, including parents and the local community, to promote resource conservation. Students are encouraged to take the initiative in introducing innovative, cost-effective technologies and mechanisms aimed at energy savings. These initiatives may be integrated into internships, academic projects, or pursued as independent efforts. Colleges should collaborate with other institutions to organise techno-fests, creating opportunities for students to exchange ideas and engage with a diverse range of knowledge, thereby fostering teamwork and innovation. With faculty guidance, students can proactively propose low-cost, innovative technologies and mechanisms that emphasise energy conservation.

- Introduce strategies for water conservation initiatives, such as water budgeting and awareness campaigns, to reduce consumption in areas where usage is notably high. Additionally, increase rainwater harvesting capacity to meet non-potable water requirements. Explore opportunities for research and the implementation of new technologies for quality assessment and treatment of gray water, and develop a comprehensive model for effective water resource management.

- Trees and shrubs should be labelled with QR codes, and informational boards displaying photographs and names of common biodiversity species should be strategically placed throughout the campus. Students, faculty, and staff are encouraged to participate in science projects that monitor biodiversity, such as birdwatching events, insect surveys, and plant identification activities. Additionally, nesting boxes and bird feeders should be installed across campus to support avian species, particularly during nesting seasons and inclement weather. Community involvement in biodiversity conservation can be promoted through outreach programs, volunteer opportunities, and educational workshops. Furthermore, initiating an apiculture project on campus would not only enhance biodiversity but also allow for the production of honey.

- Continue implementing responsible waste management practices while adapting to a comprehensive plan that evolves with emerging strengths and challenges. Regular reviews of the system should be conducted for continuous improvement. E-waste should be segregated every month, and systematic records must be maintained to monitor volumes and ensure proper disposal or recycling. Additionally, ensure the efficient operation of the biogas plant by documenting findings, which will facilitate adjustments to improve sustainable energy practices.

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

THE FEAR OF THE LORD IS THE BEGINNING OF WISDOM
ST. TERESA'S COLLEGE
(AUTONOMOUS)
ESTD 1925

Plans to protect air and water,
wilderness and wildlife
are infact plans to protect man

- Stewart Udall

11

Best practices of Environment Management System

1. SOCIETY OF TERESIANS FOR ENVIRONMENT PROTECTION

STEP is a charitable and literary organization formed by students and faculty of St. Teresa's CollegeErnakulam. It is registered under the Travancore Cochin Literary Scientific & Charitable Societies Registration Act, 1955 (Act XII of 1955) and objectives are to carry on activities for protection and conservation of environment, promote usage of biodegradable products, promote social entrepreneurship among students, provide livelihood to Kudumbasree members etc. All our products are stitched by the Kudumbashree members of the Cochin Corporation. As part of implementing Green Protocol in the college campus, the students are provided an eco-friendly cloth college bag and a cloth carry bag. The cloth bags- Prakriti Bgas and Bhoomithram Sanchis, are bags which serve as an alternative to bags made of rexin and plastic carry bags. The students are also provided with steel cups to make the campus free of plastic and paper cups. The college has also undertaken the 'Ente Haritha Bhavanam' project, brainchild of the District Collector and a joint initiative of Ernakulam District Administration, District Suchitwa Mission and St. Teresa's College, Ernakulam has provided a unique platform for college students to contribute to environmental protection from their own homes. The college is actively involved in other environmental activities promoted by the local government bodies and the students are instrumental in implementing and promoting the activities.

History of STEP

April 2016: Society of Teresians for Environment Protection (STEP) was formed in April 2016 with joint efforts of the Department of Economics, Commerce, Bhoomitra Sena and the Entrepreneurship Development Club (formed in 2010) of St. Teresa's College.

As its first activity, an exhibition and sale of Bhoomitra bags was organized on 7th December 2016 as part of annual Alumni Christmas Sale at St. Teresa's College. In an effort to make the campus plastic-free, the participating stalls were all provided paper bags made by the BMC and STEP members of the college.

December 2017: STEP training center was inaugurated in the Main block of the campus with the joint efforts of Cochin Shipyard Limited and TIECON Kochi.

June 2018: Teresian Innovation and Entrepreneurship Development Cell (IECD)was formed and a Startup Yatra jointly organized by Kerala Startup Mission, Startup India, Invest India and TIBIC on 15th November 2018 at the College.

December 2018: An Innovation and Entrepreneurship Development Centre termed as TIBIC (Teresian Innovation and Business Incubation Centre) was formed in the campus during December 2018 to promote entrepreneurship among girls and women on a wider scale. This is being supported by Kerala Startup Mission, Govt. of Kerala and Kerala State Industries Development Corporation. The Incubation cum TOT (Training of Trainers) center in our institution aims at motivating women who would like to get back into self-employment after critical child rearing stage, as well as the young female graduates to get into business.

- College students are actively engaged in stitching cloth bags, mobile pouches and pencil cases that they sell through STEP's promotional activities. Their latest venture is Changathi Cheppu (reasonably priced pencil pouches). Various committees have also been formed to steer forward the activities.
- Video tutorials with instructions to manufacture the various cloth bags and an awareness documentary on the hazards of plastic waste have been prepared by students and uploaded on the Suchitwa Mission of Kerala website for public access (find links below).
- Students have also trained more than 1000 Kudumbasree members in 80 Panchayats in Ernakulum District and various self-help groups in the other districts of Kerala in stitching such bags. In rural areas, the common strategy is to encourage people to get their own old clothes upcycled into such trendy products at very reasonable rates using the paid services of SHG groups.
- The STEP members of the college have been delivering conference bags, Prakriti bags and Bhoomitra Sanchis for various conferences and seminars conducted at GIFT (Gulati Institute of Finance and Taxation), TIECON, GULATI and several other organisations since 2016.

2.TERESIAN RURAL OUTREACH PROGRAMME (TROP)

As a Participating Institute of Unnat Bharat Abhiyan (UBA) since 2018, the college has taken up the responsibility of uplifting and empowering rural communities in the surrounding areas. The UBA activities of the college reflects its commitment to social responsibility and its efforts to empower rural communities through education, awareness programs, and skill development.

Teresian Rural Outreach Programme (TROP) in College which was implemented in 2009, is an extension activity aimed at reaching out to the marginalized and underprivileged communities. A unique endeavor of the college which empowers students to respond proactively to social concerns and work for the integrity of creation, thereby building a 'Civilization of love' as agents of transformation and development at different levels of life.

The college has adopted six villages - Kunnukara, Njarackal, Cheranalloor, Mulavukad , Kuzhupilly and Kumbalangi and each Panchayat has been allocated to different departments of the college to carry out development activities.

The goal of TROP is to encourage the students to take an active part in helping the marginalized sections of the community. They are given necessary training to impart life skills and the Teresians meet the target group on a regular basis and conduct training sessions. All the departments have adopted areas in the outskirts of Ernakulam including the coastal areas and conduct activities appropriate to their area of specialization. Activities are based on themes like language development, e-governance, environment friendly practices, parenting skills, adolescent counseling, resource management etc. Some of the departmental activities include creation of vegetable garden, crafts from wastes,workshop on waste management and clay modelling,computer literacy program(viyovigyan), developed an interactive webpage(www.ejaaalakam.com), Communication Skill classes , nutrition education, prevention of childhood disabilities, Socio-economic surveys, Mentoring and teaching at special schools and many more.

3.SHUCHITWA MISSION AND OTHER CLEANING INITIATIVES

On behalf of Gandhi Jayanthi sevana varam students of degree first year and teachers were involved in cleanliness drive organized at public park of Kumbalangi panchayat with 35 students ant 2 teachers and roadsides of Mulavukkad panchayath with 72 students and 2 teachers as participants in the drive and it become useful to 1000+ residents of that panchayath . Cleaning and eradication of plastic and paper waste in the surroundings of Hill Palace, Ernakulam by 54 students and 2 teachers. The clean-up was focused on the surroundings of the archaeological site . Beach Cleaning at Elankunnapuzha collected 30 kg of waste from the beach and among them 256 kg were footwear waste. The event raised awareness about marine conservation and contributing to cleaning up the beach environment.

i) REDUCTION IN THE USAGE OF PAPER AND PLASTIC ON THE CAMPUS

Date: Throughout the academic year
Venue: College Campus
Participants: The staff and students

The Bhoomitrasena Club of the college has advocated different measures to implement the reduction of plastic and paper usage on the campus throughout the academic year. The club has encouraged the use of soft-copy brochures as invitations for all the programmes conducted in the college, instead of using printed invitations. All staff and students follow this pattern, and it has reduced the paper usage drastically on the campus.

As it is the centenary year, the college magazine was printed as few as 350 copies, and the rest of the college community will be having the e-copy of the same, decreasing the usage of paper. Another reduction initiative of BMC is when it mandated the students to bind their projects in an eco-friendly way. No plastic covering is allowed for their project work. Also, the number of copies mandated for each student to submit to the college has been reduced to one, still reducing the wastage of paper.

Throughout the year, the BMC has also encouraged the use of biodegradable materials for gift wrapping and decoration for all programmes. No plastic has to be used for such purposes. The students have thus become innovative in finding alternatives themselves. This has reduced the plastic usage.

Additionally, during recent years, the college has been conducting green elections, showing its responsibility towards environmental sustainability. For the election of the college union, under the guidance of the BMC, the college uses only eco-friendly products, thereby reducing plastic usage and paper wastage.

ii) KICK-OFF SESSION FOR USER ACCEPTANCE TESTING (UAT)

Date: 17 October 2024
Venue: Municipal Council Hall
Participants: Ms Amina Parvin E A, Ms Meenakshi M P, and Ms Thanusha Rajpurohith

A kick-off session for the initiation of the User Acceptance Testing (UAT) for the Public Green Open Space Use-Case was held on Thursday, 17 October 2024, at the Municipal Council Hall. The event was jointly organized by C-HED, Kochi Municipal

Corporation (KMC), and GIZ India. The session aimed at officially launching the UAT phase of the project, with various stakeholders in attendance, including representatives from government departments, CDS, students, and the general public.

The session was addressed by Ms Fathima Rashna and Mr Ashish Anil from the Kochi Urban Observatory, who provided detailed insights into the project and its objectives. They explained the key features and functionality of the UAT app. The main goal of the meeting was to introduce various stakeholders to the UAT app. The organizers arranged a demonstration of the app's functionality. The participants were requested to test the app, as a part of its trial run. There was a Q&A session that critically analysed and simplified the app for the audience. After the publication of '*Spandanam'* magazine by an NGO, the session came to an end at 12.30.

The resource person of the program interacting with the audience

The release of the magazine "Spandanam" during the event

iii) BMC’S ECO-FRIENDLY STALL AT ASTA SALE

Venue: St. Teresa’s College, Ernakulam
Date: 9/12/24 and 10/12/24
Participants: students

As part of the Asta Sale conducted at St. Teresa’s College, Ernakulam, the Bhoomitrasena Club (BMC) once again demonstrated its commitment to sustainability and environmental responsibility by setting up a dedicated stall featuring eco-friendly food packaging alternatives.

The Asta Sale, a much-anticipated event that brings together a variety of student-led enterprises and creative ventures, saw enthusiastic participation from all departments. Amid this vibrant atmosphere of commerce and collaboration, the BMC’s stall stood out by offering environmentally sustainable packaging solutions for the food and beverage counters at the event.

The Event was coordinated by the Green Protocol Team, led by Ms. Praveena Meenskshi P P, to promote and popularize eco-friendly, biodegradable, and reusable alternatives to conventional plastic and non-recyclable food packaging materials.

i) STEP - BHUME WOMEN'S COLLECTIVE COLLABORATES WITH BMC

Date: 4 July 2024
Venue: College Campus
Participants: Faculty and Students

Price List

Bag type	Rate
College Bag	350-400
Conference Bag	400-450
Ball Bag With Clamp	120
Ball Bag	110
Zipper Bag	170
Strawberry Bag	120
Sanchi	30/70
Lunch Bag	150
Cosmetic Pouch	60-80
Pouch	30
Jute Pouch	120/150
Sling Bag	100

International Plastic Bag Free Day cloth carry bag sale brochure and pricing of the bags

The Bhoomitrasena Club of St. Teresa's College, in association with STEP and BhuMe Women's Collective Private Limited, sold eco-friendly carry bags on the International Plastic Carry Bag Free Day observed on 4 July 2024 as part of the club's sensitization program to spread awareness of plastic waste management.

The durable cloth carry bag sale organized on PG *Deeksharambh*, the orientation program for the postgraduate students of the college, was a humble way to sensitize, motivate, and encourage students, especially the newbies, to maintain a 'green campus' and take small steps towards creating a sustainable environment around them.

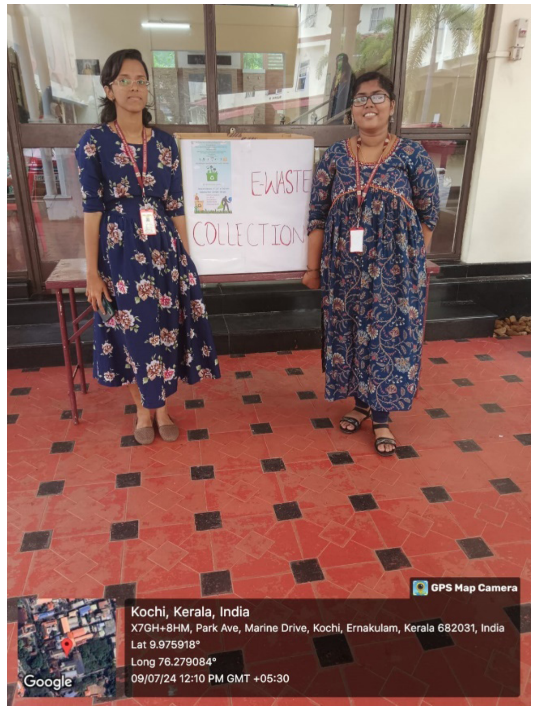
The cloth carry bag sale with a variety of products

E-WASTE COLLECTION DRIVE BY BMC

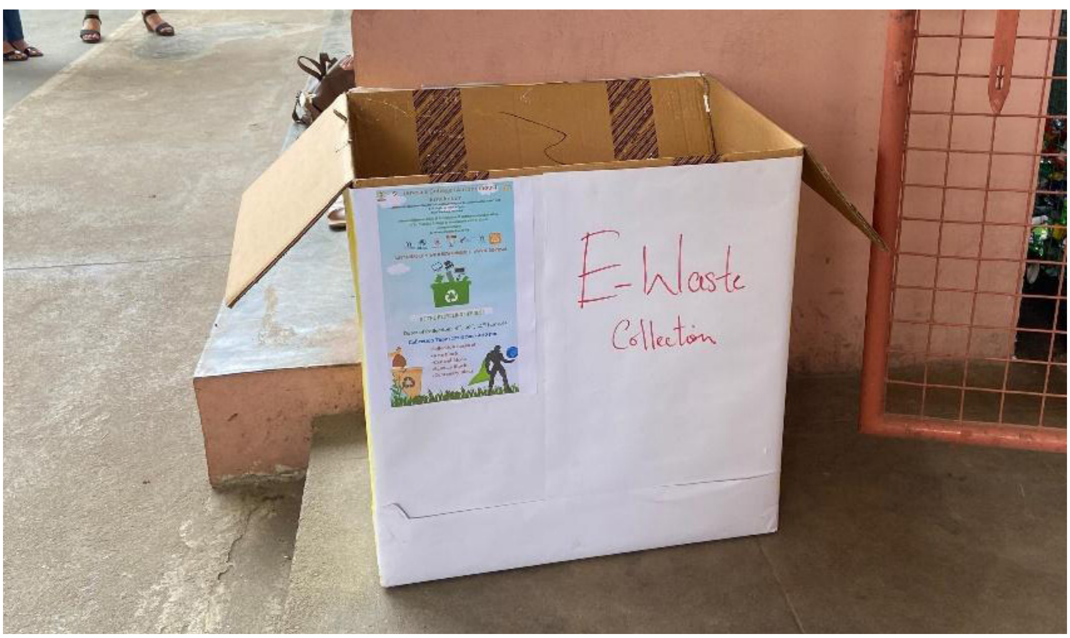
Date: From 9 and 11 July 2024
Venue: Various collecting points at St. Teresa's College (Autonomous), Ernakulam
Participants: All departments of the College

St. Teresa's College (Autonomous), Ernakulam, witnessed a significant environmental initiative organized by the Bhoomitrasena Club, in collaboration with the Innovation & Entrepreneurship Wing and Yi Kochi, from 9 to 11 July 2024. The E-Waste Collection Drive is aimed at addressing the critical issue of electronic waste management. The collection drive, open for over three days, operated from 12:00 PM to 4:30 PM, with three collection desks strategically arranged at the Arts Block, Central Block, and Science Block of the college, ensuring ease of access for all participants, including students and teaching and non-teaching staff of the college.

Sustainability with Responsible E-waste Disposal program brochure



Sustainability with Responsible E-waste Disposal program collecting points



Sustainability with Responsible E-waste Disposal program volunteers

The drive received support from various organizations and initiatives such as Young Indians (Yi), Teresian Innovation and Entrepreneurship Development Cell (IEDC), Teresian Incubation Centre (TIBIC), and institutions focusing on climate change and innovation. These collaborations underscored the college's commitment to the United Nations Sustainable Development Goal 12, which emphasizes responsible consumption and production. Volunteers from the Bhoomitrasena Club played a vital role in ensuring the smooth collection and segregation of the e-waste. The collection drive witnessed great participation, and the items collected by the drive included computer CPUs, LCD monitors, LED/LCD TVs, DVD drives, floppy drives, keyboards, UPS batteries, network cables, power cables, etc.

1. HOMESTEAD FARMING INITIATIVES BY BMC

i) '*NATTONAM UNDONAM*': SEED DISTRIBUTION PROGRAM BY BMC

Date: From 10 and 15 July 2024
Venue: Department of Botany, Science Block, St. Teresa's College (Autonomous), Ernakulam
Participants: All departments of the college

The Bhoomitrasena Club of St. Teresa's College, Ernakulam, in association with the Department of Botany and Centre for Research, held '*Nattonam Undonam*', a seed distribution program. It was a five-day program from 10 to 15 July 2024 from 12.45 pm to 1.30 pm. The sale of 10-rupee packets of seeds was arranged at the Department of Botany in the Science Block campus.

The seed distribution program was exclusively for the upcoming Onam season. The student coordinators for the event were Ananya and Aneena from II DC Botany. The whole event was a grand success under the Karshakasree in-charges, Dr Chandini V K from the Department of Botany and Ms Arya Ashok from the Department of Zoology. It was a great way of promoting the need to grow and cultivate the spirit of Onam together. The title of the event proves to be encouraging the crowd to grow vegetables and share the joy of harvest during the Onam season. The whole event witnessed great support from both students as well as the faculty and the initiative ended with a hope of harvesting the vegetables in time.

Nattonam Undonam Seed Distribution program: Packing and distribution of seeds

Nattonam Undonam Seed Distribution program brochure

i) TRAINING PROGRAM ON MICROGREEN CULTIVATION

Date: 17 July 2024
Venue: Department of Botany, Science Block, St. Teresa's College (Autonomous), Ernakulam

Participants: Students of the Department of Botany

St. Teresa's College launched a new hands-on Training on Microgreen Cultivation, organized by the Department of Botany in association with the Bhoomitrasena Club of the college on 17 July 2024. The program was designed to provide practical skills in sustainable agriculture. Upholding the slogan, "Get ready to grow the greens!", the training commenced with an introduction to microgreen cultivation and seed preparation for microgreen cultivation.

Microgreen Cultivation program brochure

Subsequent sessions covered seed bed preparation and sowing on 18 July, followed by a final session on harvesting microgreens scheduled for July 29. Each session ran from 1:30 PM to 2:30 PM in the UG Botany Lab (Science Block) of the college.

Students actively participated in this hands-on initiative, which underscored the college's dedication to innovative and hands-on learning experiences, offering students valuable insights into sustainable farming practices. The training program on "Microgreen Cultivation" was led by faculty coordinators Dr Gayathry Sharma and Dr Sreehari S Nair.

Active participation from the students

Subsequent procedures of microgreen cultivation

ii) HEAL TOMORROW – BMC FIELD VISIT

Date: 27 August 2024
Venue: Govt. HSS, Elamakkara
Participants: Student volunteers of BMC

The BMC student volunteers visited Govt HSS, Elamakkara, on 27 August 2024 to create environmental awareness among the young minds, focusing on issues surrounding plastic pollution and its impact on animals and aquatic life. The program was scheduled as a series of activities to educate and inspire the school students to adopt sustainable practices in their day-to-day lives.

The program started with a session on introducing the YOUKAN HEAL initiative to the school students, mentioning its aim to raise awareness about plastic pollution and to promote sustainable practices. Later, an interactive session was conducted to minimize plastic use and several preventive measures against plastic pollution were introduced. Students showed their active participation by asking questions and sharing their doubts about how to reduce plastic usage in their homes.

Further, the BMC student volunteers spoke about the hazards of plastic bags and how they affect aquatic life, animals and the environment, hinting at the increased use of plastic bags in society and the impacts of burning plastic waste on human health. This session was concluded by inspiring the students to ban plastic bags and switch to more sustainable measures. The session was concluded by emphasizing the importance of using eco-friendly packaging, cloth bags, DIY products, and t-shirt bags which can be made at zero cost. The volunteers encouraged the school students to educate their family and friends on the same.

HEAL TOMORROW - BMC Field Visit brochure

Overall, the BMC student volunteers had a fruitful and highly rewarding experience at Govt. HSS, Elamakkara. The school students were eager to learn and actively participated in all activities. The field visit was conducted in the belief that by educating young minds about environmental issues and encouraging them to take action, the youngsters can create a more sustainable future for the

Students of the Govt. HSS, Elamakkara, actively participating in the sessions

planet.

iii) BMC YOUKAN HEAL FIELD VISIT TO GOVT. GIRLS' HIGHER SECONDARY SCHOOL, SOUTH

Date: 30 August 2024
Venue: Govt. Girls Higher Secondary School, South
Participants: Student volunteers of BMC

Students of the Bhoomitrasena Club of St. Teresa's College visited Govt. Girls Higher Secondary School, South, as a part of YOUKAN HEAL to introduce them to the YOUKAN HEAL project and give them an awareness class on plastic waste management. The student volunteers explained the feasible solutions and taught measures to reduce plastic waste and plastic products. They also discussed how badly the use of plastic effects the surroundings and how harmful it is for humankind. The students of the school were given an introduction to the agendas of the YOUKAN HEAL project. The BMC student volunteers noticed that most of the alternative methods to reduce plastic waste were practiced in the school as they already have a Nature/HEAL Club. The students also showcased their artwork made of plastic waste.

Students of the Govt. HSS, Elamakkara, actively participating in the sessions

Students of the Govt. Girls Higher Secondary School, South, actively listening to the sessions

In the session, around 40 students from 5th and 7th grade attended. The volunteers screened video documentaries related to plastic waste issues and news reports regarding the Brahmapuram fire accident. The BMC volunteers helped the school students identify the problems related to plastic waste. The school students were further given an activity to keep track of their personal plastic use by maintaining an account of

Video documentary screening by BMC student volunteers for the school children

single use plastics materials they use.

2. SOLID WASTE MANAGEMENT (SWM) INITIATIVES BY STC

i) *MALINYA MUKTA NAVA KERALA* CAMPAIGN

Venue: Localities across the city
Participants: Students, Faculty, Local Communities

As part of its *Malinya Mukta Nava Kerala* Campaign, the Bhoomitrasena Club of St. Teresa's College (Autonomous), Ernakulam, invited its students, teachers and local communities to have environmentally sustainable practices at the community level during various festival celebrations. The club has informed the participants through its brochure that, the campaign will monitor, support, and provide alternatives for sustainable celebrations across the city. The campaign runs with a motto of "Make It Green". With the help of this campaign, the club aims to spread awareness among the local communities to follow the Green Protocol and ban plastics during local festivals. The campaign is to encourage the students and teachers to lead the making of local festivals eco-friendly so that their activities inspire a wider audience. Eventually, the general public will also take part in similar sustainable initiatives.

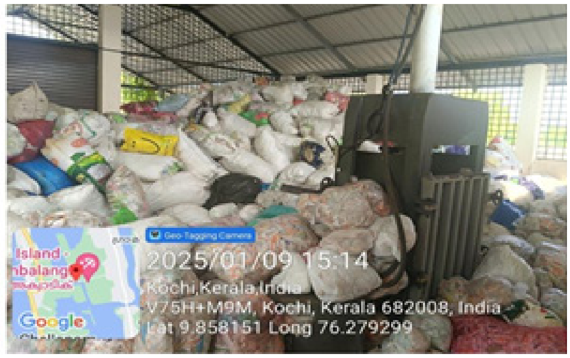
The club urged the participants to send Geo-tagged pictures of their local festivals, detailing their sustainable activities, to the club's email ID: bmc@teresas.ac.in. Through this *Malinya Mukta Nava Kerala* initiative, the club wants to gather everyone to build a cleaner, greener Kerala!

i) WASTE MANAGEMENT FACILITY AUDITING BY STC

Venue: Cheranalloor, Kumblangi, Kuzhupilly, Mulavukad, and Narakkal
Date: 7 to 9 January 2025
Participants: Faculty and Students, Bhoomitrasena Club, St. Teresa's College, Ernakulam

As a responsible institution, residing at the heart of the city of Ernakulam and promptly abiding by all regulations and instructions from the government, St. Teresa's College (Autonomous) whole-heartedly took up the auditing initiative a part of the state-level *Malinya Muktha Nava Kerala* campaign launched by the Government of Kerala. The Bhoomitrasena Club of the college took up the responsibility diligently and allocated various departments to audit the waste management facilities of multiple panchayats of the District allocated to the college. The auditing teams from the college visited the panchayats of Cheranalloor, Kumblangi, Kuzhupilly, Mulavukad, and Narakkal from

7 to 9 January 2025. They executed the audits with the help of the questionnaires provided. They came up with valuable insights into the waste management practices done by the Harithakarmasena Members of various localities visited by different teams.



Video documentary screening by BMC student volunteers for the school children

Bhoomitrasena Club members visiting the Kuzhupilly Panchayat for the audit

ii) ST. TERESA'S COLLEGE CERTIFIED AS A GREEN CAMPUS

Date: 17 October 2024
Venue: Platinum Jubilee Auditorium, St. Teresa's College

St. Teresa's College (Autonomous), Ernakulam, has been certified as a Green Campus by the Haritha Kerala Mission, Government of Kerala. This prestigious Green Campus certification is awarded to aided educational institutions for their commitment towards environmental sustainability and related initiatives.

Green Campus Certificate awarding ceremony brochure

The college receiving the Green Campus Certificate from Shri P Rajeev, Minister for Law, Industries, and Coir

Shri P Rajeev releasing the books on the 100-year journey of the college on the same function

The certificate was awarded to the college by Shri P Rajeev, Minister for Law, Industries, and Coir, on 17 October 2024 at the Platinum Jubilee Auditorium of the college. At this auspicious event, the Malayalam book, revisiting the 100 years history of the college, *St. Teresa's College – Noottandinte Charithra Vazhikal*, written by Dr Soumya Baby, and its English translation *St. Teresa's College – A Century in Retrospect*, written by Dr Usha Nair, were released by the Minister.

The college could achieve this remarkable recognition of being certified as a Green Campus was due to the joint efforts invested by the Bhoomitrasena Club, together with the IQAC Team, of the college. Moreover, towards their initiatives, the management, all departments, staff, and students of the college also have bestowed their solidarity and equal efforts to make the process a successful one.

The Green Campus certification by the Haritha Kerala Mission is based on a comprehensive assessment of 18 key parameters, including adherence to green codes of conduct, waste management, and overall campus cleanliness.

Chapter XII

EXECUTIVE SUMMARY

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

- Annie Leonardv

EXECUTIVE SUMMARY

The Green Audit assessment evaluated the college's current strengths, performance, and shortcomings, while identifying mitigation measures already implemented. A key observation from the audit is that the campus operates on a low-tension electrical supply from the Kerala State Electricity Board. It consumes 28,863.88 kWh of energy annually and exports a significant amount from its solar installation, which produces 52,680 kWh each year. The energy assessment identified the major issues include excessive current harmonics, an imbalance in current, and a lack of protective measures, particularly the absence of Residual Current Circuit Breakers (RCCBs). The safety of the electrical system is further at risk due to poor conditions in the electrical panel room. Damaged equipment and improper storage could lead to hazards. Reflection to the assessment result collage appoint expert electrical engineer to standardize existing electric system to advance and safer. Energy use varies widely across the campus. The D Block and A Block show the highest usage because they serve as main educational spaces. This variation requires specific energy management plans and upgrades to infrastructure. The findings reveal high energy consumption in older buildings like the B Block. This calls for strategic changes to improve efficiency. Water supply management is efficient. Utilize wells and rainwater harvesting to meet the needs of campus facilities. However, challenges persist in measuring water usage accurately in each building separately. The total usage pattern of is exceed the standard limit. The institution actively manages waste, focusing on recycling and sustainable practices to cut down on paper and plastic waste. Still, the lack of systematic data collection makes it hard to fully evaluate the effectiveness of waste management. Biodiversity assessments reveal low species diversity on campus, due to environmental stressors from urban areas. Regular evaluations are needed to boost ecological health and diversity. Safety protocols are well established, ensuring good health management and emergency response. However, there are gaps in emergency infrastructure, especially in the Science block, where additional exits are necessary. Community engagement initiatives, such as mental health support and anti-ragging programs, create a supportive campus environment. Noise pollution is a major issue, surpass WHO standards. Immediate action is essential to tackle these disturbances and protect the health of the campus community. While the institution shows a strong commitment to efficiency, safety, and sustainability, it must pursue strategic and systematic improvements in energy management, water quality, waste data collection, biodiversity, infrastructure safety, and noise control. Taking these steps will strengthen the campus's reputation as a responsible educational institution dedicated to overall development and environmental stewardship. The annual net institutional carbon footprint of 1,066.86 tonnes of CO_2e, equating to a per capita footprint of 0.25 tCO_2e. This net figure is derived from gross emissions totaling 1,118.84 tCO_2e, which are partially mitigated by the 51.98 tCO_2e sequestered by the college's diverse and thriving tree population. The analysis identifies the energy intensity associated with water consumption and purchased electricity as the primary contributors to the college's environmental impact. Additionally, it highlights significant operational

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