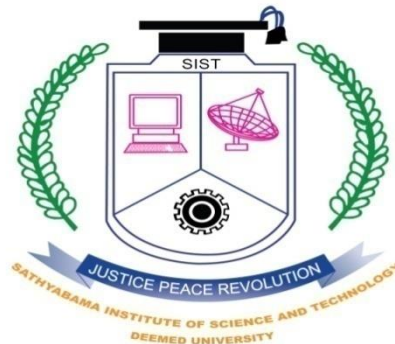


QUALITY AUDIT REPORT FOR ENVIRONMENT AND ENERGY



Sathyabama Institute of Science and Technology
Chennai, Tamil Nadu-600119

Prepared by,
WasmanPro Environmental Solutions LLP



June 2019-May 2020

EXECUTIVE SUMMARY

A Nation's growth starts from its educational Institutions, where the ecology is taught as a prime factor of development associated with environment. A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational Institutions now-a-days are becoming more sensitive to environmental factors and best practices are being introduced making them eco-friendly. To transform the institute as Environmentally Sustainable, promotion of the Environmental and Energy Audits in terms of energy savings, recycle of waste, water reduction, water harvesting are done.

Environmental and Energy auditing is a process whereby an organization's environmental performance is rated from its environmental policies and objectives. As a part of such practice, internal Environmental and Energy Audit is a key performance indicator to evaluate the sustainability of the Institution.

Environmental and Energy Audit can be a useful tool for an Institute to determine how and where the energy and water resources are used the most; the Institution can then consider how to implement changes to make it environmentally sustainable. These audits also acts as a tool to analyze the type and volume of waste being generated, to determine the quantum of waste that can be diverted to recycling project and to arrive at the best waste minimization strategy that can be adopted.

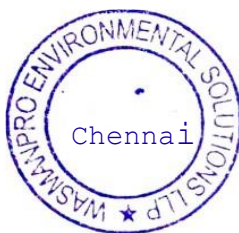
These audits promote environmental awareness, better understanding of environmental impact in the campus among staff and students. Environmental and energy auditing promotes financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. If self-enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that Institutional self-enquiry is a natural and necessary outgrowth of a quality educational Institution. Thus it is imperative that the Institution evaluates its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational Institutions in relation to environmental sustainability is more imperative.



In Sathyabama Institute of Science and Technology, the audit process involved walk through inspections, initial interviews with management to clarify policies, activities, records and the co- operation of staff and students in the implementation of mitigation measures. This was followed interview with by staff and students, collection of data through the questionnaire, review of records, observation of practices and observable outcomes. In addition, the approach ensured that the management and staff are active participants in the Environmental and Energy Auditing process in the Institute.

The baseline data prepared for the Sathyabama Institute of Science and Technology will be a useful tool for campus greening, resource management, planning of future projects for such audit purpose, and a document for implementation of sustainable development of the Institute. Existing data will allow the Institution to compare its programs and operations with those of peer Institutions, identify areas in need of improvement, and prioritize the implementation of future projects. It is expected that the management will be committed to implement the Environmental and Energy Audit recommendations.

We are happy to submit the Environmental and Energy Audit to the Sathyabama Institute of Science and Technology, Chennai.



WasmanPro Environmental Solutions LLP

Chairman



TABLE OF CONTENTS

EXECUTIVE SUMMARY	2
CHAPTER 1.....	5
INTRODUCTION.....	5
1.1 About Sathyabama Institute of Science and Technology	5
1.1.1. Vision of the Institute	6
1.1.2. Mission of the Institute	6
1.1.3. Objectives of the Institution	7
1.1.4. Core Values of the Institution	7
1.2 About WasmanPro Environmental Solutions LLP	7
1.2.1 Core Environmental Compliance & Remediation Services	8
1.2.2 WasmanPro Team.....	8
CHAPTER 2.....	10
ENVIRONMENTAL AND ENERGY AUDIT	10
2.1 General.....	10
2.2 Methodology for Environmental and Energy Auditing	10
2.3 Benefits of the Environmental and Energy Auditing	12
2.4 Scope and Goals of Environmental and Energy Auditing.....	12
2.5 Pre-Audit Stage	14
2.6 Audit Stage	14
2.7 Post Audit Stage	15
2.8 Follow-up Action and Plans.....	16
CHAPTER 3.....	17
WATER AUDIT	17
3.1 Introduction.....	17
3.2 Key Methodology adopted for Water Audit.....	17
3.3 Water Audit Survey/Questionnaire	17
3.4 Water Audit-Key Findings	20
3.5 Water Audit – Evaluations and Recommendations	26
3.5.1 Consolidation of Water Audit Findings-Evaluation	27
3.5.2 Recommendations.....	27
CHAPTER 4.....	29
ENERGY AUDIT	29
4.1 Introduction.....	29
4.2 Key Methodology adopted for Energy Audit	29
4.3 Energy Audit Survey/Questionnaire	29



4.4	Energy Audit-Key Findings.....	32
4.5	Energy Audit – Evaluations and Recommendations	37
4.5.1	Consolidation of Energy Audit Findings-Evaluation	38
4.5.2	Recommendations.....	38
CHAPTER 5.....		41
WASTE AUDIT		41
5.1	Introduction	41
5.2	Solid Waste.....	41
5.2.1	Key Methodology adopted for Solid Waste Audit	41
5.2.2	Solid Waste Survey	42
5.2.3	Solid Waste Audit-Key Findings.....	43
5.2.4	Solid Waste Audit-Evaluations and Recommendations	45
5.2.4.1	Consolidation of Solid Waste Audit Findings-Evaluation	46
5.2.4.2	Recommendations.....	47
5.3	Biomedical Waste Audit	49
5.3.1	Key Methodology adopted for Biomedical Waste Audit	49
5.3.2	Bio Medical Waste Audit-Survey/Questionnaire	50
5.3.3	Biomedical Waste Audit-Key Findings.....	51
5.3.4	Biomedical Waste Audit-Evaluations and Recommendations	52
5.3.4.1	Consolidation of Biomedical Waste Audit Findings-Evaluation	54
5.3.4.2	Recommendations.....	54
5.4	E -Waste Audit	56
5.5.1	Key Methodology adopted for E-Waste Audit.....	56
5.5.2	E-Waste Audit-Survey/Questionnaire	57
5.5.3	E-Waste Audit- Key Findings	57
5.5.4	E-waste Audit- Evaluations and Recommendations.....	58
5.4.4.1	Consolidation of E-Waste Audit Findings-Evaluation	59
5.4.4.2	Recommendations.....	59
CHAPTER 6.....		60
GREEN AUDIT		60
6.1	Introduction.....	60
6.2	Key Methodologies adopted for Green Audit	60
6.3	Green Audit-Survey/Questionnaire	61
6.4	Green Audit- Key Findings	62
6.5	Green Audit-Evaluations and Recommendations.....	63
6.5.1	Consolidation of Green Audit Findings-Evaluation	64
6.5.2	Recommendation	64



CHAPTER 7.....	67
CARBON FOOT PRINT AUDIT	67
7.1 Introduction.....	67
7.2 Key Methodologies adopted for Carbon Footprint Audit.....	67
7.3 Carbon Footprint Audit-Survey/Questionnaire	68
7.4 Carbon Footprint Auditing-Key Findings	69
7.5 Carbon Footprint Audit-Evaluations and Recommendations.....	73
7.5.1 Consolidation of Carbon Footprint Audit Findings-Evaluation	73
7.5.2 Recommendations.....	74
CHAPTER 8.....	76
AUDIT CONCLUSION	76
ANNEXURES	80

CHAPTER 1

INTRODUCTION

1.1 About Sathyabama Institute of Science and Technology

Sathyabama is a prestigious Institution which excels in the fields of Engineering, Science and Technology for more than three successful decades. The Institution is established under Sec.3 of UGC Act, 1956 and is been accredited with 'A' Grade by the National Accreditation and Assessment Council. The Institution offers various multi-disciplinary academic programs in the fields of Engineering, Science, Technology, Law, Dental Science, Pharmacy, Nursing, Management, Arts and Science and Allied Health Sciences. The Institution has been ranked 39th position among the Universities in India for the year 2020, by the National Institutional Ranking Framework (NIRF), Government of India, and ranked one among the top 50 Universities for five consecutive years. Sathyabama is ranked among the Top 5 Institutions in the Country for Innovation by ATAL ranking of Institution for Innovation Achievements, Govt. of India. Times Higher Education and QS has ranked Sathyabama among the top Institutions worldwide.

This glorious Institution is functioning under the dynamic leadership of Dr. Mariazeena Johnson, Chancellor, Dr. Marie Johnson, President. A team of dynamic and outstanding faculty, innovative pedagogical practices, state of the art infrastructure and world class research facilities add on to the attractions of the Institution. Sathyabama Institute of Science & Technology has alliances with leading Universities and Research Establishments at National and International Level. Sathyabama has undertaken various sponsored and collaborative R&D projects funded by National and International Organizations.



Figure 1: Campus View of Sathyabama Institute of Science and Technology



Figure 2: Layout Plan of Sathyabama Institute Of Science And Technology

1.1.1. Vision of the Institute

Sathyabama Institute of Science and Technology envision being an Effective and Competent Source of technical manpower for the current and future Industrial requirements.

1.1.2. Mission of the Institute

- Undertaking Research & Development activities in emerging thrust areas.
- Introducing new manpower innovative courses based on the Industry & Societal demands.
- Collaborating with National, International Institutes, Research and Development Organization and Industries.
- Serving the community at large.



1.1.3. Objectives of the Institution

The Institution endeavors to prepare its students for fulfilling careers by enabling them to realize their full potential and by inculcating in them the spirit of intellectual enquiry, independent thinking, self-reliance, leadership, co-operation, expression of cultural talents and service to society.

1.1.4. Core Values of the Institution

Sathyabama Institute of Science and Technology is committed in practices that are fair, honest and objective in dealing with students, faculty members and other stake holders, which fosters a climate of ethical conduct, respect, responsibility and trust. Sathyabama Institute of Science and Technology believes in stakeholder partnership for holistic Institutional development and to promote a healthier working atmosphere with the following core values.

- Excellence: To promote academic excellence and encourage innovation among students and staff and to sustain interactive teaching and learning process.
- Liability: To keep transparency in administrative functions, and to take responsibility for professional growth and development, and to continuously evaluate the systems and policies.
- Discipline: To inculcate human values among students, to promote gender equity, to nurture Indian culture and traditions and mould students as responsible citizens of the Nation

1.2 About WasmanPro Environmental Solutions LLP

WasmanPro has in-depth understanding and practical experience with Environmental and Energy Audit, Green Practices, Environmental Policies, Regulatory Programs, and Remediation Strategies. The firm offers comprehensive regulatory consent and compliance support that address a full spectrum of air, water, wastewater and hazardous waste issues, regulations, and policies. Drawing up on the collective experience of the team, it has developed technically sound and cost-effective strategies to achieve environmental compliance. The development and implementation of these strategies have led to:

- Faster Consent Management Services
- Reducing waste streams
- Improving mechanisms to track consent conditions
- Executing effective monitoring programs
- Implementing phased compliance and cleanup strategies



1.2.1 Core Environmental Compliance & Remediation Services

WasmanPro helps clients in adopting advanced environmental sustainability, maintain environmental compliance, and reduce environmental risk and cleanup sites by providing a diverse set of core services including:

- Environmental Compliance
- Air Emission Inventories and Reporting
- Air Quality and Clean Air Act Compliance
- Environmental Due Diligence
- Environmental Impact Assessment
- Site Investigation and Feasibility Studies
- EHS Audits & Training
- Environmental Management System and Compliance Auditing
- Environmental Monitoring
- Ground water and Sub surface Investigations
- Green Audit
- Soil Management Plans
- Hazardous and Solid Waste Management Plans
- Remedial Design and Monitoring
- Brown field Cleanup
- Pollution Prevention Plans
- Environmental, Health and Safety Plans
- Hydro geological studies

M/S WasmanPro Environmental Solutions LLP has also undertaken several Environmental and Energy Audits as per NAAC requirements.

1.2.2 WasmanPro Team

M/S WasmanPro Environmental Solutions LLP is spear headed by Dr. Karthikeyan, a certified Lead Auditor for ISO 14001, OSHA 18001 certified by CII-NABET certification program.

Dr. Karthikeyan was former Member Secretary of TNPCB and has vast experience in the field of Environmental Impact Assessment (EIA), Marine Impact Assessment (MIA), Solid Waste Management (SWM), Environment Social Management Framework (ESMF), Disaster Management Plan (DMP), Risk Assessment, Water and Wastewater treatment, Training of Engineers. The Company is also lead by senior retired professionals like G.Sathiamoorthi, Former Engineering Director Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB), V. Ganesan, Former Member State Environmental Impact Assessment Authority, Government of India, K.M.M. Annamalai, with more than 35 years of experience in EPC Project Management in various private sector companies, T.S.Murli with rich experience in



various project executions and project management in several private sector companies. WasmanPro has talented & committed employees as engineers and scientists across multiple sectors.

Sathyabama Institute of Science and Technology - Internal Audit Team

Management Representative	Dr.Dawn S S Professor (Research) Centre for Waste Management Centre of Excellence for Energy Research
Members	Dr.Vinita Vishwakarma Professor (Research) Centre for Nanoscience and Nanotechnology Dr.S.Barani Professor Department of Electronics and Communication Engineering School of Electrical and Electronics Engineering Dr.S.Poornapushpakala Associate Professor Department of Electronics and Communication Engineering School of Electrical and Electronics Engineering Dr.Arun J Assistant Professor (Research) Centre for Waste Management Ms.N.Nirmala Scientific Assistant Centre for Waste Management Mr.A.Santhosh Project Assistant Centre for Waste Management



CHAPTER 2

ENVIRONMENTAL AND ENERGY AUDIT

2.1 General

Environmental and Energy Audit forms a part of the resource management process. Although they are individual events, the real value of Environmental and Energy Audit is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water, minimization of waste generation, pollution and to attain economic efficiency. All these indicators are assessed in process of “Environmental and Energy Audit of educational institute”. Eco-campus mainly focuses on the reduction of contribution to emissions, procures a cost effective and secure supply of energy, encourages and enhances energy use conservation, promotes personal action, reduce the Institute’s energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. Target areas included in this auditing are water, energy, waste, green campus and carbon footprint.

2.2 Methodology for Environmental and Energy Auditing

The purpose of the audit was to ensure that the practices adopted by the Institution are in accordance with the Environmental Policy suggested by NAAC. The methodology includes: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations.

The methodology adopted for this audit was a step by step process comprising of:

1. Data Collection – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, conducting surveys, distributing questionnaires, communicating with responsible persons and measurements.

Following steps were taken for data collection:

- The team went to each department, library, canteen, hostels, research centers etc.
- Data about the general information was collected by observation and interview.
- The power consumption of appliances was recorded by taking an average value in some cases.
- For Waste auditing details about types of waste generated, mode of disposal were collected.

- For Water auditing details about source of water for the Institution, various uses of water, mode of disposal of waste water were collected.
- For Energy auditing details about source of power for the Institution, major points of power usage, generation of power from non-conventional source were collected.
- For Carbon Foot Print auditing details about source of emission of greenhouse gases, details about major Carbon Foot Print reduction strategy were collected.
- For Green Auditing details about total campus area, area under green coverage, area under Marshy land were collected.
- Five categories of questionnaires were distributed among the students and staff for data collection.

2. Data Analysis - Detailed analysis of data collected was done. It includes calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan, analysis of various water usage and wastage points, analysis of water recycling and reusing methods implemented in the campus, analysis of types of waste being generated, studying various waste management strategy adopted in the campus, analyzing various Carbon Foot Print strategy being implemented in the campus.

3. Recommendation/Suggestions– On the basis of results of data analysis and observations, various suggestions that the Institution can implement were recommended.

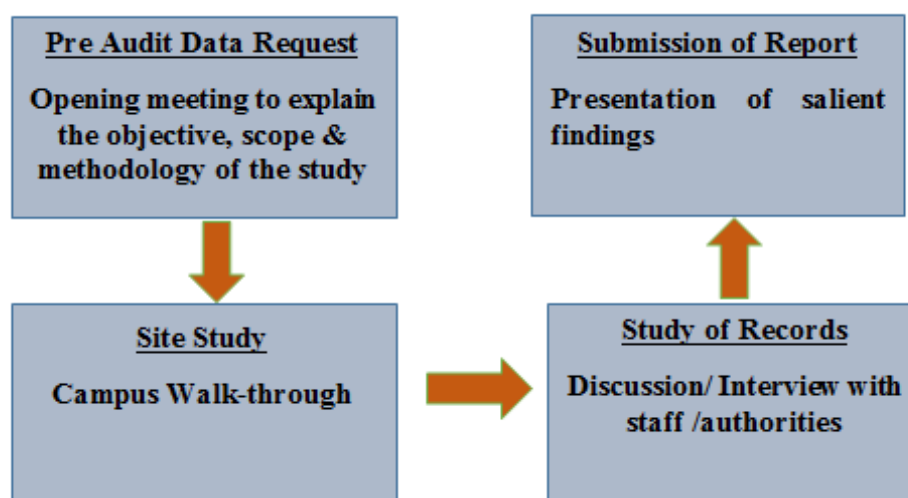


Figure 3: Audit Stages



2.3 Benefits of the Environmental and Energy Auditing

- ✓ More efficient resource management
- ✓ To provide basis for improved sustainability
- ✓ To create a green campus
- ✓ To enable waste management through reduction of waste generation, E-Waste management, solid-waste management and wastewater recycling
- ✓ To create plastic free campus and evolve health consciousness among the stakeholders
- ✓ Recognize the cost saving methods through waste minimizing and managing
- ✓ Authenticate conformity with the implemented laws
- ✓ Empower the organizations to frame a better environmental performance
- ✓ Enhance the alertness for environmental guidelines and duties
- ✓ Impart environmental education through systematic environmental management approach and Improving environmental standards
- ✓ Benchmarking for environmental protection initiatives
- ✓ Financial savings through a reduction in resource use
- ✓ Development of ownership, personal and social responsibility for the Institute and its environment
- ✓ Developing environmental ethics and value systems in youngsters.
- ✓ Environmental and energy auditing should become a valuable tool in the management and monitoring of environmental and sustainable development programs of the institute.

2.4 Scope and Goals of Environmental and Energy Auditing

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental issues. Environmental and Energy Audit is the most efficient and ecological way to manage environmental problems.

Environmental and Energy auditing is used as a tool to investigate, understand, identify effects of various activities on the environment against set criteria or standards. These are used to help



improve existing activities, with the aim of reducing the adverse effects of these activities on the environment. It is necessary to conduct these audits in the Institution because students become aware of the Environment, advantages it offers, thereby become the warriors to save the planet. Thus, such quality audits become necessary at the Institutional level.

A very simple indigenized system has been devised to monitor the environmental performance of Sathyabama Institute of Science and Technology. It comes with a series of questions to be answered on a regular basis. This innovative scheme is user friendly and totally voluntary. The aim of this is to help the Institution, identify their weak areas, and project their best practices and to set examples for the community, and to educate the young learners.

Environmental and Energy Auditing is done in three phases

Phase I - Pre Audit Stage

Phase II - Audit Stage

Phase III - Post Audit Stage

1. Pre Audit Stage

- Plan and organize
- Walk through audit
- Macro data collection
- First hand observation and assessment
- Issue questionnaire for each department

2. Audit Stage

- Primary data gathering
- Analysis of energy use, water use, waste generation
- Analysis of Annual Energy Bill, Water Bill, GHG Emission
- Analysis of energy consumption pattern, water usage pattern
- Identification of resource conservation opportunities
- Select most promising techniques
- Cost benefit analysis

3. Post Audit Stage

- Implementation of ideas
- Follow up and periodic review

2.5 Pre-Audit Stage

A pre-audit meeting provides an opportunity to reinforce the scope and objectives of the audit and to discuss on the practicalities associated with the audit. This meeting is an important prerequisite for the Environmental and Energy Audit because it is the first opportunity to meet the expert and deal with any concerns.

The pre-audit meeting was conducted successfully at Sathyabama Institute of Science and Technology, Chennai on 20th February 2020 and necessary documents were collected directly from the Institution before the initiation of the audit process. The audit protocol and audit plan were handed over at this meeting and actual planning of audit processes was discussed. The WasmanPro team worked under the leadership of the lead auditor Dr. K. Karthikeyan, to ensure completion within the brief and scope of the audit.



Figure 4: Sathyabama Officials and WasmanPro Officials during Pre-Audit Stage Meeting held on 20th February 2020

2.6 Audit Stage

In Sathyabama Institute of Science and Technology, Environmental and Energy Auditing was coordinated with WasmanPro Environmental Solutions LLP. The entire exercise was conducted by involving the Centre for waste Management team, along with different student groups, researchers, teaching and non-teaching staff. The Environmental and Energy Auditing began with the team conducting walk through inspections of all the different facilities at the Institute, determining the different types of appliances and utilities (lights, taps, toilets, fridges, etc.) as well as measuring the usage per item (Watts indicated on the appliance or measuring

water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and students were interviewed to get details of usage, frequency or general characteristics of certain appliances. Data collection was done in the sectors such as Water use, Energy, Waste, Green coverage and Carbon footprint. Various records and documents were verified several times to clarify the data received through survey and discussions.

The methodology adopted for this audit was a step- by- step process comprising of:

- Involvement of Student Clubs and Forums
- Site inspection
- Interviews
- Review of Policies
- Review of Documents and Records



Figure 5: The Audit Team of WasmanPro Environmental Solutions LLP with Centre for Waste Management Team, Sathyabama Institute of Science & Technology

2.7 Post Audit Stage

The base of any Environmental and Energy Auditing is that its findings are supported by documents and verifiable information. The audit process seeks, on a sampled basis, to track past actions, activities, events, and procedures to ensure that they are carried out according to systems requirements and in the correct manner. The real value of Environmental and Energy Auditing is when they are carried out at defined intervals, and their results and recommendations can bring improvement or change over time. Although Environmental and Energy Auditing are carried out using policies, procedures, documented systems and objectives as a test, there is always an element of subjectivity in an audit. The essence of any audit is to find out how well the organization, departments and equipment are performing keeping the environmental



sustainability in mind. Each of the three components is crucial in ensuring that the organization's environmental performance meets the goals set in its green policy. The individual functioning and the success of integration will all play a role in the degree of success or failure of the organization's environmental performance.

2.8 Follow-up Action and Plans

Environmental Audits are exercises which generate considerable quantities of valuable information. The time and effort and cost involved in this exercise is often considerable and in order to be able to justify this expenditure, it is important to ensure that the findings and recommendations of the audit are considered at the correct level within the organization and that action plans from the audit findings are implemented.

Audit follow up is part of the wider process of continuous improvement. Without follow-up, the audit becomes an isolated event which soon becomes forgotten in the pressures of organizational priorities and the passing of time.



CHAPTER 3

WATER AUDIT

3.1 Introduction

Water is a natural resource; all living matters depend on water. While water is available in many natural environments, in human settlements potable (drinkable) water is less readily available. We need to use water wisely to ensure that drinkable water is available for all, now and in the future. A small drip from a leaky tap can waste more than 180 liters of water in a day; that is a lot of water to waste - enough to flush the toilet eight times! Aquifer depletion and water contamination are taking place at unprecedented rates. It is therefore essential that any environmentally responsible Institution should examine its water use practices. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the demand and supply of water. It is therefore essential that any environmentally responsible Institution examine its water use practices.

3.2 Key Methodology adopted for Water Audit

1. Base Line data were collected by distributing questionnaire among students and staff and also by conducting interviews among them.
2. A walk through survey of the entire facility was conducted to identify the type of water fixtures and measuring water usage points based on flow rates. Survey was done to identify defective fixtures and to spot water leakage/ wastage points.
3. Distribution of questionnaire and walk through survey was carried out between 25th -28th February 2020
4. Based on the findings, calculation was done on overall water usage in the campus and methods for reducing the water footprint was suggested

3.3 Water Audit Survey/Questionnaire

1. List various sources of water in your institute.
2. How many wells are there in your institute?
3. Does the institute buy water from tankers?



4. What is the depth of each well?
5. What is the present depth of water in each well?
6. No. of motors used for pumping water from each well?
7. What is the total horsepower of each motor?
8. Quantity of water stored in overhead water tank?(in liters)
9. Quantity of water pumped every day?(in liters)
10. List out various uses of water
11. No. of water coolers. Amount of water used per day?(in liters)
12. No. of water taps. Amount of water used per day?
13. No. of bath rooms in staff rooms, common area, hostels. Amount of water used per day?
14. No. of toilet, urinals. Amount of water used per day?
15. No. of water taps in the canteen. Amount of water used per day?
16. Amount of water used per day for gardening.
17. No. of water taps in laboratories. Amount of water used per day in each lab?
18. Total use of water in each hostel?
19. Is there any water used for agricultural purposes?
20. How many water fountains are there?
21. How often is the garden watered?
22. Quantity of water used to watering the ground?
23. Quantity of water used for bus cleaning?(liters per day)
24. Amount of water for other uses?(items not mentioned above)
25. At the end of the period, compile a table to show how many liters of water have been used in the institute for each purpose
26. If there is water wastage, specify why.
27. How many of the taps are leaky? Amount of water lost per day?



28. Are there signs reminding people to turn off the water?
29. How many water fountains are leaky?
30. How can the wastage be prevented/stopped?
31. Locate the point of entry of water and point of exit of waste water in the institute.
32. Where does waste water come from?
33. Where does the waste water go?
34. What are the uses of waste water in your institute?
35. Is there any treatment for waste water?
36. What happens to the water used in labs? Whether it gets mixed with ground water?
37. Is there any treatment for the lab water?
38. Whether green chemistry methods are practiced in labs?
39. Write down four ways that could reduce the amount of water used in the institute.
40. Record water use from the institute water meter for six months.
41. Bimonthly water charges paid to water connections if any,
42. Is there any water conservation plan in the institute?
43. Does your institute harvest rainwater?
44. If yes, how many rain water harvesting units are there?(Approx .amount)
45. Is there any water less toilets?
46. Is drip irrigation used to water plants outside?
47. Area under green coverage.
48. Is there any water management plan in the institute?
49. Are there any water saving techniques followed in your institute? What are they?
50. Pleases share some idea on how your institute could save more water.

3.4 Water Audit-Key Findings

Main water uses in the campus were noted to be for gardening, cleaning, drinking, toilet and bathroom usages, hostel uses, cooking, washing, laboratory uses, canteen uses, office uses, floor cleaning, etc.

Table 1: Source of Water for the Institution

Tankers	25-30 per day of 12,000 lts capacity
Number of bore wells	3 bore well within 25-30 kms from Institution (One owned, two hired)
Number of ponds	Nil

Table 2: Water Storage Structure in the Campus

Number of Raw Water Tank	4
Number of Fire Water Storage Tank	1
Number of Treated Water Tank	3 (50,000 lts)
Number of Rain Water Collection Tank	1
Number of water tanks for storage	9
Total capacity of water storage tank	1 MLD

Table 3: Distribution Tanks in the Campus

Tank capacity Gents hostel Ladies Dental	30-50 Thousand L 3 tanks 4 tanks 2 tanks
Tank capacity Small blocks Other blocks	25-50 Thousand L 3 tanks 6 tanks
Tank capacity Syntax tanks	5-20 Thousand L 15



Table 4: Various points of Usage of Water

RO Plant 40000 L Capacity	2 tanks (20000 L each)
Number of Urinals and Toilets	688,1475
Number of water less urinals	Nil
Number of bathrooms	975
Number of water taps	1685
Water taps in laboratories	114
Number of Washbasin	375
Water pumps–Nos. HP each	6 (10HP)
Quantity of water pumped	25 - 30 Lorries (12000 L)

Table 5: RO Plant Water Output Details

Parameter	Result
pH	7.8
Turbidity	1 NTU
TDS	83 mg/L

Table 6: Water Cooler Details

SL.NO	Location	Nos.
1	Block (Research)	6
2	Block (admin)	6
3	Block (hospital)	12
4	Block (academics)	9
5	Block (dental)	8
6	Hostel	5
7	Hostel	4
8	Work shop 3 & 4	2
9	Library	8
10	Ladies Hostel	7
11	Mess	11
12	Canteen	Nil
	Grand Total	78

Table 7: Various Points of Water Wastage

Number of Leaky Taps	Nil
Number of leaky pipes	Nil
Number of Urinals	Nil
Number of Leaky Tanks	Nil
Overflow water Wastage	Max 5 mts overflow- immediate switch off followed
Any Evaporation Loss from Storage Tanks	No Evaporation Loss as the Storage Tanks are completely covered

Table 8: Details of Water Treatment System

No. of water treatment system in place	1
Total Quantity of Water being treated	1.1 MLD
Total Quantity of Water Reused	0.88 MLD

Overall Utilization of water in the institute

The water consumption by the Institution is moderate as the Institution is using treated water from the STP for gardening and flushing which are the major water usage points. Since water for flushing is met by recycled water the intake water can directly be diverted for purposes like drinking, cooking, cleaning, bathing etc. So the intake water of 360 KLD per day seems adequate. As with the adoption of STP and reusing the recycled water for flushing and gardening the Institution could reduce their water footprint to a great extent.

Total fresh water consumption in the Institution = 330 KLD

Water charges paid –Rs.4,00,000-8,00,000/ month.



3.4.1 Wastewater Treatment Unit Details

Sewage Treatment Plant at Sathyabama Institution Campus (Capacity of 1.50 Million Liters per Day)

Total population	13722 persons
Staying in hostels	6384 persons
Day-scholars	5635 persons
Boys' hostel rooms available	620 Nos
Number of boys in one room	6
Staying boys strength 620*6	3720 boys
Girls' hostel rooms available	444 Nos
Number of girls in one room	6
Staying girls strength 444*6	2664 girls
Total Hostlers	6384 students
Input flow to STP	1070928 liters (1.1MLD)
STP designed for	1.5 MLD

Design Details

STP Design Capacity : 1500 m³ / day

Hours of Operation : 20 Hours

Average Flow rate : 75 m³/Hr

Table 9: Characteristics of Raw Sewage

SLNo	Parameters	Inlet Character	Unit
1	Flow	1500	m ³ /day
2	pH	7.2	-
3	BOD at 3 days	400	mg/l
4	COD	900	mg/l
5	TSS	400	mg/l

The BOD and COD values are displayed higher than the raw sewage characteristics as high strength organic loads are coming from the Institution, hospital and dental college, mess, labs.

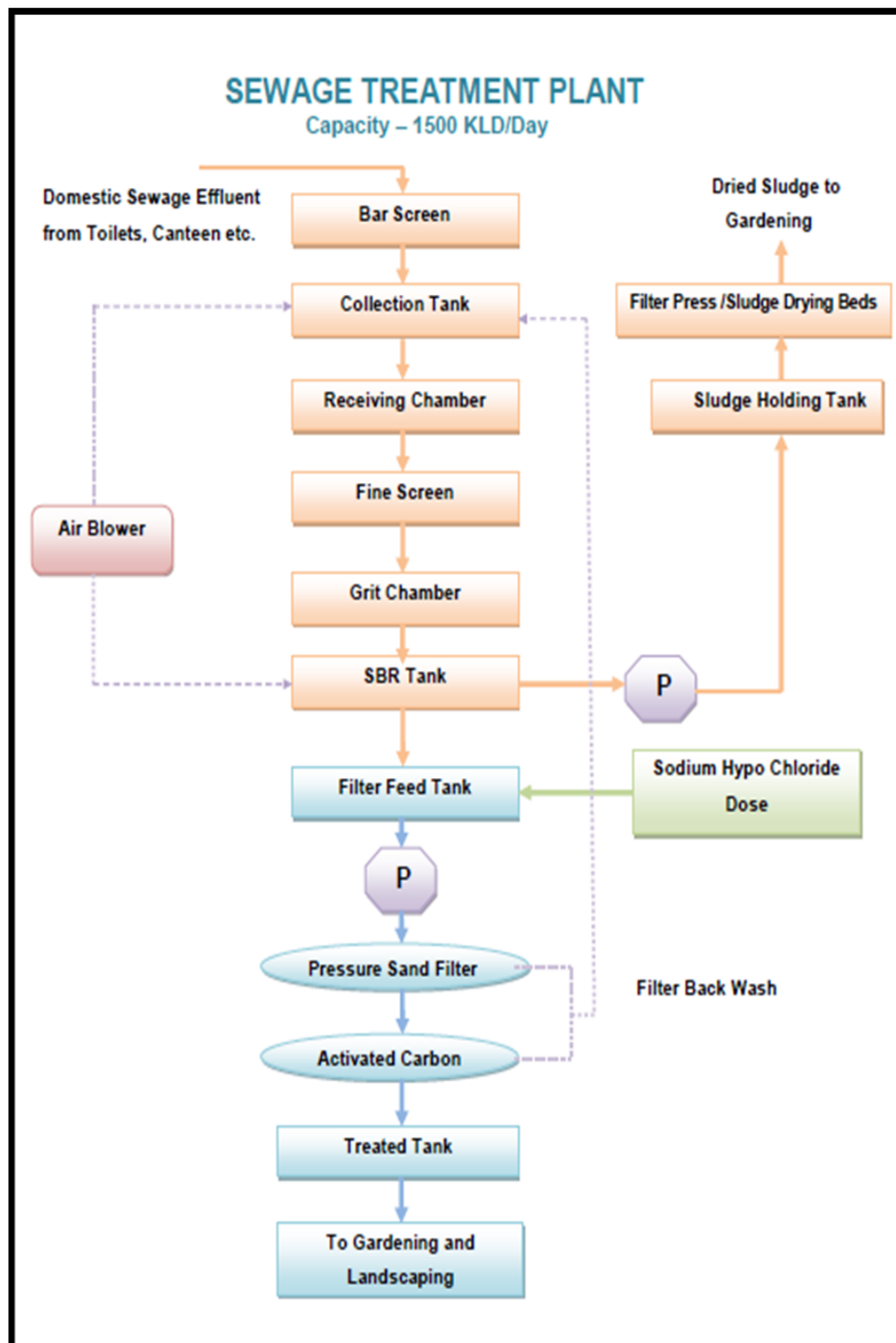


Figure 6: Flow diagram of the treatment process in the STP

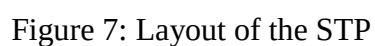




Table 10: Size of Unit Operations of Sewage Treatment Plant

S.No	Description of unit operation of STP	Size/Capacity (M)	Liquid Volume (KL)	Free Board Volume (KL)
1	Bar Screen	2.5 × 1.5 × 1.0M (TD)	-	3.75
2	Raw Sewage Sump	15.0 × 12.0 × 4.0M (LD) + 1.0M (FB)	720	180
3	Receiving Chamber	2.5 × 1.5 × 0.7M (TD)	-	2.6
4	Fine Screen Channel	4.0 × 0.525 × 0.8M (TD)	-	1.7
5	Grid Chamber Manual	4.5 × 2.5 × 1.5M (LD) + 0.5M (FB)	16.875	5.625
6	SBR Basins – I	15.0 × 6.0 × 4.5M (LD) + 1.0M (FB)	405	90
7	SBR Basins – II	15.0 × 6.0 × 4.5M (LD) + 1.0M (FB)	405	90
8	Clarified Water Tank	15.0 × 12.0 × 2.8M (LD) + 2.2M (FB)	504	396
9	Treated Tank	15.0 × 12.0 × 4.5M (LD) + 0.5M (FB)	810	90
10	Sludge Sump	4.0 × 4.0 × 3.5M (LD) + 0.5M (FB)	56	8
11	Sludge Drying Beds (4 Nos)	3.0 × 3.0 × 1.5M (TD)	28.8	25.2

3.5 Water Audit – Evaluations and Recommendations

Water auditing was done for systematic & scientific examination of water usages of the Institution. Water auditing was used for categorizing all water use in the Institution and act as a tool to overcome the shortage, leakage and losses in the system. With the help of water audit, it was identified and quantified what steps can be taken to reduce water use and losses. Water audit and its analysis was done to identify methods to reduce the water foot print of the Institution thereby leading to saving the precious water resource and money associated with it.



Water audit was extensively done for the Sathyabama Institute of Science and Technology and the Audit findings are as follows.

Best Practices Observed in the Institution -Water Management

- ❖ Treatment of waste water using STP and reusing it for gardening and flushing
- ❖ Rainwater harvesting using Rooftop Rain water harvesting structures and rain water harvesting pits.
- ❖ Institution has own RO unit catering to drinking water requirement of the entire campus

3.5.1 Consolidation of Water Audit Findings-Evaluation

The main source of water for the Institution is the water taken from the lorry tankers. The campus has Storm water drainage channels that collects the storm water and diverts it to rain water harvesting pits. The Institution has also made facilities for roof top rain water harvesting structures and rain water harvesting pits which is highly appreciable. Institution has own RO unit catering to drinking water requirement of the entire campus. There is no water leakage as the leaky taps are repaired whenever such leaks come to the notice of the authority. This is made possible by the Institutes water maintenance division who are working round the clock to ensure that there is no leakage. STP of 1.5 MLD capacity has been installed to treat the waste water which is then diverted to gardening and flushing. So it can be concluded that the Institution is been taking a great effort to decrease the water footprint by relying on the recycled waste water and water harvested during the rainy season. Hence it can be said that the Institution is taking the right steps towards water management and is on the path towards achieving Zero Liquid Discharge which is highly commendable.

Based on the above findings, few recommendations that the Institution can follow are suggested in the following section.

3.5.2 Recommendations

- ❖ Liquid waste generated from health care facilities shall be pretreated before mixing with other wastewater
- ❖ Display Posters to motivate students to conserve water
- ❖ Develop Portal where students can report leaky taps/ water wastage points when-ever it comes to their notice.

- ❖ Replace conventional flush system with latest dual model flush system to conserve water- as at present the toilet commodes have 10 litre flush which can be replaced with 3/6 litres or 2/4 litres dual flush cisterns. This can reduce water use by around 30-40%.
- ❖ Installation of water meter to analyze water consumption
- ❖ Installation of more Rainwater Harvesting pits is recommended in-order to reduce the water foot print of the Institution.
- ❖ Installation of artificial ground water recharge structure.



Figure 8: Water transporting tanker



Figure 9: Water treatment unit



Figure 10: Sewage treatment plant



Figure 11: Site visit at STP



Figure 12: STP Plant Overview



Figure 13: Control Panel Rooms



CHAPTER 4

ENERGY AUDIT

4.1 Introduction

Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the audit. Energy Audit provides a “bench-mark” for managing energy in the Institution and also provides the basis for planning a more effective use of energy throughout the Institution.

The primary objective of Energy Audit is to determine ways to reduce energy consumption-per unit of product output or to lower operating costs. An old incandescent bulb uses approximately 60W to 100W while an energy efficient light emitting diode (LED) uses only less than 10 W. Thus Energy auditing deals with methods to reduce its consumption and conservation of energy. It is therefore essential that any environmentally responsible Institution examine its energy use practices.

4.2 Key Methodology adopted for Energy Audit

1. The Energy audit was focused on the study of all major energy consumption equipment and evaluation of operational efficiency of these equipment's from the energy conservation point of view.
2. Base Line data were collected by distributing questionnaire among staffs of electrical maintenance division of the Institute and also by conducting interviews among them.
3. A walk through survey of the entire facility was conducted for first hand observation and assessment of current level operation and practices
4. The walk through survey and base line data collection was held between 2nd -5th of March 2020
5. Based on the above findings, the base line data collected were analyzed along with annual Energy bill and analysis of major energy consumption pattern was carried out.

4.3 Energy Audit Survey/Questionnaire

1. List the ways of energy usage in the Institution. (Electricity, electric stove, kettle, microwave, LPG, Petrol, diesel and others).
2. The amount spent for petrol/diesel for the past one year?
3. Are there any energy saving methods employed in the Institution? If yes, please specify.



4. How much money does the Institution spend on energy such as electricity, gas, firewood, etc. in a month? (Record monthly)
5. How many CFL bulbs have been installed? Mention hours of usage (Hours used/day for how many days in a month)
6. Energy used by each bulb per month? For example-60watt bulb x 4hours x number of bulbs
7. How many LED bulbs are used in the Institution? Mention hours of usage (Hours used/day for how many days in a month)
8. Energy used by each bulb per month? (KWh).
9. How many incandescent (tungsten) bulbs have been installed? Mention hours of usage (Hours used/day for how many days in a month)
10. How many fans are installed in the Institution? Mention hours of usage (Hours used/day for how many days in a month)
11. Energy used by each fan per month?(kWh)
12. How many air conditioners are installed in the Institution? Mention hours of usage (Hours used/day, for how many days in a month)
13. Energy used by each air conditioner per month? (KWh).
14. How much electrical equipment including weighing balance is installed the Institution? Mention the use (Hours used/day for how many days in a month)
15. Energy used by each electrical equipment per month? (KWh).
16. How many computers are there in the Institution? Mention hours of usage (Hours used/day for how many days in a month)
17. Energy used by each computer per month?(kWh)
18. How many photocopiers are installed by the Institution? Mention hours of usage (Hours used/day for how many days in a month).
19. How many cooling apparatus have been installed in the Institution? Mention hours of usage (Hours used/day for how many days in a month)
20. Energy used by each cooling apparatus per month? Mention hours of usage (Hours used/day for how many days in a month)
21. Energy used by each photocopier per month? Mention hours of usage (Hours used/day for how many days in a month)



22. How many inverters have been installed? Mention hours of usage (Hours used/day for how many days in a month)
23. Energy used by each inverter per month?(kWh)
24. How many electrical equipment are used in different labs of the Institution? Mention hours of usage (Hours used/day for how many days in a month)
25. Energy used by each equipment per month?(kWh)
26. How many heaters are used in the canteen of the Institution? Mention hours of usage (Hours used/day for how many days in a month).
27. Energy used by each heater per month?(kWh)
28. No of streetlights in the Institution?
29. Energy used by each streetlight per month?(kWh)
30. No of TV in the Institution and hostels?
31. Energy used by each TV per month?(kWh)
32. Any other item that uses energy (Please write the energy used per month) Mention hours of usage (Hours used/day for how many days in a month)
33. Any alternative energy sources/non-conventional energy sources employed/installed in the Institution? (photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.
34. Do you run switch off drills at Institution?
35. Are the computers and other equipment put on power-saving mode?
36. Does the machinery (TV, AC, Computer, weighing balance, printers, etc.) run on standby mode most of the time? If yes, how many hours?
37. What are the energy conservation methods adapted by the Institution?
38. How many boards are displayed for energy saving awareness?
39. How much ash is collected after burning fire wood per day in the canteen?

4.4 Energy Audit-Key Findings

4.4.1 List of Instruments

Following instruments were used to collect data related to energy audit:

- 3-phase power analyzer
- Lux meter
- Power Clamp meter
- Hygrometer
- Anemometer
- Measuring tape
- Ultra-sonic flow meter

Table 11: Major Utilities at Sathyabama Institution

S.NO	Particular	Quantity	Rating
1.	Transformer	3	1000kVA × 2 630kVA × 1
2.	Capacitor Bank	4	100 kVA × 4
3.	Diesel Generators	6	725 kVA × 1 625 kVA × 1 500 kVA × 3 185 kVA × 1
4.	Single phase load (lights, fan, power sockets, etc.)	Multiple	Total 440kW
5.	Electric Motor	Multiple	Total 526 HP
6.	Power Load in facility	Multiple	Total 570 kW
7.	Power Load for UPS	Multiple	Total 669 kVA

Table 12: Transformer Ratings

S.NO	Transformer	Transformer Rating (in kVA)
1	Transformer	1000
2	Transformer	1000
3	Transformer	630

4.4.2 Air-Conditioning Systems

Air-Conditioners are used to maintain comfort in working environment. People working in offices require a certain ambient condition to be comfortable to perform the task. Here at Sathyabama Institution, the type AC units are used are as follows:

- Split – High wall
- Split – Cassette
- Duct type

The units used are of different capacities, depending on the space and number of people occupying that space. Due to large number of ACs installed, auditors did the study on sample basis.

Table 13: Detailed performance assessment of Air-Conditioners

S.NO	Location	Rated Capacity in (TR)	Type	Compressed Load (in kW)
1	Auditorium AC unit 1	11.5	Ducted	10.85
2	Auditorium AC unit 1	11.5	Ducted	11.06
3	Auditorium AC unit 1	11.5	Ducted	10.97
4	Auditorium AC unit 1	8.5	Ducted	8.89
5	Auditorium AC unit 1	8.5	Ducted	8.93
6	Library Auditorium	2	Split	2.45
7	Library Auditorium	2	Split	2.2



Table 14: List of lighting load

Area	Equipment	Rating(W)	Quantity	Total load (in kW)
Block No.1	Tube Light	40	156	6.24
Block No.2	Tube Light	40	34	1.36
Block No.3	Tube Light	40	37	1.48
Block No.4	Tube Light	40	37	1.48
Block No.5	Tube Light	40	35	1.4
Block No.6	Tube Light	40	29	1.16
Block No.7	Tube Light	40	35	1.4
Block No.8	Tube Light	40	35	1.4
Block No.10	Tube Light	40	156	6.24
Block No. 11	Tube Light	40	136	5.44
Block No.12	Tube Light	40	156	6.24
Block No.14	Tube Light	40	156	6.24
Block No.15	Tube Light	40	156	6.24
Block No.16	Tube Light	40	156	6.24
Block No.18	Tube Light	40	156	6.24
Dr.MGRillam(Boys hostel)	Tube Light	40	320	12.8
Dr.Gopalakrishananillam (boys hostel)	Tube light	40	320	12.8
3 rd year hostel(Boys hostel)	Tube light	40	203	8.12
Panimalarhostel(Ladies hostel)	Tube light	22	203	4.466
Janakiammalhostel(Ladies hostel)	Tube light	40	156	6.24
Janakiammal hostel-I(Ladies hostel)	Tube light	40	156	6.24
Janakiammal hostel-II(Ladies hostel)	Tube light	40	200	8
Janakiammal hostel-III(Ladies hostel)	Tube light	40	206	8.24
Administrative office	Tube light	40	156	6.24
Old office	Tube light	40	31	1.24
Ladies mess	Tube light	40	250	10
PG mess	Tube light	40	22	0.88
Boys mess	Tube light	40	250	10
CSC block	Tube light	40	80	3.2
ECE block	Tube light	40	80	3.2
E&C AND E&I block	Tube light	40	30	1.2
EEE block	Tube light	40	55	2.2
Machine shop	Tube light	40	30	1.2
CAD lab	Tube light	40	20	0.8
Production lab	Tube light	40	50	2
Welding lab	Tube light	40	60	2.4
Civil block	Tube light	40	97	3.88
Bio-tech block	Tube light	40	130	5.2
M.sc block	Tube light	40	30	1.2
ETC block	Tube light	40	90	3.6
Thermal lab	Tube light	40	30	1.2

Area	Equipment	Rating(W)	Quantity	Total load (in kW)
Mech & production	Tube light	40	30	1.2
Aeronautical lab	Tube light	40	156	6.24
B.Arch.	Tube light	40	156	6.24
Nano-tech block	Tube light	40	60	2.4
Auditorium	Tube light	40	156	6.24
Transport shed	Tube light	40	10	0.4
Library	Tube light	40	30	1.2
Play ground	Tube light	120	22	2.64
Sewage & drainage	Tube light	40	2	0.08
Dobi room	Tube light	40	4	0.16
Street light	Tube light	120	20	2.4
			Total	214.5

Table 15: Performance assessment of lighting system

LUX Measurement					
S.No	Location	Wattage	No.of.Fittings	Avg LUX	Remarks
1	Library hall	1572	44	155	No day light available
2	Library hall Ground floor (student sitting area)	3960	15	115	Daylight available
3	Library 2nd Floor (HR discussion panel)	180	10	64	
4	Interview panel room	220	1	219	No day light available
5	Auditorium	30	1	186	
6	Janakiamal Hostel	36	2	85	
7	St Mother tresailum	72	2	47	
8	Mother of Rosery illum	80	2	48	
9	Immaculate Marry illum	44	2	85	
10	Gopal Krishnan illum	44	2	189	
11	MGR illum	72	2	66	
12	Col Dr Jeppiarillum	72	2	72	
13	Class Room Block 15	240	6	60	Daylight available, with daylight average lux will be 170
14	Class Room Block 18	320	8	85	Daylight available, with daylight average lux will be 185



15	Class Room Block 8 (Room 9)	108	6	95	Daylight available, with daylight average lux will be 200
----	--------------------------------	-----	---	----	--

Table 16: Standard lux level in different areas

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surrounding	20-50
Simple orientation for short visits	50-100
Working areas where visual tasks are only occasionally performed	100-150
Warehouse, Homes, Theaters, Archives	150
Easy Office work, Classes	250
Normal Office work, PC work, Study library, Groceries, Show room, Laboratories	500
Supermarkets, Mechanical workshops, Office landscapes	750
Normal Drawing work, very detailed mechanical works	1000
Detailed Drawing work, very detailed mechanical works	1500-2000
Performance of visual tasks of low contract and very small size for prolonged periods of time	2000-5000
Performance of visual tasks of low contract and very small size for prolonged periods of time	2000-5000
Performance of very prolonged and exacting visuals tasks	5000-10000
Performance of very special visual tasks of extremely low contract and small size	10000-20000

Table 17: Assessment of Pumps

Particular	Location	Value	Unit
Pump No 1	Boys Hostel	15.00	HP
Pump No 2	Girls Hostel	15.00	HP



Table 18: Financial analysis of energy savings in lighting system

Lighting technology	Present rating (in W)	Number of fixtures	Connected load (in kW)	Average running hours per day	Daily energy consumption (kWh)
Conventional FTLs	40	5371	215	5	1074
LED Tube lights	22	5371	118	5	591
Savings per day	18				483
Average tariff	7.50	Per kWh			
Annual energy savings (in kWh)					159519
Monetary savings per day					3625.43
Annual benefits					11,96,390.25
Economics of project					
Cost of one LED tube light					400.00
Cost of installation per light					50.00
Total cost for one light					450.00
Number of lights					5371
Total investment					24,16,950.00
Simple payback					2.02

Table 19: Fans installed at the facility

Area	Equipment	Rating(W)	Quantity	Total load (in kW)
Block No.1	Fan	80	65	5.2
Block No.2	Fan	80	38	3.04
Block No.3	Fan	80	36	2.88
Block No.4	Fan	80	36	2.88
Block No.5	Fan	80	37	2.96
Block No.6	Fan	80	28	2.24
Block No.7	Fan	80	45	3.6
Block No.8	Fan	80	43	3.44
Block No.10	Fan	80	65	5.2
Block No. 11	Fan	80	65	5.2
Block No.12	Fan	80	55	4.4
Block No.14	Fan	80	55	4.4
Block No.15	Fan	80	65	5.2
Block No.16	Fan	80	65	5.2
Block No.18	Fan	80	65	5.2
Dr.MGRillam(Boys hostel)	Fan	80	180	14.4
Dr.Gopalakrishananillam (boys hostel)	Fan	80	180	14.4
3 rd year hostel(Boys hostel)	Fan	80	155	12.4

Panimalarhostel(Ladies hostel)	Fan	80	155	12.4
Janakiammalhostel(Ladies hostel)	Fan	80	65	5.2
Janakiammal hostel-I(Ladies hostel)	Fan	80	50	4
Janakiammal hostel-II(Ladies hostel)	Fan	80	150	12
Janakiammal hostel-III(Ladies hostel)	Fan	80	150	12
Administrative office	Fan	80	8	0.64
Old office	Fan	80	12	0.96
Ladies mess	Fan	80	140	11.2
PG mess	Fan	80	13	1.04
Boys mess	Fan	80	140	11.2
EEE block	Fan	80	24	1.92
Machine shop	Fan	80	30	2.4
Production lab	Fan	80	20	1.6
Welding lab	Fan	80	10	0.8
Civil block	Fan	80	10	0.8
Bio-tech block	Fan	80	30	2.4
M.sc block	Fan	80	18	1.44
ETC block	Fan	80	20	1.6
Thermal lab	Fan	80	20	1.6
Aeronautical lab	Fan	80	65	5.2
B.Arch.	Fan	80	65	5.2
Nano-tech block	Fan	80	30	2.4
Auditorium	Fan	80	50	4
Transport shed	Fan	80	4	0.32
Library	Fan	80	12	0.96
Sewage & drainage	Fan	80	1	0.08
Dobi room	Fan	80	1	0.08
			2571	205.7

Table 20: Financial analysis of implementing energy efficiency in ceiling fans

Lighting Technology	Present Rating (in W)	Number of Fixtures	Connected load (in kW)	Average running hours per day	Daily energy consumption (kWh)
Conventional Fans	80	2571	206	7	1440
BLDC fans	30	2571	77	7	540
Saving per day	50		129		900
Average tariff	7.50	per kWh			
Annual Energy savings (in kWh)					296951
Monetary savings per day					6,748.88
Annual benefits					22,27,128.75



Table 21: Economic feasibility for 5 Star ACs

Air Conditioner Rating	EER (kW/kW)	AC Cooling Capacity (in TR)	Power Consumption (in kW)
1 Star	2.7	2.5	3.25
5 Star	4.5	2.5	1.95
Savings (in kW)			1.3
Running House per day			24
Duty Cycle (Compressor running)			0.65
Energy Savings per day			20.28
Annual Energy Saved (for 365days)			7402.2
Number of ACs			6
Total Savings (Annual)			44413.2

Table 22: Generator Rating

S.NO	Generator	Generator Rating (in kVA)	No of Generator
1	Generator	720	1
2	Generator	625	2
3	Generator	500	3
4	Generator	320	1
5	Generator	185	1



Table 23: Monthly consumption, demand and billing details

Consumption Month	Units consumed (in kWh)	Consumption in kVAh	Actual Max. demand (in kVA)	Power factor	Max. demand (in kW)	Billing amount (in Rupees)
May-19	308633	327850	1275	0.941	1200.27	34,27,094.00
Jun-19	409482	431900	1545	0.948	1464.81	35,77,890.00
Jul-19	408381	424775	1545	0.961	1485.37	35,76,261.00
Aug-19	487896	503650	1530	0.969	1482.14	41,01,496.00
Sep-19	469758	485250	1640	0.968	1587.64	39,90,834.00
Oct-19	330366	348775	1455	0.947	1378.20	30,54,981.00
Nov-19	261980	279540	974	0.937	912.82	28,50,037.00
Dec-19	420940	431100	1208	0.976	1179.53	41,89,396.00
Jan-19	429346	438100	1455	0.980	1425.93	43,61,340.00
Feb-19	443259	455100	1595	0.974	1553.50	45,59,940.00

Table 24: Various solar devices installed in the institute

Devices	Power output
Hetero junction oxide solar cells (lab scale)	3 W
Thin film solar cells (lab scale)	10 W
Perovskite solar cells (lab scale)	0.1 W
Si based solar cell panels	10 KW
Ceria based SOFC	0.3 W

Average Electricity Charges paid per year is Rs 3,76,89,269.

4.5 Energy Audit – Evaluations and Recommendations

Energy Audit was used as the key for decision-making in the area of energy management in the Institution. Energy Audit attempted to balance the total energy input with its uses, and served as a tool to identify all the energy streams in the facility. It quantified energy usage according to its discrete functions. Thus energy audit was used as an effective tool in defining and pursuing comprehensive energy management program in the Institution.

Energy audit was extensively done for the Sathyabama Institution of Science and Technology and the Audit findings are as follows:

Best Practices Observed in the Institution - Energy Management

- ❖ Periodic maintenance of electrical/electronic equipments are done to optimize the power usage.
- ❖ Usage of Star rated Electric/Electronic Appliances
- ❖ Air conditioners are set at optimum temperature to conserve energy
- ❖ Use of Solar -Wind Hybrid system to power laboratory
- ❖ Use of Solar Lamps to light the Walkways
- ❖ Use of Solar power to Run the Kitchen
- ❖ Energy saving through the replacement of incandescent bulbs, CFL lamps and tube lights to LED light
- ❖ Since 2014 Earth Hour has been organized in the Sathyabama Institution of Science and Technology to create awareness among the upcoming generation that electricity is being



wasted and we all have the sole responsibility to conserve it.

- ❖ To enhance awareness among students about energy efficiency and energy conservation various training programs and seminars were conducted at Sathyabama Institute of Science and Technology.
- ❖ The Centre of Excellence for Energy Research developed various types of solar cells and fuel cells like heterojunction solar cells, perovskite based solar cells, intermediate temperature solid oxide fuel cell, oxide and nitride-based super-capacitors for energy production and storage.
- ❖ Centre of Excellence for Energy Research is conducting research on the production of hydrogen using titanium oxide as photocatalyst for water splitting
- ❖ The Institute also has signed MoUs with Foreign Institutes to collaborate on research activities in the field of clean energy.

4.5.1 Consolidation of Energy Audit Findings-Evaluation

The total energy utilization of the Institution for different purposes is approximately 4330954 KWH/year. The main source of power is the electricity purchased from Tamil Nadu Electricity Board. The average Electricity Charges paid per year is Rs 37689269. The campus has solar powered lights along the walk ways. Institution had World's Largest Solar Steam Cooking System with 110 concentrator dishes, but these panels got damaged during the floods of 2018. Now efforts have been taken to re-commission the solar cooking system. The Institution has also taken an effort to power its laboratory using the Solar-Wind Hybrid system. Various researches are going on in the Institution focusing on developing cost effective, efficient and sustainable technologies for meeting the energy needs of the Institute. The Institute also has signed MoUs with various Foreign Institutions to collaborate on research activities in the field of clean energy. All these are great initiatives to reduce the dependence on conventional source of power and to move towards green lighting of the campus. Hence it can be concluded that the Institution is taking a great effort in energy conservation and management.

Based on the above finding few recommendations that the Institution can follow are:

4.5.2 Recommendations

- ❖ Install motion sensors, dimmers, as it turns on the connected lighting system when it detects motion, and turns off the light when there is no motion. This can be installed in bathrooms to automatically turn off the lights when not in use.



- ❖ The generators can be run with biodiesel to reduce the dependence of conventional power
- ❖ Install a programmable/smart thermostat- to eliminate wasteful energy use from heating and cooling, as it automatically turns off or reduce heating and cooling once the set temperature is achieved
- ❖ Clean or replace all A/C filters regularly as dirty filters make the system work harder and run longer than necessary.



Figure 14: Solar-Wind Hybrid system at the institute



Figure 15: Solar Panels with Controller



Figure 16: Solar Powered Cooking System

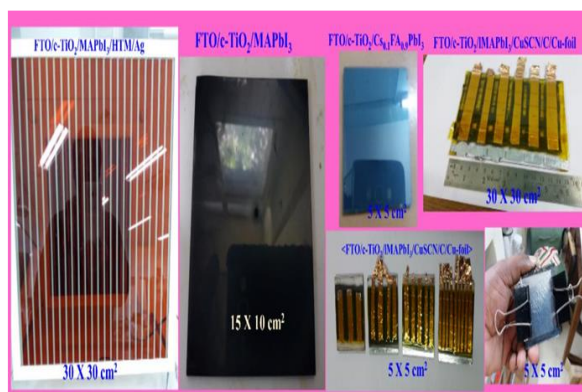


Figure 17: Large Area Perovskite Solar Cells



Figure 18: Training Programmes for students -I



Figure 19: Training Programmes for students -II



CHAPTER 5

WASTE AUDIT

5.1 Introduction

A waste audit involves assessing the waste generated by the Institution to determine the sources and amounts of waste that is generated and disposed. A waste audit will provide baseline data to determine priorities and to establish waste reduction recommendations. A waste audit is a valuable step in managing an organization's waste in a more environmental friendly manner, while helping to reduce waste disposal cost. Solid wastes may include both organic and inorganic waste materials produced by various activities in the Institution. Solid wastes have the potential to pollute all the vital components of living environment - air, land and water. This clearly indicates the need to addresses waste production, management and disposal including, plastic waste, paper waste, food waste, by following the 3 Rs of waste management- Reduction, Reuse, Recycle.

5.2 Solid Waste

Solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling and reuse. Thus the minimization of solid waste being generated and their effective management is essential for maintaining a sustainable environment inside the campus.

The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible Institution examines its waste processing practices.

5.2.1 Key Methodology adopted for Solid Waste Audit

1. Base Line data were collected by distributing questionnaire among students and staff also by conducting interviews among them.
2. A walk through survey of the entire facility was conducted to identify various waste generation points and to estimate the quantity of waste generated.



3. The walk through survey and base line data collection was done between 6th -11th March 2020
4. Based on the observations, the waste was categorized into different types and the current waste management, recycling and disposal systems were analyzed and suitable recommendations were suggested for adhering to 3R s (reduce, reuse, recycle) of waste management strategy.

5.2.2 Solid Waste Survey

1. Does the Institution generate any waste? If so, what are they? How much quantity? Number/weight.

- Paper Waste
- Plastic Waste
- Metal Waste
- Glass Waste
- Organic Waste
- Bio-Medical Waste
- E- Waste
- Hazardous Solid Waste
- Others(Specify)

2. What is the approximate quantity of waste generated per day?(In Kilograms)

3. Why waste is a problem?

4. Whether waste is polluting ground/surface water? How?

5. Whether waste is polluting the air around the campus?

6. Is there any waste treatment system in the Institution? Methods

- Composting
- Recycling
- Reusing
- Others(specify)

7. How many separate boxes do you think you would need to put into a classroom to start a waste segregation and recycling campaign?



8. What should be the use for each box?(Develop a color code with reasons)
9. Do you use recycled paper in Institution?
10. Is there any waste wealth program implemented in the Institution?
11. How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.
12. Is there any zero garbage policy followed in the Institution? (Reduce, Recycle, Reuse, Refuse)
13. What is the total strength of students, teachers and Non- teaching staff in the Institution?
14. Which of the following are found near the Institution?
 - Municipal dump yard/Garbage heap
 - Sewer line/stagnant water/Open drainage
 - Presence of Bus station/Railway station/Industry
 - Market/shopping complex/public halls

5.2.3 Solid Waste Audit-Key Findings

- ❖ Paper Waste like Newspaper, Magazines, Card Board, Box Board were disposed by selling it to vendor in exchange of recycled papers.
- ❖ Plastic waste like milk covers, plastic covers were segregated at the source and was disposed by selling it to the vendor
- ❖ Other Solid waste like clothing, terracups, dried leaves were disposed by giving away to Corporation
- ❖ Food wastes generated in the canteen and mess were disposed by giving away to Pig farm as feed to pigs which falls under highest strata of waste reduction strategy as per the Food Waste Management Hierarchy. The average quantity of food waste generated 346500 kg/ year.
- ❖ Laboratory Wastewater was sent directly to STP for further treatment.
- ❖ Glass waste generated was recycled and reused, non- recyclable glass waste was given to Corporation.
- ❖ The average quantity of biodegradable wastes generated (Paper, dried leaves, vegetation, garden waste, except food waste is 2178 kg/year.
- ❖ Worn out flowers used for decoration and paying homage to the memorial of Col Dr Jeppiaar was converted to Incense Sticks



Table 25: Various Types of Waste Generated

Type of Waste	Quantity	Disposal Mechanism adopted
Paper Waste , tea cups, tetra packs, juice bottles	Collected in bin of 4.5 * 3.5*3.5 - 36 such bins get filled in three days	1)Of the total waste collected 1-3% is recycled through recyclers who take recyclable papers and return A4 sheets in return of 50% lesser weight 2) Other wastes are being collected by Corporation vehicles once in three days; which can be accounted as 12 bins.
Plastic Waste	Major quantum is diverted to architecture department for sustainable building research	Remaining wastes were given away to corporation along with paper waste
Metal Waste : Steel chairs, scrap cupboards, racks	Waste generated during the period 2015-2016; 2016-2017;2017-2018; 2018-2019, 2019-2020 Metal racks-32, Steel cupboards-50, Plastic chairs-300	Metal waste generated was disposed by selling to Scrap dealers
Food Waste including vegetable/fruit peels, waste food	900-1200 kg per day	Food waste was diverted to pig farms as feed for pigs

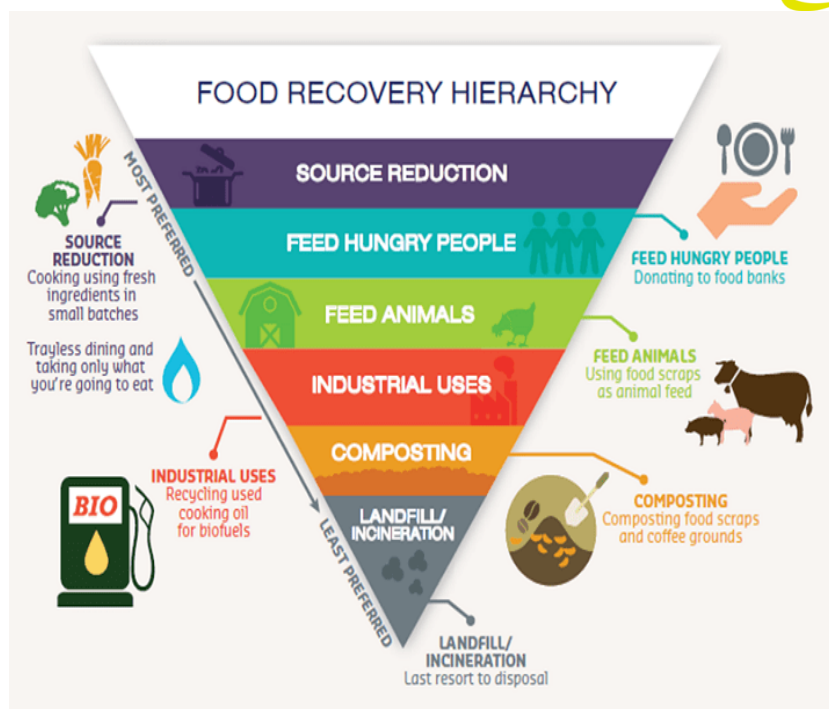


Figure 20: Food Waste Management Hierarchy

5.2.4 Solid Waste Audit-Evaluations and Recommendations

Solid wastes generated in the Institution comprised of both organic and inorganic waste materials produced by various activities in the Institution. These wastes have the potential to pollute all the vital components of living environment - air, land and water. Waste audit involved the assessment of the waste generated by the Institution and also identified the source and amount of waste that is generated and disposed. The waste audit was used as the baseline data to determine priorities and establish waste reduction recommendations. Thus waste audit was a valuable step in managing an organization's waste in a more environmental friendly manner, while helping in the reduction of waste disposal costs.

Waste audit was extensively done for the Sathyabama Institution of Science and Technology and the Audit findings are as follows:

Best Practices Observed in the Institution –Solid Waste Management

- ❖ Segregation of waste at the source was done-such Segregation was carried out in each and every building in the campus
- ❖ Disposal of waste into colour coded bins
- ❖ Recycling of Paper Waste



- ❖ Diversion of Plastic Waste to architecture department for sustainable building research
- ❖ Diversion of food waste including vegetable/fruit peels, to pig farms as feed, which is one of most preferred form of disposal of food waste management
- ❖ Technology Development for conversion of food waste to organic pots
- ❖ Technology Development for conversion of worn out ornamental flowers to Incense Sticks
- ❖ Technology development for conversion of organic waste into electricity
- ❖ Technology Development for production of organic sanitary pads
- ❖ Smart Compost development from solid waste
- ❖ Generation of Biodiesel from Waste Cooking Oil to Run Biodiesel powered buses
- ❖ Technology Development for Generation of Bio diesel from Waste Cooking Oil to run the pump sets for farmers
- ❖ Production of Eco Friendly soap from waste cooking oil
- ❖ Students prepared paper bags and distributed to various shops in exchange for plastic bags to create awareness on the detrimental effects of plastic bags.
- ❖ Students made an eco-market by making products out of recycled waste products.
- ❖ Eco club students conducted a workshops on making useful things from waste pet bottles, paper, glass, cardboards, ice cream sticks etc.
- ❖ Students cultivated Mushrooms and Ladies finger in waste pet bottles
- ❖ Girl students were exclusively called upon to make value added and fashionable products from waste scraps, and those were shelved for sale.

5.2.4.1 Consolidation of Solid Waste Audit Findings-Evaluation

In the Institution campus, general wastes are generated from the Garden, Mess, College, Hostel, Sweeping areas, Kitchen, Laboratories, Stores sections etc. The source segregation of the waste from the entry level at each stage was done. In each and every block and also in each and every room in both the boys and girls hostel were provided with the colour coded bins. In the campus verandahs, drums are located for the collection of waste. Large trolleys are operated by the each section for the collection of waste from their source. The Food waste generated at the Mess was given to the pig farms on a daily basis, which is one of most preferred form of disposal in food waste management hierarchy. The garden waste was collected by the sweepers on a daily basis and disposed into the bins to be given away to the Corporation. Metal Waste like Steel chairs, scrap cupboards, racks etc. were sold to scrap dealers and revenue was generated from it.



Major quantum of plastic waste was diverted to Architecture department for sustainable building research and few left out waste was given away to Corporation. Few plastic bottles, plastic covers, cans, broken glass wares, tins were recycled for planting saplings and also to create decorative items to be displayed in the campus. The waste cooking oil was recycled and reused to generate biodiesel to run the buses. The Institution has also developed technology for development of Incense Sticks from waste ornamental/ ritual flowers and also developed the technology for production of organic sanitary pads and these knowledge were imparted to rural women of the villages adopted by Sathyabama Institute. This provided a means of livelihood for these rural women. This initiative was recognized by the Government under Unnat Bharat Abhiyan Scheme. So that it can be concluded the Institution is putting a great effort towards sustainable management of solid waste generated in the campus. Hence it can be said that Institution is following the 3 Rs- Reduce, Reuse, Recycle- the key ideals of sustainable waste management, to the core.

Based on the above finding few recommendations that the Institution can follow are-

5.2.4.2 Recommendations

- ❖ Installation of Bio-methanation plant -the renewable energy generated from this can be used as a substitute to conventional source of power
- ❖ A portion of food waste generated can be diverted to biomethanation plant as the quantum of food waste is very high
- ❖ Install Composting plant to treat old leaves and other organic waste generated in the campus that can't be diverted to pig farm
- ❖ Try to achieve Zero Waste Target which refers to producing, consuming and recycling products without throwing anything away.



Figure 21: Source of wood waste generation



Figure 22: Incense sticks from waste ritual flowers



Figure 23: Biodiesel developed from waste cooking oil used to run Generator



Figure 24: Awareness given to Anganwadi Children on Segregation of Waste



Figure 25: Biodiesel developed from Waste cooking oil used to run bus



Figure 26: Organic pots from food waste and coco peat



5.3 Biomedical Waste Audit

Biomedical waste comprises human & animal anatomical waste, treatment apparatus like needles, syringes, and other materials used in health care facilities in the process of treatment and research. This waste is generated during diagnosis, treatment, or immunization in hospitals, nursing homes, pathological laboratories, blood banks, etc.

These wastes are potentially hazardous, toxic and highly infectious because of their high potential for disease transmission. Indiscriminate disposal of such waste poses health risk to human population, especially to health care personnel, sanitary workers. It is of at most importance that biomedical waste is managed in an environmentally sound manner which requires proper understanding of risk associated with the disposal of such waste. Scientific disposal method should be followed during proper segregation, storage, handling, treatment and disposal of biomedical waste. The auditor analyzes whether biomedical waste management practices were satisfactory and in accordance with BMW rule 2016.

The auditor diagnoses the prevailing Biomedical waste are segregated at source and put in color coded bags as per Schedule I of BMW RULE 2016 and sealed before giving it to Common Biomedical Waste treatment facility for treatment, processing and disposal. The auditor also looks into the fact whether the awareness on biomedical waste segregation, management and disposal amongst the doctors and the paramedical staff are adequate. The auditor will suggest the methods to be followed while disposing the Biomedical waste and record to be maintained in the Institution.

5.3.1 Key Methodology adopted for Biomedical Waste Audit

1. Base Line data were collected by distributing questionnaire among students and staff also by conducting interviews among them.
2. A walk through survey was done for assessing the knowledge of doctors and paramedical staff regarding biomedical waste handling and management.
3. A walk through survey was done for observing the real time practices of the biomedical waste management in the various departments of Dental College and Hospital and to formulate details of Biomedical waste (infectious and non-infectious) being generated.
4. Walk through survey and base line data collection was done on 12th March 2020



5. Based on the observations and surveys, analysis was done to see whether Biomedical Waste Management Rules were followed and suitable recommendations were also suggested.

5.3.2 Bio Medical Waste Audit-Survey/Questionnaire

1. Whether Bio medical waste are segregated at source and put in color coded bags as per Schedule I of BMW RULE 2016 Is Color coding practiced?
2. Whether Performa of the label used on container/bag?
3. How much waste is generated per day/week/month/year?
4. Whether the Standard for treatment and disposal of waste is been followed?
5. Whether there is any mixing of general waste with bio-medical waste?
6. Is there adequate awareness on biomedical waste segregation, disposal, effect and management amongst the doctors and the paramedical staff?
7. Whether the workers involved in the biomedical waste handling were provided with gloves, face mask and head cap?
8. Is there Pre-treatment of the laboratory waste, microbiological waste, blood samples, and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO ?
9. Whether the liquid waste generated from health care facilities pretreated before mixing with other wastewater?
10. Whether training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year?
11. Whether Regular checkup of Healthcare workers are conducted?
12. Whether health care workers and others, involved in handling of bio-medical waste are given immunization for protection against diseases that are likely to be transmitted by handling of bio-medical waste?

5.3.3 Biomedical Waste Audit-Key Findings

Sathyabama Dental College and Hospital established in 2009 is an autonomous Institution affiliated to Sathyabama Institution of Science and Technology, Chennai, Tamil Nadu, India. The Institution has gained an unsavory reputation and has been accredited by the National Assessment and Accreditation Council (NAAC) with 'A' grade.

Sathyabama Dental College and Hospital has 18 functioning departments and has its own pharmacy. These departments are under the supervision of 60-90 doctors and 20-35 paramedical staff. The total numbers of patients coming to have treatment are about 150-250 per day.

Sathyabama Dental College and Hospital is using color coded bins for all types of Bio Medical Wastes being generated.

GJ.Multiclave (India) Pvt. Ltd Adyar, Chennai is the authorized recycler who collects the Biomedical waste being generated in the Institution for further treatment and disposal.

Table 26: Generation of waste (infectious and non-infectious) in different departments of Sathyabama Dental College and Hospital

Department	Types Of Waste Generated	Quantum Of Waste (Approximately)	No Of Person Involved In Waste Handling
Department of oral maxillofacial pathology	Sharps, body fluids, Discarded medicine	2-3 kg/week	>5
Department of public health dentistry	Gloves, mask, washed water	Variable	+2
Department of oral medicine and Radiology	Gloves ,mask, instrument pouches	Gloves-40 pieces Mask-30 pieces Instrument pouch-75 pieces per day	
Department of oral maxillofacial surgery	Sharps, outdated Medicine	1(red, blue, black) bag/day	2
Department of prosthodontics and implantology	Plaster of paris, Alginate	POP -40kg/week Alginate -10kg/week	4

Department of Pedodontics	Cotton, gloves, needles, bandages	10kg/week	2
Department of Conservative dentistry and endodontics	Soiled cotton, needles, syringes, amalgam	01.5 kg/day	4
Casualty	Sharps, plastics container , anatomical organs	3 kg/day	2

Color Coding of Biomedical Waste

- ❖ **Yellow**-Human & Animal Anatomical Waste, Discarded Chemicals, Chemical Waste, Lab Waste
- ❖ **Red**- Contaminated Waste (Recyclable) – Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (syringe without needle)
- ❖ **Blue**-Broken or discarded and contaminated glass vials including medicine vials and ampoules
- ❖ **White**-Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades.

Table 27: Quantity of Bio-Medical waste generated

Years	Red			Yellow			Blue		
	Avg/ day	Avg/ Week	Avg/ Month	Avg/ day	Avg/ week	Avg/ Month	Avg/ Day	Avg/ week	Avg/ month
2019	2.33	16.31	70	1.66	11.62	50	1.33	9.31	40
2020	3.75	26.25	112.5	2.25	15.75	67.5	1.75	12.25	52.5

5.3.4 Biomedical Waste Audit-Evaluations and Recommendations

Biomedical wastes generated from Dental College and Hospital are potentially hazardous, toxic and highly infectious because of their high potential for disease transmission. Indiscriminate disposal of such waste can pose health risk to human population, especially to health care personnel, sanitary workers and students in and around the campus. Audit was done to see if biomedical wastes are managed with at most importance in an environmentally sound manner.



Audit was done to analyze whether proper understanding of risk associated with the disposal of such waste exist among the staff. Audit was done to analyze the level of awareness about proper segregation, storage, handling, and disposal among staffs and doctors.

Biomedical Waste audit was extensively done for the Sathyabama Institute of Science and Technology and the Audit findings are as follows:

Best Practices Observed in the Institution –Biomedical Waste Management

- ❖ Biomedical waste are segregated at source and put in color coded bags
- ❖ Compliance with the BMW Management Rules, 2016
- ❖ Sealing of the color coded bags before giving it to Common Biomedical Waste treatment facility for treatment processing and disposal
- ❖ Adequate awareness level amongst the doctors and the paramedical staff on biomedical waste segregation, disposal and management exist.
- ❖ Records of the Biomedical waste generation is maintained
- ❖ The Institution has its own General hospital and Dental Hospital that offers free of cost medical treatment to its students, staff and their family members
- ❖ Periodic vaccination camps, blood donation camps, dental camps are conducted by General Hospital and Dental College of Sathyabama University
- ❖ General hospital and Dental Hospital offers medical treatment to nearby community at a very reasonable rate.
- ❖ Mobile health monitoring facility is run by the Institution and conducts regular health checkup for the members of its adopted villages.
- ❖ Psychological counseling is offered on a regular basis to its students to reduce the stress of students and to help them not to fall into depression
- ❖ Medical camps are held regularly in the college campus as well as in the adopted villages and the schools
- ❖ The Institution has signed MoU with various Universities and Hospitals to strengthen research partnership and to collaborate in various research activities.



5.3.4.1 Consolidation of Biomedical Waste Audit Findings-Evaluation

Sathyabama Institution of Science and Technology has its own Dental College and Hospital with 18 functioning departments and own pharmacy. The Hospital has nearly 100 beds the various departments are under the supervision of 60-90 doctors and 20-35 paramedical staff. The Hospital conducts periodic health checkups and vaccination drive for the inmates of the Institute as well as for the people nearby. This Dental College and Hospital are the main source of Biomedical Waste Generation. The average quantity of biomedical waste generated is 785kg/year. This is been handled with proper care and disposed into proper colour coded bags and sealed before handing over to the authorized handler. The Institution is taking utmost care to ensure that the Biomedical Waste so generated is handed over to authorized handler at periodic intervals as mentioned in the BMW Management Rules, 2016. The Doctors and the staffs in the Hospital and Dental college are well aware of the safe handling and disposal methods of Biomedical Waste.

Based on the above finding few recommendations that the Institution can follow are

5.3.4.2 Recommendations

- ❖ Phase-out the use of chlorinated plastic bags, gloves, and blood bags as soon as possible (as per BMW Management Rules, 2016)
- ❖ Pre-treatment of the laboratory waste, microbiological waste, blood samples, and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO needs to be done
- ❖ Treatment of liquid waste generated from health care facilities due to use of chemicals in production of biological and used or discarded disinfectants, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, housekeeping and disinfecting activities etc. shall be pretreated before mixing with other wastewater.
- ❖ Provide training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year and the details of training programs conducted, number of personnel trained and number of personnel not undergone any training shall be provided in the Annual Report

- ❖ Conduct Regular checkup of Healthcare workers and immunize all its health care workers and others, involved in handling of bio-medical waste for protection against diseases including Hepatitis B and Tetanus that are likely to be transmitted by handling of bio-medical waste. (in 2021 bring it to best practices, write about vaccination camps) (write about free health care for staff)



Figure 27: Colour coded bin for BMW Waste disposal



Figure 28: Lead Auditor Inspecting Hospital Campus



Figure 29: Free Dental Check up for local people



Figure 30: Color coded bags for BMW waste collection



5.4 E -Waste Audit

E-Waste or Electronic-Waste is the term used to describe old, end-of-life or discarded electric/electronic appliances which includes computers, mobiles, consumer electronics etc. It majorly includes electronic equipment, completely or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes.

E-waste consists of toxic elements such as Lead, Mercury, Cadmium, Chromium, Polybrominated biphenyls and Polybrominated diphenyl. Burning of E-waste can have serious implications on human health and can cause air pollution, soil pollution and groundwater contamination.

The auditor will analyze whether E-waste generated is channelized through authorized producer or dismantler or recycler. Auditor will also diagnose whether the records of E-waste generated are maintained as per Form-2 and whether such records are produced for scrutiny by the concerned State Pollution Control Board. Auditor will ensure that all steps are taken to manage the E-waste in a manner which shall protect the health and environment against any adverse effects.

5.5.1 Key Methodology adopted for E-Waste Audit

1. Base Line data were collected by distributing questionnaire among students and staff also by conducting interviews among them.
2. A walk through survey was done for assessing the types of E-Waste being generated, for quantification of E-waste Generated, for analyzing the existing E-waste Management Strategy in the Institution, for analyzing whether Extended Produce Responsibility is being followed in the Institution.
3. Walk through survey and base line data collection was done on 13th March 2020
4. Based on the observation and surveys, analysis was done to see whether E-Waste Management Rules were followed and suitable recommendations were also suggested



5.5.2 E-Waste Audit-Survey/Questionnaire

1. What the Institution does with electronic/electrical products that are no longer in use?
2. What the Institution does with broken electronic/electrical products?
3. How many electronic/electrical products does the Institution purchase a year?
4. On average, how many electronic/electrical products does the Institution choose to repair in a year?
5. Awareness about E-waste Laws among the students?
6. Awareness about what happens to E-waste if not recycled through proper channels?
7. What is the approximate quantity of E-waste generated per day?
8. Whether E-waste generated by them is channelized through authorized producer or dismantler or recycler?
9. Whether records of e-waste generated are maintained in Form-2?
10. Whether end-of-life electrical and electronic equipment are admixed with e-waste containing radioactive material?
11. Whether the annual returns are filed in Form-3, to the concerned State Pollution Control Board?

5.5.3 E-Waste Audit- Key Findings

- ❖ Sathyabama Institution being an educational Institution will fall under the category of Bulk Consumer as per E-Waste Management Rules 2016.
- ❖ Main source of E- Waste in the campus includes used Electric/ Electronic equipments like Laptops, PC, desktops, monitors, circuit boards, old mobile phones, printers, scanners, damaged electrical/electronic equipments used in the laboratories etc.
- ❖ Nearly one tonne of E-Waste is being generated in an year in the Institution which is sold to the recycler and generating a revenue of 3 lakhs per annum
- ❖ M/S Earth Sense Recycle Pvt Limited ,Chennai is the authorized recycler who collects the E-waste being generated in the Institution for further dismantling, recycling and disposal



- ❖ Name & Address of authorized collection centre /dismantler/recycler / refurbisher who collects E- waste from the Institution is M/S Earth Sense Recycle Pvt Limited, Thenmelpakkam Village, Chengalpattu, Chennai
- ❖ Major type of E Waste generated in the campus is batteries- nearly 2400 to 2500 batteries are used in the UPS units across the institute. These batteries are refilled frequently. Old batteries are exchanged upon replacement of new batteries.
- ❖ Other E-waste generated in the campus includes A/C, Laptops, Desktops, Tab, Old Phones, Damaged Laboratory Equipments, Switch Boards and Circuits, Printer and Scanner Scraps, Tubes and Bulbs, etc.
- ❖ Earlier 500 new systems were bought in a year and nearly 200 old systems were getting repaired.
- ❖ Extended producer responsibility is been followed for equipments like batteries and UPS.

5.5.4 E-waste Audit- Evaluations and Recommendations

The existing practices of E-waste management in India suffer from quite a few disadvantages like appropriate inventory, unhealthy conditions of informal recycling, inadequate legislation, poor awareness, dumping of E-Waste. These results in toxic materials entering the waste stream causing adverse effects on the environment and human health and wasting recoverable valuable by-products. The audit attempts to analyse the level of awareness about E-Waste generation, storage, disposal, environmental and health concerns among the members of the Institution. The audit was done to analyze whether E-waste management rule is followed and whether Extended Producer Responsibility (EPR) is implemented in the campus. The audit was done to analyze whether Institution has safe storage area for storing the e-waste before its disposal.

E-Waste audit was extensively done for the Sathyabama Institute of Science and Technology and the audit findings are as follows

Best Practices Observed in the Institution -E-Waste Management

- ❖ Effort to utilize the Extended Producer Responsibility
- ❖ Use of reusable products/ equipment
- ❖ E-Waste generated is channelized through authorized recycler for treatment, dismantling and disposal
- ❖ Compliance with the E-Waste Management Rules 2016



- ❖ Adequate efforts are put in to ensure that no damage is caused to the environment during storage and transportation of the E-Waste

5.4.4.1 Consolidation of E-Waste Audit Findings-Evaluation

Sathyabama Institution being an educational Institution will fall under the category of Bulk Consumer as per E-Waste Management Rules 2016. Main source of E- Waste in the campus includes used Electric and Electronic equipments like Laptops, PC, desktops, monitors, circuit boards, old mobile phones, printers, scanners, damaged electronic equipments used in the laboratories etc. E-Waste is generated from various Department/Schools especially electric and electronics department, Mechanical department, IT department, Administrative Building. Institution is generating nearly one tonne of E-Waste in a year which is sold to the recycler and generating revenue of nearly 3Lakhs from it. The Institution is taking adequate efforts while handling the E-Waste especially while collection, storage, transportation.

Based on the above finding few recommendations that the Institution can follow are

5.4.4.2 Recommendations

- ❖ Records of E-waste generated shall be maintained as per Form-2 mentioned in E-Waste Management Rules 2016
- ❖ Ensure that electrical and electronic equipment are not admixed with e-waste containing radioactive material
- ❖ Maintain a record of collection, sale, transfer and storage of wastes and make these record available for inspection
- ❖ The E-waste storage area shall have separate containers for storage of batteries, capacitors containing PCBs (Poly Chlorinated Biphenyls) or PCTs (Poly Chlorinated Terphenyls)
- ❖ The E-waste storage area shall have water proof roofing and impermeable surface



CHAPTER 6

GREEN AUDIT

6.1 Introduction

The rapid urbanization economic development at local, regional and global level has lead to several environmental and social crises. Biodiversity is facing serious threats from habitat loss, pollution, over consumption and invasive species. This will affect nature's delicate balance and quality of life. Without this variability in the living world, ecological systems and functions would breakdown, with detrimental consequences for all forms of life, including human beings. On this background it becomes essential to adopt the system of green campus for the organization which will lead to sustainable development and at the same time reduce the sizeable amount of atmospheric CO₂ from the environment.

A significant density of trees will decrease the amount of carbon dioxide in the atmosphere. Trees play an important ecological role within the urban environment for its urban heat, climate, air pollutants entrapment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen that a single tree generates is enough to provide one day's supply of oxygen for people. Trees in the campus impact student's mental health as well; studies have shown that trees greatly reduce stress, which is a huge deal when considering that many students are under some amount of stress. In this note, every educational Institution must conduct green audit as a form of self-assessment to reflect the role the Institution has been playing in mitigating the environmental impacts caused by its various activities.

6.2 Key Methodologies adopted for Green Audit

1. A walk through survey of the entire campus was done to observe the total area under green coverage, presence of marshy land, ponds and to identify various types of trees and plants.
2. Obtaining information by conducting interviews and distributing questionnaire among students and staff about Eco Club activities and various Green Campus initiatives.
3. Walk through survey and base line data collection was done between 16th -17th March 2020



4. Based on the findings, the total Green Cover area of the campus was calculated and suggestions were for better green management practices.

6.3 Green Audit-Survey/Questionnaire

1. Is there a garden in the Institution? Area?
2. Do students spend time in the garden?
3. List the plants in the garden, with approx. numbers of each species.
4. List the species planted by the students, with numbers.
5. Whether scientific names of the trees are displayed in the campus?
6. Is there any plantation in the campus? If yes specify area and type of plantation.
7. Is there any vegetable garden in the Institution? If yes how much area?
8. Is there any medicinal garden in the Institution? If yes how much area?
9. What are the vegetables cultivated in the vegetable garden? (Mention the quantity of harvest in each season)
10. How much water is used in the vegetable garden and other gardens? (Mention the source and quantity of water used).
11. Whether recycled water is used for gardening?
12. Whether organic farming is done in the Institution? How?
13. Is there any composting pit in the institute? If yes what is being done with the compost generated?
14. Is there any student market in the institute?
15. Give the number and names of the medicinal plants in the Institution campus.
16. Any threatened plant species planted/conserved?
17. Is there a nature club in the institute? If yes what are their activities?
18. Is there any arboretum in the Institution? If yes details of the trees planted.
19. Is there any fruit yielding plant in the Institution? If yes details of the trees planted.
20. Is there any grove in the Institution? If yes details of the trees planted.



21. Is there any irrigation system in the Institution?
22. What is the type of vegetation in the surrounding area of the Institution?
23. What are the nature awareness programs conducted in the campus?
24. What is the involvement of students in the green cover maintenance?
25. What is the total area of the campus under tree cover? Or under tree canopy?
26. Share the IDEAS for further improvement of green cover.

6.4 Green Audit- Key Findings

Area under green cover is approximately 40469.445 sq.m and efforts are taken to increase the green cover by terrace farming, planting of saplings, roof top gardening, vegetable gardening etc. The Institution also has a marshy land area of 5120 sq.m. The various tree/plant/shrub species observed in the campus are listed below.

Table 28: Campus Trees

S.No	Tamil Names	Botanical Names
1	Pungai	<i>Millettia pinnata</i>
2	Neem	<i>Azadirachta indica</i>
3	Thoongumoonjimaram	<i>Samanea saman</i>
4	Like coconut-	<i>Cocos nucifera</i>
5	Idly poo	<i>Ixora coccinea</i>
6	Savukku	<i>Casuarina equisetifolia</i>
7	Badam	<i>Terminalia catappa</i>
8	Hibiscus	<i>Hibiscus rosa-sinensis</i>
9	Jasmine/mullai	---
10	Coconut	<i>Cocos nucifera</i>
11	Australian babul plant	<i>Acacia auriculiformis</i>
12	Ashoka maram	<i>Saracaasoca</i>
13	Munkil	<i>Bambusoideae</i>
14	kagitha poo	– <i>Bougainvillea</i>
15	Tamanu maram	<i>Calophylluminophyllum</i>
16	Mayilkondraimaram	<i>Delonix regia</i>
17	Koyyamaram	<i>Psidium guajava</i>
18	Kondraimaram	<i>Cassia fistula</i>
19	Elumiccai	<i>Citrus × limon</i>
20	Mhaliammaram	<i>Mimusopselengi</i>
21	Vep pammaram	<i>Azadirachta indica</i>



22	Badammaram -	<i>Terminalia catappa</i>
23	Pungaimaram -	<i>Millettia pinnata</i>
24	Thoongumoonjimaram -	<i>Samanea saman</i>
25	Perunkondraimaram -	<i>peltophorum-pterocarpum</i>

6.5 Green Audit-Evaluations and Recommendations

The environment where we live within is of utmost concern since it is directly related to the survival. Keeping it healthy is the responsibility of each and every individual. Green audit was done to analyze whether the Institution is taking adequate steps for protection and conservation of the environment in and around the campus. Green audit was done to analyze whether the concept of sustainable environment is adhered to while undertaking various construction and expansion activities in the campus.

The audit was done to suggest methods and practices that can be followed for environmental protection. During the audit, various trees and plant species were observed, and area under green coverage was analyzed to ensure that the campus conform to green standards. The audit was done to ensure that the practices followed in the campus are in accordance with the Green Policy recommended by NAAC.

Green audit was extensively done for the Sathyabama Institute of Science and Technology and the audit findings are as follows:

Best Practices Observed in the Institution –Green Campus Management

- ❖ Planting and caring of trees in and around the campus
- ❖ Various plantation drives involving the students were held in the campus
- ❖ Institution is maintaining Marshy Land in its natural form there by helping in Ground Water Recharge and even act as a habitat for the birds nearby.
- ❖ Eco-club developed an eco-farm in the Institution campus, for growing vegetables using organic fertilizers.
- ❖ Terrace garden was inaugurated at the Chemical Engineering Department
- ❖ Eco club along with Rotaract club of Sathyabama Institution arranged for a 100sq.ft.terrace garden in Administration building, International Research Centre, ECE Block, CSE Block, 14th classroom Block, Biotechnology Department and Chemical Engineering Department.



- ❖ Fifth phase of terrace gardening incorporated 'PET-bottle-watering method'
- ❖ Various seminar were conducted to give awareness about various gardening practices
- ❖ With the coordination of staffs and students at the Institution, students were demonstrated the scientific methodology for preparation of Bio Manure and organic pots
- ❖ Workshops were conducted to generate awareness regarding Vermi Composting practices, Carbon Credits and for generating Wealth out of Waste (WOW).
- ❖ Workshop on seed balls, a permaculture technique for growing seeds in an easy and effective way was conducted.

6.5.1 Consolidation of Green Audit Findings-Evaluation

The Institution has green cover of 33,705sq.m and Marshy Land of 5,120 sq m area. This will help in absorption of pollutant and nullifying the GHG emitted in the campus. The Institution is conducting various eco club activities involving the students for making the campus green and eco- friendly.

Various seminars and workshops were conducted to give awareness about Vermi-Composting, seed balls, preparation of Bio-Manure, making of Organic pots. Institution is also promoting terrace gardening by motivating the students to do gardening on the roofs of various building. The campus has several plant, tree and shrubs species that contribute to aesthetics and overall greening of the campus. So it can be concluded that Institution is taking great effort in maintaining an eco- friendly green campus.

Based on the above finding few recommendations that the Institution can follow are-

6.5.2 Recommendation

- ❖ Promote Indoor Gardening-Indoor plants are commonly used for their aesthetics benefits but they also have vital role reducing airborne pollution. The right choice of plants can be an excellent way of improving indoor air quality and general health. List of indoor plants are shown below.
- ❖ Ensure that an audit is conducted annually and action is taken on the basis of audit report, recommendation and findings.
- ❖ Review periodically the list of trees planted in the campus, allot scientific names and numbers to the trees and maintain records of the same.

Table 29: List of few indoor plants with their benefits

Plants	VOC it removes	Indoor source of VOC's	Plant care
 Aloe Vera	Formaldehyde, Trichloroethylene and Benzene	Chemical based cleaners and paints	Easy to grow with enough sunlight
 Bamboo Plant	Formaldehyde, Trichloroethylene and Benzene	Paints, Plastics, Wood products etc.	Thrives under lowlight conditions as well as easy to maintain
 Chinese Evergreen	Benzene	Paints	Low maintenance plant that prefer slow light conditions.
 English Ivy	Formaldehyde, Benzene, Airborne fecal matter particles	Wood, Paper products, Airborne fecal –matter particles from pests	Easy to maintain



Figure 31: Institute initiatives for maintaining a green campus



Figure 32: Campus greenery



Figure 33: Students involved in green campus activities



Figure 34: Plantation drive by NSS

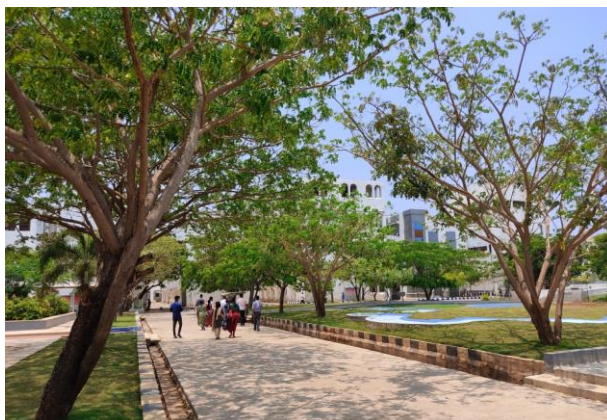


Figure 35: Green Campus I



Figure 36: Green Campus II



CHAPTER 7

CARBON FOOT PRINT AUDIT

7.1 Introduction

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 412 ppm of the Earth's atmosphere.

An important aspect of doing a carbon foot print audit is to account the carbon foot print of the campus by determining the net amount of greenhouse gas emitted from various activities in the campus so that the Institution can adopt better ways to reduce its carbon foot print. One aspect is to consider the distance travelled and mode of travel used to commute between home and Institution every day by the students and staffs. So the carbon foot print auditing determine the total carbon foot print of the campus and analyzes whether the campus is eco-friendly and follows environmentally sustainable practices. It is therefore essential that any environmentally responsive Institution shall examine its carbon footprint.

7.2 Key Methodologies adopted for Carbon Footprint Audit

1. A walk through survey was conducted in the entire campus to observe various greenhouse gas emission points.
2. Base Line data was collected by distributing questionnaire among students and staff also by conducting interviews among them.
3. Walk through survey and base line data collection was done between 18th -19th March 2020
4. Based on the data collected, the Green House Gas Emission as CO₂ Eq from the various sources was calculated.
5. Observation was done to see whether the authorities have implemented any Carbon Footprint Reduction Strategy
6. Recommendations were given for further Green House Gas Emission Reduction.



7.3 Carbon Footprint Audit-Survey/Questionnaire

1. What is the total strength of students and teachers in the Institution?
2. Total Number of vehicles used by the stakeholders of the Institution. (per day)
3. No. of cycles used?
4. No. of two wheelers used (average distance travelled and quantity of fuel and amount used per day)
5. No. of cars used (average distance travelled and quantity of fuel and amount used per day)
6. No. persons using common (public) transportation (average distance travelled and quantity of fuel and amount used per day)
7. No. of persons using Institution conveyance by the students, non-teaching staff and teachers (average distance travelled and quantity of fuel and amount used per day)
8. Number of parent-teacher meetings in a year? Parents turned up(approx.)
9. Number of visitors with vehicles per day?
10. Number of generators used per day (hours). Give the amount of fuel used per day.
11. Number of LPG cylinders used in the canteen (Give the amount of fuel used per day and amount spent).
12. Quantity of kerosene used in the canteen/labs (Give the amount of fuel used per day and amount spent).
13. Amount of taxi/auto charges paid and the amount of fuel used per month for the transportation of vegetables and other materials to canteen.
14. Amount of taxi/auto charges paid per month for the transportation of office goods to the Institution.
15. Average amount of taxi/auto charges paid per month by the stakeholders of the Institution.
16. Use of any other fossil fuels in the Institution (Give the amount of fuel used per day and amount spent).
17. Suggest the methods to reduce the quantity of use of fuel used by the stakeholder's /students/ teachers / non-teaching staff of the Institution.



7.4 Carbon Footprint Auditing-Key Findings

Feasible emission inventories were selected to analyze the carbon footprint of the campus. The inventory survey was done for one academic year. The selected inventories are Human Factor, Transportation, Electricity, Solid Waste, Production and Consumption of Food, LPG & Natural Gas.

Data keepers are identified and the primary details were collected. Parameter wise and zone wise details were also collected. The received data were assembled and the missing gaps were recognized.

7.4.1 Human factor

Carbon dioxide emitted by a person per day is not negligible. It is equivalent to the emission of a car in a 5km stretch. Humans emit 26 giga tons of carbon dioxide per year while CO₂ in the atmosphere is rising by only 15 giga tones per year. Just for breathing, humans emit per person each day 1140 grams of CO₂, assuming that they eat normally and follow a mean diet of 2800kcal.

The population details of each zone include the total number of teaching faculty; non-teaching staff and students were collected. The carbon dioxide emissions will be larger in the Zone having highest population.

7.4.2 Transportation

Fossil fuels are used for transportation. The carbon dioxide emitted by different fuels is in different amounts. The engine of the vehicle burns fuel and creates a certain amount of CO₂, depending upon its fuel type, fuel consumption and the driving distances. One liter of petrol and diesel emits 2.3 kg and 2.7 kg of carbon dioxide, respectively. Travelling by car for 1000km can produce about 200-230 kg of carbon dioxide into the atmosphere. If a person travels by a bus for 1000km, it can add 1075 kg of CO₂ to his/her Carbon foot print. Worldwide, the fossil fuels used for transportation contribute over 13% of GHG emissions.

The transportation details for the Institution campus like the type of vehicle, No. of vehicles and the fuel used were collected. The carbon dioxide emitted from petrol is less compared to that of diesel. The Carbon footprint by the emission inventory transportation will be quite high.



It was noted that the Institution run buses with 15% biodiesel blends along with the diesel. The buses were reported to run smoothly with lesser emissions and noise and improved mileage on average of 5 to 7 km/L which was about 4 to 6 km/L with Diesel alone.

7.4.3 Electricity

Electricity is one emission inventory which contributes much to the Carbon footprint of the Institution. On an average, electricity sources emit 1.297lbs CO₂ per kWh i.e. 0.0005883 metric tons of CO₂ per kWh. The emission factor given by GRID 2010 version 1.1 for hydroelectricity is 6.8956 x10⁻⁴ metric tons CO₂/kWh. 50 grams of CO₂ is emitted from 1 unit of solar power.

The details of the consumption of electricity and the use of generators in different zones were surveyed. If the number of classrooms and labs are more in a zone, consumption of electricity in that zone is more.

It was noted that the Institution uses a lot of Renewable power especially Solar and Solar-Wind Hybrid Model as a supplement to conventional power thereby reducing emission of GHG to the atmosphere also contributing to the INDC commitment pledged by Government of India.

7.4.4 Solid waste

Generally, 1kg of solid waste is generated per capita per day. For high income countries, the solid waste generation is 1.1-5 kg per capita per day. For middle income countries, it is 0.52-1 kg and for low income countries the value is 0.45-0.89 kg/capita/day. One kilogram of solid waste can emit about 0.125 kg of carbon. The details regarding the solid waste generated in each zone is collected including the waste produced in canteen and hostels.

The solid waste generated in the canteen and hostel which is taken out of the campus comes under other indirect emissions. Solid Waste emits less amount of carbon dioxide compared to other emission inventories considered.

7.4.5 LPG And Natural Gas

The consumption of 1L of LPG can release 1.5 kg of CO₂ to the atmosphere. Also, burning of wood (250kg) can add 33 kg of CO₂ to the Carbon footprint. The consumption details of LPG and Natural Gas in canteen and hostels were surveyed. It was noted that the Institution uses the solar power to run the kitchens. It is Asia's largest solar powered Kitchen.

Carbon Footprint Analysis

Carbon footprint analysis can be done by suitably combining data collected with respective emission factor of the selected emission inventories. Table represents emission factors of the selected inventories.

Table 30: Emission Inventory

S.No	Emission Inventory	CO ₂ Emitted
1	Human Factor	1.14kgper person per day
2	Petrol	2.3 kg per liter
3	Diesel	2.7kgper liter
4	Hydro Electricity	0.68956kgper kWh
6	Solid Waste	0.125kgperkg
7	LPG	1.5kgperkg
8	Natural Gas	0.775kgperkg

Table 31: Details for Carbon Foot Print Auditing

S.No	Details	Data for 2019-2020
1	Total number of Students	12019
2	Total number of Faculty Members	1063
3	Total number of Non-teaching staff	Office staff including Accounts section:50 Lab technician:40 Attenders:85 Drivers:60-80 Cleaners:10-15 Sweepers:195-210 Electricians:15-20 Plumbers:15-20 Mess Workers:100-120

4	Total number of Four wheelers	Buses: 80-100 Cars:25 Auto:10
5	Total number of Two wheelers	25-50
6	Total number of Generators used	6 100 HP (from grid) Usage of generator has reduced Diesel requirement Per day 250 L diesel when operated with full student capacity
7	Total number of LPG cylinders	25-30 with full capacity (19 kg cylinder – 25 to 30 cylinder for 2days)
8	Any Carbon Footprint reduction strategy battery powered vehicles biodiesel run buses no vehicles days	4 (overnight charge battery capacity) 5 (12%) 20L short routes, 50 long route

The total carbon foot print of campus is determined, and tabulated below.

Table 32: Total CO₂ Emission from the Institution Campus

S.No	Emission Inventory	Total(Kg of CO ₂ /Month)
1	Human Factor	469.29
2	Transportation	28831.5
3	Electricity	218115.3626
4	Solid Waste	252932.136
5	Food	78750.00
6	LPG	33088.23
	TOTAL	612186.5186



Total CO₂ emitted from the whole campus was estimated to be 8097.84 ton/year during the year 2019-2020.

7.5 Carbon Footprint Audit-Evaluations and Recommendations

Carbon Footprint Audit was done to measure the total quantity of greenhouse gases being emitted by the Institution as a result of its daily activities. Carbon Footprint was done to analyze the impact of various activities on the environment and it was quantified in the form of total greenhouse gases being emitted. Hence Carbon Footprint Audit was able to identify areas wherein intervention can be done to reduce the impact and optimize the usage of resources.

Carbon Footprint audit was extensively done for the Sathyabama Institute of Science and Technology and the Audit findings are as follows:

Best Practices Observed in the Institution –Carbon Footprint Reduction

- ❖ Restriction of personal vehicle inside the campus enhancing reduction of carbon foot prints
- ❖ Use of battery operated Vehicles to commute inside the campus
- ❖ Blending of Conventional fuel with biodiesel generated from Waste Cooking Oil thereby reducing the carbon footprint
- ❖ Use of Solar and Wind Hybrid system power the laboratory thereby reducing dependence on Conventional power
- ❖ Use of Solar Lamps to light the Walkways
- ❖ Use of Solar power to Run the Kitchen
- ❖ Use of Walkways to commute short distances
- ❖ Area under Green cover is 33,705sq.m and Marshy Land of 5,120 sq m area in the Institution.

7.5.1 Consolidation of Carbon Footprint Audit Findings-Evaluation

Carbon Footprint audit was extensively done for the Sathyabama Institute of Science and Technology and inventories selected for the audit were Human Factor, Transportation, Electricity, Solid Waste, LPG, Natural Gas etc. Carbon footprint analysis was done by suitably



combining data collected with respective emission factor of the selected emission inventories. Total CO₂ Emission from the Institution Campus from the selected inventories was found as 8097.84 ton/year. It was noted that the Institution is using of battery operated vehicles to commute inside the campus and have restricted the use of personal vehicles. Also Institution is promoting carpooling to reduce the overall number of vehicles used for commuting.

The Institution is also using biodiesel to blend with conventional fuel to run the campus buses. Solar power was used for running the Institution Kitchen, but these panels got damaged during the floods of 2018. Now efforts have been taken to re-commissioning the solar cooking system. The Institution has also taken an effort to power its laboratory using the Solar-Wind Hybrid system. All these are great initiatives to reduce the overall carbon foot print by decreasing the dependence on conventional source of power.

Based on the above finding few recommendations that the Institution can follow are-

7.5.2 Recommendations

- ❖ Use of Bicycles can be encouraged
- ❖ Check for Green Tags before purchasing goods
- ❖ Encourage use of organic food
- ❖ Use of Biogas made from waste



Figure 37: E-mobility of the campus



Figure 38 : Solar roofed sitting area



Figure 39: Solar-Wind Hybrid at the institute



Figure 40: Biodiesel run bus of the institute



Figure 41: Solar Panels with Controller



Figure 42: Biodiesel Buses



CHAPTER 8

AUDIT CONCLUSION

The Environmental Audit for Sathyabama Institute of Science and Technology, Chennai, endorsed the commitment towards the environment with a greater involvement, action plans and their implementation at every stage by the management and teaching professionals and the student community.

The Institution has done a significant work for scientific disposal and management of E-waste, Biomedical Waste, Solid Waste and generation of energy from the waste. The Institute with more than 10,000 occupants has a huge cooking facility that generates on an average 750 liters of waste cooking oil on a weekly basis. The Institute is following trans-esterification of Waste Cooking Oil for the production of biodiesel which used for the operation of their buses with 15% biodiesel blends. This will help in reduction of GHG as the biodiesel blended fuel emits less CO₂ than the conventional fuel. The buses were reported to run smoothly with lesser emissions and noise and improved mileage on average of 5 to 7 km/l which was about 4 to 6 km /l with Diesel alone. The Biodiesel powered buses in the Institution has lead the team to step further to test the Waste Cooking Oil Biodiesel for the agricultural pump sets to cater to the needs of farmers who were looking for an alternative to the costlier crude based fuel. This initiative was successful and the farmers could operate the pump sets with Biodiesel generated from Waste Cooking Oil.

The farmers reported that the pump sets gave a good pickup with less noise during operation. This initiative will definitely boost the Climate Resilient agriculture in providing a Sustainable, Eco friendly fuel to the farmers of Mittappalli village and promote them on the economic grounds and motivate them to contribute towards Greener India.

The Food waste generated in the Institution was given to the pig farms on a daily basis, which is one of most preferred form of disposal in food waste management hierarchy. Major quantum of plastic waste was diverted to Architecture department for Sustainable building research and few left out waste was given away to Corporation. Few plastic bottles, plastic covers, cans, broken glass wares, tins were recycled for planting saplings and also to create decorative items to be displayed in the campus. The Institution is also developing technology for conversion of food waste to organic pots, for generation of electricity from organic waste, for smart Compost development from solid waste. So that it can be concluded the Institution is putting a great effort



towards the management of solid waste generated in the campus. Hence it can be said that Institution is following the 3 Rs- Reduce, Reuse, Recycle- the core of ideals of sustainable waste management, to the core.

The Institution is having own STP to which all the waste water is been sent. The water is been treated using Sequential Batch Reactor and the treated sewage water is further reused for gardening, flushing and other purposes. The Storm water is also diverted to this unit so the proper reuse of rain water is happening. This initiative of the Institution has helped them to reduce their water foot print by a great extent. At present the Institution is taking only moderate amount of water from outside as the Institution is using treated water from the STP for flushing which is the major water usage point. Since water for flushing is met by recycled water the intake water can directly be diverted for purposes like drinking, cooking, cleaning, bathing etc. As with the adoption of STP and reusing the recycled water for flushing and gardening the Institution was able to reduce their water footprint considerably. So it can be concluded that the Institution is moving towards achieving Zero Liquid Discharge Goals.

The Institution has installed many Solar Panels and Solar-Wind Hybrid system and the power generated is used for lightning of the walkway and laboratory. The Institute had Asia's largest kitchen run using Solar Power. But these panels got damaged during the floods of 2018, and now efforts have been taken to re-commission it. Hence the Institution is taking a great effort towards substituting non-renewable power with renewable source of power, thereby contributing to the INDC commitment made by Government of India which is highly appreciable. As the campus is spread over 134 acres of land, installation of more solar systems is a good choice of action towards harnessing more renewable source of energy. Adopting the roof top solar paneling technology can contribute to this even more. This solar energy can be used for running pumps and blowers at the STP which in turn help to manage the expenditures on electricity as well.

The Institution is using battery operated vehicles to commute inside the campus and have restricted the use of personal vehicles. The Institution is promoting carpooling to reduce the overall number of vehicles used for commuting. The Institution is also using biodiesel to blend with conventional fuel to run the campus buses. Pedestrian pathways are also promoted that will encourage students to walk preventing them from using vehicles for commuting. These are great initiatives taken by the Institution in reducing the overall carbon footprint of the Institution.



The Institution has green cover of 34,133 sq.m and Marshy Land of 5,120 sq m area. This will help in absorption of pollutant and nullifying the GHG emitted in the campus. The Institution is maintaining Marshy Land having an area of 5,120 m² undisturbed. This will help in Ground Water Recharge and help in maintaining the ground water table in the nearby areas. It also acts as a habitat for the aquatic birds and a source of drinking water to small animals and birds in the nearby area. This Marshy land also acts as a natural rain harvesting structure. Seeing the green campus with different plant species will act as a motivation for the staff and the students. Efforts are taken to increase the green cover by terrace farming, planting of saplings, roof top gardening, vegetable gardening etc.

The audit has shown a significant effort was put in by the Institution in Waste Management, Water Management and Conservation, in Maintaining a Green and Eco friendly Campus focusing on reduction in Carbon Foot Print and Water Footprint. This Climate Resilient Infrastructure in the Institute makes the Institute a Green and Eco friendly campus. This shows the Institutions commitment towards its environmental and social responsibility. This clearly displays the Institutions endeavor to exercise leadership in addressing the fundamental problems of resource exploitation, by reversing the trends of environment degradation, and in promoting sustainability and to become stewards of Mother Nature.

8.1 Marks Awarded for Each Zone.

8.1.1 Economic Use of Water in the Institute Campus



8.1.2 Overall Utilization of Water in the Institute Campus



8.2.1 Energy Utilization



8.2.2 Waste Utilization



8.3.1 Routine Green Practices



8.3.2 Carbon Foot Print in Campus



8.4.1 Sewage Treatment in Institute



8.5 Overall Star value awarded based on Environmental audit is 4.6 out of 5.





ANNEXURES



SEWAGE TREATMENT PLANT TEST REPORT FOR TREATED SEWAGE SAMPLE (2019)

ECES
Eco Care Engineering Systems

TEST REPORT

Report No : ECES/LAB/2019-20/046 **Report Date** : 27.11.2019
Sample Description : Treated Sewage sample **Received on** : 22.11.2019
Sample Collected from : M/s. Sathyabama Institute of Science and Technology
Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 119
Sample Drawn by : M/s. Eco Care Engineering Systems **Commenced on** : 22.11.2019
Completed on : 27.11.2019

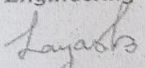
S.No	Test Parameters	Protocol	Results	TNPCB Tolerance Limit for Sewage
1.	pH at 25° C	IS:3025 Part: 11-1983 (Reaff:2012)	7.47	5.5 - 9.0
2.	Total Suspended Solids	IS:3025 Part 17-1984 (Reaff:2012)	10 mg/l	30 mg/l
3.	Total Dissolved Solids	IS:3025 Part 16-1984 (Reaff:2012)	1005 mg/l	—
4.	BOD @ 27° C for 3 days	IS:3025 Part 44-1993 (Reaff:2014)	13 mg/l	20 mg/l

Note: BDL: Below Detection Limit, DL: Detection Limit.

Note: This report relates only to the particular sample submitted for test. Any correction not attested shall invalidate this report. Retention period of tested sample is one month only. This report is strictly confidential. Its use for publicity, arbitration or as evidence in legal disputes is strictly forbidden.


Chemist



for Eco Care Engineering Systems

Authorized Signatory

REDMI NOTE 9
ALOKIAR CAMERA

No.10/25, Egambaram Dabedhar Street, Alandur, Chennai - 600 016. Tel : 044-22311125. Telefax : 044-22311125. E-mail : ecocare.cp@gmail.com



SEWAGE TREATMENT PLANT TEST REPORT FOR TREATED SEWAGE SAMPLE (2020)

ECES
Eco Care Engineering Systems

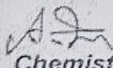
TEST REPORT

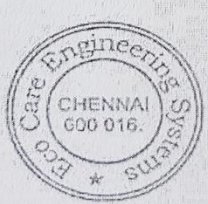
Report No : ECES/LAB/2019-20/067 Report Date : 27.01.2020
Sample Description : Treated Sewage sample Received on : 23.01.2020
Sample Collected from : M/s. Sathyabama Institute of Science and Technology
Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 119
Sample Drawn by : M/s. Eco Care Engineering Systems Commenced on : 23.01.2020
Completed on : 27.01.2020

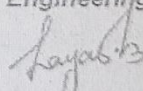
S.No	Test Parameters	Protocol	Results	TNPSB Tolerance Limit for Sewage
1.	pH at 25° C	IS:3025 Part: 11-1983 (Reaff:2012)	7.85	5.5 - 9.0
2.	Total Suspended Solids	IS:3025 Part 17-1984 (Reaff:2012)	17 mg/l	30 mg/l
3.	Total Dissolved Solids	IS:3025 Part 16-1984 (Reaff:2012)	1012 mg/l	--
4.	BOD @ 27° C for 3 days	IS:3025 Part 44-1993 (Reaff:2014)	11 mg/l	20 mg/l

Note: BDL: Below Detection Limit, DL: Detection Limit.

Note: This report relates only to the particular sample submitted for test. Any correction not attested shall invalidate this report. Retention period of tested sample is one month only. This report is strictly confidential. Its use for publicity, arbitration or as evidence in legal disputes is strictly forbidden.


Chemist



for Eco Care Engineering Systems

Authorized Signatory

No.10/25, Egambara Dabedhar Street, Alandur, Chennai - 600 016. Tel : 044-22311125 Telefax : 044-22311125 E-mail : ecocare.cp@gmail.com



BIOMEDICAL MEDICAL WASTE COLLECTION SLIP

HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020. Ph : 044 - 2445 1683

No. 36267 Veh.No. 5957
Date: 28/12/19 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : Sathiyabama
2. Collected By : asaulad
3. Collected from : _____
a. Red : 2.000
b. Yellow : 1.000
c. White / Sharp Containers : _____
d. Blue : 1.000
4. Total Bags / Kg : 4.000
5. Waste Segregated : Yes ☒ No ☐
6. Barcoded Bags : Yes ☐ No ☐
7. Bags Sealed / Tied Properly : Yes ☐ No ☐
For GJM (I) P. Ltd., For HCE

HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020. Ph : 044 - 2445 1683

No. 35188 Veh.No. 2067
Date: 28/12/19 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : Sathiyabama
2. Collected By : J. Sivaraj
3. Collected from : _____
a. Red : 2.000
b. Yellow : 2.000
c. White / Sharp Containers : _____
d. Blue : 1.000
4. Total Bags / Kg : 5.000
5. Waste Segregated : Yes ☐ No ☐
6. Barcoded Bags : Yes ☐ No ☐
7. Bags Sealed / Tied Properly : Yes ☐ No ☐
For GJM (I) P. Ltd., For HCE

HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020. Ph : 044 - 2445 1683

No. 275315 Veh.No. 2067
Date: 27/12/19 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : Sathiyabama
2. Collected By : S. Sivaraj
3. Collected from : _____
a. Red : 3.000
b. Yellow : 2.000
c. White / Sharp Containers : _____
d. Blue : 2.000
4. Total Bags / Kg : 7.000
5. Waste Segregated : Yes ☐ No ☐
6. Barcoded Bags : Yes ☐ No ☐
7. Bags Sealed / Tied Properly : Yes ☐ No ☐
For GJM (I) P. Ltd., For HCE

HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020. Ph : 044 - 2445 1683

No. 15750 Veh.No. 2067
Date: 7/2/2020 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : Sathiyabama
2. Collected By : Sivaraj S
3. Collected from : _____
a. Red : 3.000
b. Yellow : 2.000
c. White / Sharp Containers : _____
d. Blue : 1.000
4. Total Bags / Kg : 6.000
5. Waste Segregated : Yes ☒ No ☐
6. Barcoded Bags : Yes ☒ No ☐
7. Bags Sealed / Tied Properly : Yes ☒ No ☐
For GJM (I) P. Ltd., For HCE



HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020, Ph : 044 - 2445 1683
No. 72490 Veh.No. 6987
Date: 16/03/20 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : Sathya Bama
2. Collected By : Sivaraj's
3. Collected from : _____
a. Red : 4.000
b. Yellow : 2.000
c. White / Sharp Containers : _____
d. Blue : 1.000
4. Total Bags / Kg : 7.000
5. Waste Segregated : Yes ☒ No ☐
6. BarCoded Bags : Yes ☐ No ☐
7. Bags Sealed / Tied Properly : Yes ☐ No ☐
For G.J. Multi Clave (India) Pvt. Ltd., For HCE

HOSPITAL COPY
G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020, Ph : 044 - 2445 1683
No. _____ Veh.No. 2667
Date: 10/03/2020 Time: _____

B.M.W. COLLECTION SLIP

1. HCE Name : _____
2. Collected By : Sathya Bama
3. Collected from : Aravind
a. Red : 2.000
b. Yellow : 1.000
c. White / Sharp Containers : _____
d. Blue : _____
4. Total Bags / Kg : 3.000 kg
5. Waste Segregated : Yes ☒ No ☐
6. BarCoded Bags : Yes ☒ No ☐
7. Bags Sealed / Tied Properly : Yes ☒ No ☐
For G.J. Multi Clave (India) Pvt. Ltd., For HCE

**AGREEMENT COPY BETWEEN GJ MULTICLAVE AND SATHYABAMA FOR
COLLECTION, TRANSPORTATION, TREATMENT, DISPOSAL OF BIOMEDICAL WASTE**

भारतीय गैर न्यायिक
बीस रुपये **Rs.20**
रु.20 **TWENTY RUPEES**
INDIA NON JUDICIAL

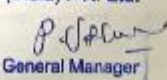
तमिलनाडु TAMIL NADU
27 FEB 2020
75AB 773893
V.BEDHARAJAN
Stamp Vendor
L.No: 12144/B1/96
Ekkattuthangal, Ch-32.
Mobile No: 9710019475

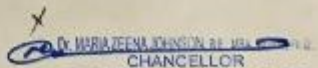
AGREEMENT
FOR COLLECTION, TRANSPORTATION, TREATMENT AND DISPOSAL OF
BIOMEDICAL WASTES

This Agreement made and entered into at Chennai on this 1st October 2020 BETWEEN
M/s. G. J MULTICLAVE (INDIA) PVT. LTD, incorporated under the Companies Act, 1956
having its Registered Office at New No.37, Old No.20, Teachers Colony, Adyar, Chennai - 600
020 represented by its Manager, Mr.P.SIVAKUMAR, S/o. Sri.P.Pauldurai, hereinafter called
the **FIRST PARTY**.

AND

SATHYABAMA DENTAL COLLEGE & HOSPITAL, Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119, represented by its Chancellor, Dr.MARIA ZEENA JOHNSON, hereinafter
called the **SECOND PARTY**.

For GJ Multiclave (India) Pvt. Ltd.

General Manager


CHANCELLOR
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119.



PESO CERTIFICATE


Government of India
Ministry of Commerce & Industry
Petroleum & Explosives Safety Organisation (PESO)
No. 143, Rajiv Gandhi Salil Road, Marthalis Road, Egmore,
Chennai - 600098

E-mail : pesochennai@explosives.gov.in
Phone/Fax No. : 044 - 28514848, 28514848

Date: 05/12/2013

No. : PSC/TN/14/3990 (P256236)

To,

Mrs. SATHYABAMA UNIVERSITY,
Jeppiaar Nagar,
Rajiv Gandhi Salil,
Chennai,
District: CHENNAI,
State: Tamil Nadu
PIN: 600119

Subj: Existing Petroleum Class A,B Retail Outlet at Plot No, Sy NO.3957, in the University campus-Old Mahatma Gandhi Road, SHOLINGANALLUR, TIRUPORUR -block, District: KANCHIPURAM, State: Tamil Nadu, PIN: 600088 - Licence No: PSC/TN/14/3990 (P256236) - Reg Renewal of Licence.

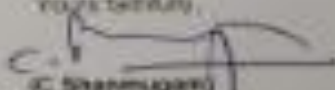
Sir(s),

Please refer to your letter No. : A, dated 01/12/2013

Licence No: PSC/TN/14/3990 (P256236) dated 12/05/2011 is returned herewith duly renewed upto 31/12/2023

Please follow the procedure strictly as laid down in rule 145 of the Petroleum Rules, 2000 and submit complete documents for the Renewal of the licence to Jt. Chief Controller of Explosives, South Circle Office, Chennai, to be to reach his office on or before 31/12/2023.

Please acknowledge the receipt.

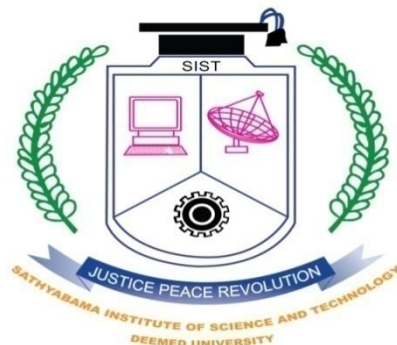
Yours faithfully,

(J. Shanmugam)
Controller of Explosives
For Jt. Chief Controller of Explosives
Chennai

(For more information regarding states, fees and other details please visit our website <http://peso.gov.in>)

<http://10.0.1.28/pesochennai/Contented/areaPrint.aspx> 10/5/2013



GREEN AUDIT **(As per Criteria 7 of NAAC)**



Sathyabama Institute of Science and Technology
Chennai, Tamil Nadu-600119

March 2020 - March 2021



EXECUTIVE SUMMARY

A Nation's growth starts from its educational institutions, where the ecology is taught as a prime factor of development associated with environment. A clean and healthy environment aids effective learning and provides a conducive learning environment. Educational institutions now a day are becoming more sensitive to environmental factors and best practices are being introduced making them eco-friendly. To bring the institute as Environmentally Sustainable, promotion of the Environmental and Energy Audits in terms of energy savings, recycle of waste, water reduction, water harvesting are done. The educational institutes have improved many environmental concerned activities. These activities pursued by colleges can also create a variety of adverse environmental impacts.

Green auditing is a process whereby an organization's environmental performance is rated from its environmental policies and objectives. As a part of such practice, internal green audit is a key performance indicator to evaluate the sustainability of the institute.

Green audit can be a useful tool for an institute to determine how and where they are using the most energy or water or resources; the institute can then consider how to implement changes and make environmental and energy settings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. It can also create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of environmental impact on campus. Green auditing promotes financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. If self enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self enquiry is a natural and necessary outgrowth of a quality educational institution. Thus it is imperative that the college evaluate its own contributions toward a sustainable future. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent.



In Sathyabama Institute of Science and Technology, the audit process involved walk through inspections, initial interviews with management to clarify policies, activities, records and the co- operation of staff and students in the implementation of mitigation measures. This was followed by staff and student interviews, collection of data through the questionnaire, review of records, observation of practices and observable outcomes. In addition, the approach ensured that the management and staff are active participants in the Green Auditing process in the college.

The baseline data prepared for the Sathyabama Institute of Science and Technology will be a useful tool for campus greening, resource management, planning of future projects for such audit purpose, and a document for implementation of sustainable development of the college. Existing data will allow the college to compare its programs and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. It is expected that the management will be committed to implement the Green Audit recommendations.

VICE CHANCELLOR, SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY

TABLE OF CONTENTS

March 2020 - March 2021	1
EXECUTIVE SUMMARY	2
1 CHAPTER	11
1.1 Introduction	11
1.2 About WasmanPro Environmental Solutions LLP.....	16
1.3 Core Environmental Compliance & Remediation Services	16
1.4 Vision and Mission.....	19
1.4.1 Institutional Vision	19
1.4.2 Mission	19
1.5 Objectives of the College.....	20
1.5.1 Core Values of the College	20
1.5.2 Reverence	20
1.5.3 Excellence	20
1.5.4 Liability.....	20
1.5.5 Discipline	20
1.6 Campus Infrastructure	21
1.6.1 Administrative Block.....	21
1.6.2 Class Rooms.....	21
1.6.3 Library.....	21
1.6.4 Open Air Theatre.....	23
1.6.5 Conference Hall.....	23
1.6.6 Indoor auditorium	24
1.6.7 Placement:.....	25
1.6.8 Hostel:	26
1.6.9 Mess-Dining hall.....	27
1.6.10 Transport facilities	29
1.6.11 Indian Bank	31
1.6.12 Gym.....	32
1.6.13 Power House Power Generator.....	33
1.6.14 Dispensary.....	33
1.6.15 Sewage Treatment Plant	34
1.7 Layout of Sewage Treatment Plant	24
2 CHAPTER	28
2.1 Pre-Audit Stage	28
2.2 Scope and Goals of Green Auditing.....	29
2.3 Benefits of the Green Auditing	29

2.4	Target Areas of Green Auditing.....	30
2.4.1	Auditing for Water Management.....	30
2.4.2	Auditing for Energy Management.....	31
2.4.3	Auditing for Waste Management.....	31
2.4.4	Auditing for Biomedical -Waste Management.....	31
2.4.5	Auditing for E -Waste Management.....	32
2.4.6	Auditing for Green Campus Management	33
2.4.7	Auditing for Carbon Footprint.....	33
2.5	General Methodology of Green Auditing	34
3	CHAPTER	35
3.1	Survey Forms.....	35
3.1.1	Auditing for Water Management.....	35
3.1.1	Auditing for Energy Management.....	37
3.1.2	Auditing for Waste Management.....	39
3.1.3	Waste Audit.....	39
3.1.4	Auditing For Green Campus Management.....	42
3.1.5	Auditing for Carbon Footprint.....	43
4	CHAPTER	45
4.1	Audit Stage.....	45
5	CHAPTER	49
5.1	Post Audit Stage	49
5.2	Key Findings and Observations	49
5.2.1	Water.....	49
5.2.2	Energy.....	52
5.2.3	Waste	62
5.2.4	Green Campus.....	68
5.2.5	Carbon Footprint Auditing	71
6	CHAPTER	76
6.1	Evaluation of Audit Findings	76
6.1.1	Water.....	76
6.1.2	Recommendations	77
6.1.3	Energy.....	78
6.1.4	Recommendations	78
6.1.5	E-waste	79
6.1.6	Recommendations	79
6.1.7	Biomedical Waste.....	80
6.1.8	Recommendations	80

6.1.9 Waste	81
6.1.10 Recommendations	82
6.1.11 Green Campus	82
6.1.12 Suggestions	82
6.1.13 Recommendations	83
6.1.14 Carbon Footprint	84
6.1.15 Recommendation.....	85
6.2 Consolidation of Audit Findings	90
6.2.1 Water Audit	91
6.2.2 Energy Audit	91
6.2.3 Waste Audit	92
6.2.4 Green Campus Audit	92
6.3 Follow Up Action and Plans	92
6.4 Environmental Education	93
7 CHAPTER	94
7.1 Marks Awarded for Each Zone.	96
7.1.1 Economic Use of Water in the College Campus	96
7.1.2 Overall Utilization of Water in the College Campus	96
7.1.3 Energy Utilization	96
7.1.4 Waste Utilization	96
7.1.5 Routine Green Practices	96
7.1.6 Carbon Foot Print in Campus	96
7.1.7 Sewage Treatment in College	96
7.2 Overall Star value awarded based on Environmental audit is 4.6outof5.....	96
8 ANNEXURE	97
8.1 Certification of Accreditation (National Assessment and Accreditation Council - NAAC) ...	97
8.2 National Board of Accreditation.....	98
8.3 All India Council for Technical Education (Approval Process 2020-21).....	99
8.4 Atal Ranking Of Institutions on Innovation Achievements	105
8.5 Bar Council of India	106
8.6 Council of Architecture.....	107
8.7 Grant of Central Government Permission for Establishment of New Dental College (Sathyabama University Dental College and Hospital)	108
8.8 Renewal of Central Government Permission for MDs Course (Sathyabama University Dental College and Hospital)	109
8.9 Ministry of Human Resource Development.....	110
8.10 University Grants Permission.....	111
8.11 Tamil Nadu Nurses and Midwives Council (B.Sc.,(N) Programme)	112

8.12 Pharmacy Council of India	113
8.12 Pharmacy Council of India	113
8.13 Rated for Excellence	114
8.14 Indian College & University Rating	115
8.15 World University Ranking	116
8.16 Biomedical Waste Collection, Transportation , Treatment and Disposal Agreement with M/S G.J Multiclave (India) Pvt. Ltd.	117
8.17 Biomedical Waste Collection Slip	120
8.18 Petroleum & Explosives Safety Organisation (PESO) Approval for Petrol Pump	121
8.19 Fire License	122
8.20 Electricity Bill (2021)	123
8.21 Sewage Treatment Plant Test Report for Treated Sewage Sample (2019)	124
8.22 Sewage Treatment Plant Test Report for Treated Sewage Sample (2020)	125

LIST OF TABLES

Table 1: Gym Facilities	32
Table 2: Characteristics of Raw Sewage	34
Table 4: Source of Water	50
Table 5: Water Storage.....	50
Table 6: Various points of Usage of Water	51
Table 7: Number of Water Cooler Details.....	51
Table 8: Various Points of Water Wastage	51
Table 9: Treated Water.....	52
Table 10: Overall Utilization of water in the college	52
Table 11: Major Utilities at Sathyabama Institute	53
Table 12: Transformer Ratings	53
Table 13: Monthly consumption, demand and billing details	54
Table 14: Detailed performance assessment of Air-Conditioners	55
Table 15: List of lighting load	56
Table 16: Performance assessment of lighting system.....	57
Table 17 : Standard lux level in different areas	58
Table 18 : Assessment of Pumps	58
Table 19 : Financial analysis of energy savings in lighting system	59
Table 20 : Fans installed at the facility	59
Table 21 : Financial analysis of implementing energy efficiency in ceiling fans	61
Table 22 : Economic feasibility for 5 Star ACs.....	61
Table 23 : Various Types of Waste Generated.....	62
Table 24 : Generation of waste (infectious and non-infectious) in different departments of Sathyabama University Dental College and Hospital.....	65
Table 25 : Quantity of Bio-Medical waste generated.....	66
Table 26: List of Various Chemicals used in the Laboratories	66
Table 27 : Campus Trees	68

Table 28: Details for Carbon Foot Print Auditing	74
Table 29 : List of Few Indoor Plants with their Benefits	83

LIST OF FIGURES

Figure 1: View of Sathyabama Institute of Science and Technology	11
Figure 2: Campus View of Sathyabama Institute of Science and Technology	12
Figure 3: Night View of the Campus.....	12
Figure 4: Sathyabama Institute front view.....	13
Figure 5: Col. Dr. Jeppiaar Research Park inside the campus	13
Figure 6: International Research Centre inside the campus	14
Figure 7: Parking facilities inside the campus.....	14
Figure 8: Green vegetation inside the campus	15
Figure 9: Greenery at the corridor.....	15
Figure 10: Campus view of the institute showing greenery	16
Figure 11: Central Library	22
Figure 12: Seminar Hall	24
Figure 13: Conference Hall.....	24
Figure 14: Indoor Stadium.....	25
Figure 15: Students attending placement drive coaching.....	25
Figure 16: Recruitment status of the institute	26
Figure 17: Boys' Hostel	27
Figure 18: Girls' Hostel.....	27
Figure 19: Mess Hall Entrance	28
Figure 20: Dining Area I	28
Figure 21: Dining Area II	29
Figure 22: Mobility facilities for students	30
Figure 23: Transport facilities of Sathyabama Institute of Science and Technology	30
Figure 24: E-mobility of the Institute	31

Figure 25: Institute's Banking facility	31
Figure 26: Gym at the Institute.....	32
Figure 27: Houses of Worship inside the campus.....	33
Figure 28: Flow diagram of the treatment process in the STP	35
Figure 29: Layout of the STP	24
Figure 30: Unit operations of STP	25
Figure 31: Team Leader- Environmental Audit at STP	26
Figure 32: STP-SBR-Unit.....	26
Figure 33: STP-Sand Filtration, Carbon Filtration.....	27
Figure 34: Sathyabama Officials and WasmanPro Officials during Pre-Audit Stage Meeting	28
Figure 35: Audit Stages.....	35
Figure 36: Audit Stage Meeting between Sathyabama and WasmanPro officials	46
Figure 37: Audit Discussion.....	46
Figure 38: The Audit Team of WasmanPro Environmental Solutions LLP with HOD, Centre for Solid Waste Management & Energy	47
Figure 39: Field visit to record the Environmental and Energy management activities.....	47
Figure 40: Audit Team visits the STP.....	48
Figure 41: Audit team visit to the hospital to observe the activity of Bio Medical Waste Management	48
Figure 42: Solid Waste Management Hierarchy.....	64
Figure 43: Banners of different functions of the Eco Club	69
Figure 44: Tree plantation in the college campus	70
Figure 45: Plantation drive by NSS.....	70
Figure 46: Students engaged in the Eco Club activities.....	71

1 CHAPTER

1.1 Introduction

Sathyabama is a Prestigious institution which excels in the fields of Engineering, Science and Technology for more than three successful decades. It offers multi-disciplinary academic programs in various fields of Engineering, Science, Technology, Law, Dental Science, Pharmacy, Nursing, Management, Arts and Science and Allied Health Sciences. It is established under Sec.3 of UGC Act, 1956 and is been Accredited with ‘A’ Grade by the National Accreditation and Assessment council. The Institution persistently seeks and adopts innovative methods to improve the quality of higher education and is responsive to the changes taking place in the field of education on a global scale. The Institution has a team of dynamic and outstanding faculty; innovative pedagogical practices, State of the Art infrastructure and world class Research Facilities. This glorious Institution is functioning under the dynamic leadership of Dr. Mariazeena Johnson, Chancellor, Dr. Marie Johnson, President and Ms. Maria Bernadette Tamilarasi Johnson, Vice President.

Sathyabama has a good presence in rankings and ratings at National and International level. The Institution has been ranked in 39th position by the National Institutional Ranking Framework (NIRF), Government of India among the Universities in India for the year 2020 and ranked one among the top 50 Universities for five consecutive years. Sathyabama is ranked among the Top 5 Institutions in the Country for Innovation by ATAL ranking of Institution for Innovation Achievements, Govt. of India. Times Higher Education and QS has ranked Sathyabama among the top Institutions worldwide. Sathyabama Institute of Science & Technology has alliances with leading Universities and Research Establishments at National and International Level. It is a research intensive University with world class laboratories and research facilities and is involved in research in the emerging areas of Science and Technology. Sathyabama has undertaken various sponsored and collaborative R&D projects funded by National and International Organizations. Sathyabama has written a special page in the history of space research on 22nd June 2016 with the launch of “SATHYABAMASAT” in association with ISRO. Sathyabama has emerged as a leading Institution and achieved excellence in higher education to international standards owing to its research and academic excellence.



Figure 1: View of Sathyabama Institute of Science and Technology



Figure 2: Campus View of Sathyabama Institute of Science and Technology



Figure 3: Night View of the Campus



Figure 4: Sathyabama Institute front view



Figure 5: Col. Dr. Jeppiaar Research Park inside the campus



Figure 6: International Research Centre inside the campus



Figure 7: Parking facilities inside the campus



Figure 8: Green vegetation inside the campus



Figure 9: Greenery at the corridor



Figure 10: Campus view of the institute showing greenery

1.2 About WasmanPro Environmental Solutions LLP

WasmanPro has in-depth understanding and practical experience with Environmental Green Audit, Green Practices, Environmental policies, regulatory programs, and remediation strategies. Our team of environmental experts has provided Environmental compliance and remediation services for a wide variety of Commercial and Industrial Facilities. We offer comprehensive regulatory consent and compliance support that address a full spectrum of air, water, wastewater and hazardous waste issues, regulations, and policies. Drawing up on the collective experience of our team we have developed technically sound and cost-effective strategies to achieve environmental compliance. The development and implementation of these strategies have lead to:

- Faster Consent Management Services
- Reducing waste streams
- Improving mechanisms to track consent conditions
- Executing effective monitoring programs
- Implementing phased compliance and cleanup strategies

1.3 Core Environmental Compliance & Remediation Services

WasmanPro helps our clients advance environmental sustainability, maintain environmental compliance, and reduce environmental risk and cleanup sites by providing a diverse set of core services including:

- Environmental Compliance
- Air Emission Inventories and Reporting
- Air Quality and Clean Air Act Compliance
- Environmental Due Diligence
- Environmental Impact Assessment
- Site Investigation and Feasibility Studies
- EHS Audits & Training
- Environmental Management System and Compliance Auditing
- Environmental Monitoring
- Ground water and Sub surface Investigations
- Green Audit
- Soil Management Plans
- Hazardous and Solid Waste Management Plans
- Remedial Design and Monitoring
- Brown field Cleanup
- Pollution Prevention Plans
- Environmental, Health and Safety Plans
- Hydro geological studies

M/S WasmanPro Environmental Solutions LLP has taken up the studies for conducting the Environmental and Energy Audit as per NAAC requirements. Dr. Karthikeyan who is the certified Lead Auditor for ISO 14001, OSHA 18001 certified by CII-NABET certification program. His team comprises of the water expert Er. G. Sathiyamoorthy, Former Engineering Director, Metro Water, CMWSSB.

Meet the Team

Sl.No	Name & Title	Qualification	Expertise
1	Dr.K. Karthikeyan Former Member Secretary, Tamil Nadu Pollution Control Board (TNPCB) Chief Environmental Coordinator Chairman WasmanPro Environmental Solutions LLP Chairman Centre of Excellence Urban Air Quality and Climate Change Chairman Centre of Excellence Urban Solid Waste Management	B. E Chemical Engineering M. Tech Environmental Engineering M.Sc. Industrial hygiene and Safety Ph. D - Environmental Science Certified Lead Auditor - Environmental Management Systems ISO 14000 and OSHAS 18000 Certified Professional-Fecal Sludge Management Certified Professional-Decentralized Waste Water Treatment Certification on 24 hr HAZOPER- Hazardous Operations	EIA Coordinator, Environmental Impact Assessment, Environmental / CRZ clearance, Environmental Management Plan, Ecology and biodiversity impact assessment, Water Quality monitoring prevention and control, Bathymetry studies, Geotechnical Studies, Brine discharge modeling, Environmental and Social Management Framework Assessment and hazard management, Disaster Management, City Sanitation Safety Plan as per WHO guidelines, Fecal Sludge Management, Decentralized waste Water treatment, Coastal zone Management

2.	Er.G. Sathiamoorthi Former Engineering Director Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) Vice-Chairman, WasmanPro Environmental Solutions LLP	B.E Civil Engineering	Water and Waste Water Treatment, Land Use and Land Cover, Hydrology, Ground water and Water Conservation, Water Quality Monitoring, Prevention and Control, Decentralized Waste Water Treatment, City Sanitation Safety Plan as per WHO guidelines
3.	Er. K. M. M. Annamalai President, WasmanPro Environmental Solutions LLP	B.E Chemical Engineering	Hazard Analysis and Mitigation process. Expert Project Management Consultancy, Risk Assessment and Hazard Management,

4.	Er. T.S Murali Vice President- Project Development , WasmanPro Environmental Solutions LLP, Chennai	Professional Expert Member B.E (Chemical Engineering),	Expert in Solid Waste Management, Bio methenation and Composting, Hazardous Waste Management, Waste Water Treatment, Waste Reduction and Recycling and Expert in Project Management Consultancy.
5.	Er. Ann Christy Jose Senior Environmental & Instrumentation Engineer, WasmanPro Environmental Solutions LLP	B.Tech Biotechnology and Biochemical Engineering, M.Tech Environmental Engineering,	Solid Waste Management, Sustainable E-Waste Management, Environmental Impact Assessment, Water Auditing and Water Budgeting, Disaster Management,
6.	Er.P. Gajendran, Senior Environmental & Instrumentation Engineer, WasmanPro Environmental Solutions LLP	B.E Electronic and Communication Engineering	Environmental Instrumentations, Noise and vibration, hazard management.

7.	Er. Aiswarya Environmental Engineer, WasmanPro Environmental Solutions LLP	B.E- Environmental Engineering M.Tech- Environmental Engineering and Management	Environmental Impact Assessment, Water Auditing and Water Budgeting
8.	Ms. Nithya Lakshmi Environmental Health & Safeguard Specialist. WasmanPro Environmental Solutions LLP	B. Sc Biochemistry PG Diploma in Industrial safety M. Sc - Environmental Science	Environmental Health & Safety
9.	Er.K. Gowtham Environmental Scientist WasmanPro Environmental Solutions LLP	B. Sc - Biochemistry. Diploma in diagnostic and clinical laboratory management Diploma in Industrial safety M.Sc - Environmental Science	Environmental Scientist
10.	Er. Daniel Ramesh	B. Sc Plant Biology & Biotechnology.	Environmental Strategic Executive

1.4 Vision and Mission

1.4.1 Institutional Vision

Sathyabama Institute of Science and Technology envision being an Effective and Competent Source of technical manpower for the current and future Industrial requirements.

1.4.2 Mission

- Undertaking Research & Development Activities In Emerging Thrust Areas.
- Introducing New Manpower Innovative Courses Based On the Industry & Societal Demands
- Collaborating With National, International Institutes, Research and Development Organization and Industries.
- Serving the Community At Large.

1.5 Objectives of the College

The college endeavor's to prepare its students for fulfilling careers by enabling them to realize their full potential and by inculcating in them the spirit of intellectual enquiry, independent thinking, self-reliance, leadership, co-operation, expression of cultural talents and social service.

1.5.1 Core Values of the College

Sathyabama Institute of Science and Technology is committed in practices that are fair, honest and objective in dealing with students, faculty members and other stake holders, which fosters a climate of ethical conduct, respect, responsibility and Trust. Sathyabama Institute of Science and Technology believe in Stakeholder partnership for holistic institutional development and to promote a healthier working atmosphere with the following core values

1.5.2 Reverence

- To fulfill the mission of reaching newer heights through multiple practices by fostering an inclusive and caring environment.
- To respect and value the individual diversity, allowing harnessing the richness of ideas and perspectives for the benefit of the whole staff and student community.
- To keep up confidence on the stakeholders and recognize their support to show gratitude to the stakeholders contribution

1.5.3 Excellence

- To promote Academic excellence and encourage innovation among students and staff
- To exhibit quality in recruitment, infrastructure facilities and service
- To sustain interactive teaching learning process

1.5.4 Liability

- To keep transparency in administrative functions
- To take responsibility for professional growth and development
- To continuously evaluate the systems and policies

1.5.5 Discipline

- To inculcate human values among students

- To promote gender equity, Indian culture and traditions
- To mould our students as responsible citizens of the Nation

1.6 Campus Infrastructure

1.6.1 Administrative Block

The very first structure that welcomes every entrant of the College is newly renovated Admin(administrative) Block, which houses offices of the Principal, Administrative Officer (AO), College Administration, Accounts Section, Teachers' Staff Room and Conference Hall with multi-purpose rooms. The administration block would provide a spacious conference room adjacent to the Principal's office. At the entry of the Administrative Block, a reception area has been provided which will facilitate the students, staff and other persons who seek to enquire something in relation to the college.

1.6.2 Class Rooms

About 141 class rooms including all UG programs, PG programs and Doctorates. They are providing the students with such kind of healthy environment in the classrooms that are spacious, airy, well equipped with white/blackboards that kindle a desire to learn more.

1.6.3 Library

A state of art central library with world class amenities situated in an area of 1.5 Lakh square feet is a monumental addition to the infrastructural excellence of the University. The Central Library consists of around 4 Lakh numbers of books with a spectrum of titles, back volumes, PhD thesis and various reputed magazines. This is equipped with a Digital library section, OPAC system, reference section, audio visual rooms and seven conference halls with CCTV facilities. It also consists of nearly 10 years newspapers for the reference. RF ID system is in place for issuing the books to the students and staff from central library. Advisory Bureau of Higher Studies (ABHS) is another wing in the Central Library with diverse collection of books other than curriculum related books of the main library. The University has a central library which acts as an Information Resource Centre for the faculty and the students. However there is an exclusive library present in each department for the benefit of the students. The library has specialized technology to access e-journals and online books 24/7. The digital library provides a platform for virtual networking

with international experts.



Figure 11: Central Library

Book Bank

The university has subscribed to IEEE, ASME, ASCE, ACM, Elsevier and Springer link. At present, a total of 311328 books 1442 e-books, 2377 DVDs, 62083 e-journals, 6835 subscribed journals are available in our central library. Our Library will continue to augment its resources and modernize with latest techniques in the future. Our modernized library has a Pentium LAN server with 4 nos. of AT486DX4 nodes by which issues and returns are done. Students and staff members can search for books, on the author, title or subject heading and their availability using the software LIBGENIE. Also the university has subscribed to MALIBNET (Madras Library Network), Anna university library, IIT library and British Council library through which it can access the library in and around Chennai City.

a) Print (books, back volumes & theses): 308709+2408+871

b) Average no. of books added during the last 3 years: 6000

c) Non Print (Microfiche, AV): CD/DVD: 2377

d) Print (journals, magazines): 205

e) Electronic (e-books, e-journals)

a. Open access journals: 62083

b. Subscribed journals + proceedings: 6835

c. e-books: 1442

f) Special collections

- Text books : 83713
- Reference books : 4432
- Standards : 500
- Patents : 100
- Special/Library Science
- Collection and Thesis: 833 (Architecture Student projects)

1.6.4 Open Air Theatre

There are four open air theatres present on campus. They serve the dual purpose of screens for films, projector for the entertainment of the students and also as stages for cultural activities performed by the students. Films are projected in the open-air theatre for the hostel students.

1.6.5 Conference Hall

Four Open Air theatres of 6500 sq.ft. each, and three conference halls of 4000 sq.ft. All A/c halls are equipped with the latest teaching aids like LCD projector, slide projector and overhead projector. Conference halls are for conducting guest lecturers Symposiums, seminars, etc. Educational cassettes are also projected in these theatres in consultation with subject staff. Movies are also screened in the theatre for hostel students on holidays.



Figure 12: Seminar Hall



Figure 13: Conference Hall

1.6.6 Indoor auditorium

The campus has a 6033 sq.mts. indoor air conditioned (7) and non air conditioned (1) auditorium with a fully inbuilt sound system and lighting. This auditorium is used for all important college events such as convocation, college day etc. During normal days, it can be used by the students to play indoor games like badminton and table tennis.



Figure 14: Indoor Stadium

1.6.7 Placement:

Sathyabama's placements saw an overall increase of 3.68% this year (2019-20). The highest CTC offered was 41 LPA. The median package of the batch stood at 4.2 LPA. A total of 230 companies participated in this year placement process and rolled out over 1822 offers. We had companies from various sectors who participated in the placement activities for our students.



Figure 15: Students attending placement drive coaching



Figure 16: Recruitment status of the institute

1.6.8 Hostel:

The University provides on-campus accommodation for students from outside Chennai. Separate hostel facilities are available for boys and girls. Totally there are 10 hostels with 560 rooms for boys and 470 rooms for girls and an average of five students per room utilize this facility. All the hostel rooms have attached bathroom facility

The hostel rooms are provided with fans, good lighting, adequate water facility, playground, news papers and magazines. Similarly, all the hostels have Wi-Fi facility with access to e-journals and other technical resources and thereby the students can access internet in their respective rooms using their lap-tops. The hostels are provided with a good hygienic cooking facility and spacious dining halls. There are 24 hours watchmen and wardens for hostels. The hostels are provided with telephone facility. A separate canteen, stores, computer centre with internet facility, audio-visual halls, medical room, gymnasium, and beauty parlour are some of the supporting services provided for the hostellers. Generator / Electricity Backup, Indoor sports facilities exists.

Boys Hostel

- i. Number of Hostels: 05
- ii. Number of Inmates: 3400
- iii. Facilities: Computer lab, Wi-Fi, Telephone / Fax, ATM, Xerox, Indoor, Gym, Indoor Mess, Mediation centre, Stores, Beauty Parlor.



Figure 17: Boys' Hostel

Girls Hostel

- i. Number of Hostels : 05
- ii. Number of Inmates : 2500
- iii. Facilities : Computer lab, Wi-Fi, Telephone / Fax, ATM, Xerox, Indoor, Gym, Indoor Mess, Meditation centre, Stores, Beauty Parlour.



Figure 18: Girls' Hostel

1.6.9 Mess-Dining hall

The university has three mess halls with the centralized kitchen, these halls provides breakfast, Tea, Lunch to all the students and staff.

- General Mess hall with 5962 Sq.mts. with seating capacity of 4000 students.
- PG Mess hall with 7257 Sq.mts. with seating capacity of 3000 students.

- Ladies Mess hall with 2965 Sq.mts. with seating capacity of 3000 students.

Cooking in the mess halls is carried out by using solar energy. World largest solar cooking is installed and is used for daily domestic needs of the University. Few staff and students have started with the initiative of extending the solar energy tapping to meet the electricity needs of laboratories also.



Figure 19: Mess Hall Entrance



Figure 20: Dining Area I



Figure 21: Dining Area II

1.6.10 Transport facilities

The Institution holds a robust transport system facilitating easy mobility of students and staff from every nook and corner of the city to campus. Ample numbers of buses are operated every day and hassle free journey is an experience of people travel to the campus. Safety and Security are always given prime importance, experienced drivers operate our buses and the transport department provides timely updates related to any change in bus-routes through our website.

More than 150 buses transit students and the faculty members from various points in the city and also from the suburbs like Ennore, Pattabiram, Thiruvallur, Red Hills, Chengleput, Thiruvettriur, Kancheepuram.

- All The Buses Reach The Campus Before 7.45 A.M And Leave The Campus At 3.15 P.M. On Regular Working Days
- Special Buses Are Operated To Support Students Attending Placement Training / Special Coaching Classes Such As Civil Services Examinations / Accessing Library Facility. These Buses Generally Leave The Campus At 5.00 P.M.



Figure 22: Mobility facilities for students



Figure 23: Transport facilities of Sathyabama Institute of Science and Technology



Figure 24: E-mobility of the Institute

1.6.11 Indian Bank

Indian bank has a branch in the campus. This makes it easy for students and staff to process their financial transactions. Two ATM is available inside the campus. 24hrs ATM facility is also available inside the campus.



Figure 25: Institute's Banking facility

1.6.12 Gym

The University has state of art gymnasium for girls and boys separately which can be utilized for free of cost. Yoga classes are conducted regularly in association with world community centre. In house medical facility is available for 24 hours inside the University campus.

Table 1: Gym Facilities

1	Gymnasium [A/C Hall]	1 (no)
2	Gymnasium [Non-A/C]	1 (no)



Figure 26: Gym at the Institute

Houses of Worship:

There is a fully air conditioned Church available for worship, prayer and meditation by the students and staff of each community. They are also used during the various religious festivals.



Figure 27: Houses of Worship inside the campus

1.6.13 Power House Power Generator

Eight Generators with following capacity to cater the energy demand in this institute

- 720 KVA Generator : 1 No
- 625 KVA Generator : 2 Nos
- 500 KVA Generator : 3 Nos
- 320 KVA Generator : 1 No
- 185 KVA Generator : 1 No

1.6.14 Dispensary

The University offers medical facilities for its students and teaching and non- teaching staff. The University has separate medical rooms in boys and girls hostels. Medical rooms are facilitated with essential diagnostic facilities, a doctor and 3 nurses to assist in three shifts per day. The University has an on-campus 24 X 7 general hospital with all necessary equipments and facilities. Students, teaching and non-teaching staff can avail the medical facilities for first aid in the medical room and in the hospital when it is needed.

1.6.15 Sewage Treatment Plant

Sewage Treatment Plant at Sathyabama University Campus (Capacity of 1.50 Million Liters per Day)

Total population	13722 persons
Staying in hostels	6384 persons
Day-scholars	5635 persons
Boys' hostel rooms available	620 Nos
Number of boys in one room	6
Staying boys strength 620*6	3720 boys
Girls' hostel rooms available	444 Nos
Number of girls in one room	6
Staying girls strength 444*6	2664 girls
Total Hostlers	6384 students
Input flow to STP	1070928 liters (1.1MLD)
STP designed for	1.5 MLD

Design Details

STP Design Capacity	: 1500 m ³ / day
Hours of Operation	: 20 Hours
Average Flow rate	: 75 m ³ /Hr

Table 2: Characteristics of Raw Sewage

SLNo	Parameters	Inlet Character	Unit
1	Flow	1500	m ³ /day
2	pH	7.2	-
3	BOD at 3 days	400	mg/l
4	COD	900	mg/l
5	TSS	400	mg/l

The BOD and COD values are displayed higher than the raw sewage characteristics as high strength organic loading are coming from institute, medical college and hospital, mess, labs.

Sewage Treatment Plant

Capacity - 1500 KL/Day

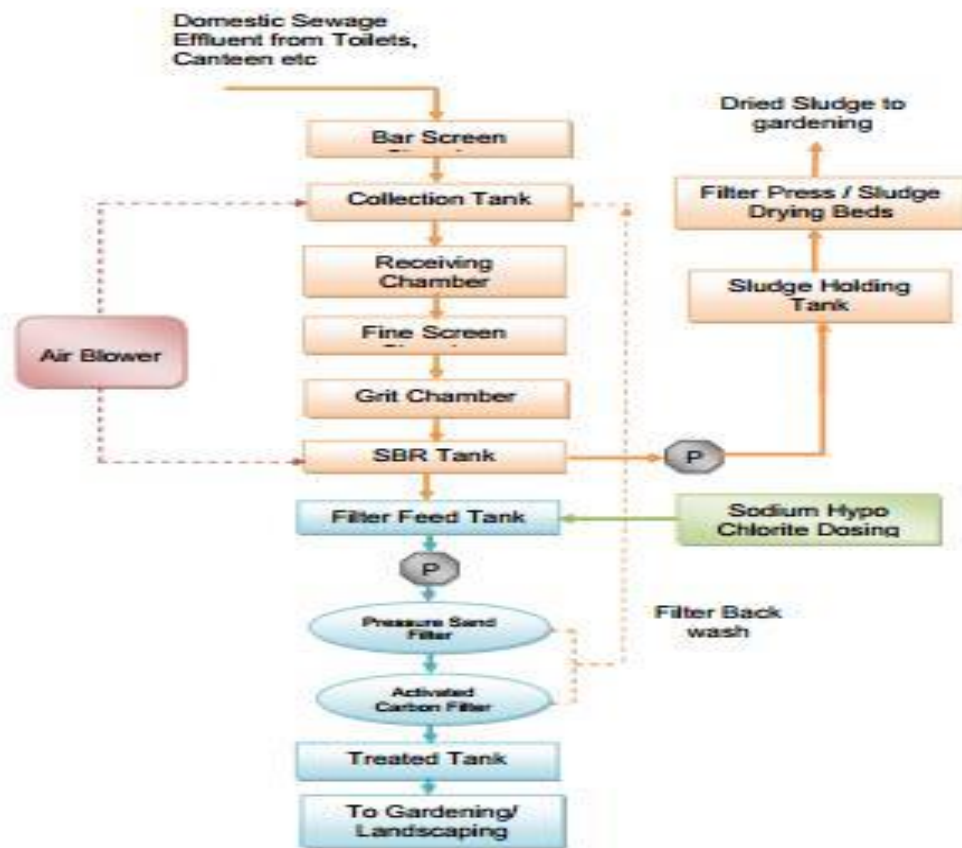


Figure 28: Flow diagram of the treatment process in the STP

Sewage Treatment Plant Description:

1. Primary treatment

- BAR SCREEN CHAMBER for removing floating particles like paper waste, cloths present in the sewage effluent.

Peak flow: 225 m³/h,

Area provided : 3.75 m²

- RAW SEWAGE COLLECTION TANK It is a balancing tank is provided with course bubble aeration system to keep the effluent in live condition without septic.

Average flow: 75.0 m³/hr,
Retention time : 8.00 hrs,
Volume required: 600 m³ and
Volume provided: 624 m³

- FINE SCREEN CHANNEL is a manual type screen with 10 mm spacing to remove the fine floating particles present in the sewage effluent.
- GRIT CHAMBER MANUAL it is a sedimentation basin to remove the inorganic particles such as sand, gravel, grit and egg shells.

2. Biological treatment

- Sequential Batch Reactor (SBR) BASINS, treated sewage is pumped into the two SBR Basins which are work in sequential way and influent flow is controlled using automatic sluice gates.

Operation time 4 hours

Average flow : 75.0 m³ /day,

Frequency : 12 Batches / Day,

SBR Process : 4.00 Hrs

Size of SBR tank : 15.0 x 6.0 x 5.0 (LD)+0.5 (FB)

- CHLORINATION TANK - For the purpose of disinfection.

Backwash period : 4 hrs

No of pumps: 2 any (1 working + 1 standby)

PRESSURE SAND FILTER - It is a Mild Steel two coats of Epoxy paint and filled with filter media

- Top portion of the filter is filled with filter sand.
- Middle portion of the filter is filled with two types of Sand.
- Bottom portion of the filter is filled with three layers of pebbles
- Filter back wash has to be carried out

Size of vessel provided : 2.5 m dia

Height : 1.5 m

ACTIVATED CARBON FILTER - To remove organics and the filter back wash has to be carried out based on the differential pressure between the inlet and the outlet.

Size of vessel provided : 2.5 m dia

Height : 1.5 m

- SLUDGE DISPOSAL- A sludge pump is provided to remove the solids at the bottom of SBR tank.

It is pumped to a Sludge Holding tank and sent to the filter press for sludge drying.

Average flow : 75.0 m³ / day

Suspended solids : 400mg/l

- TREATED TANK - The treated water can be utilized for gardening and flushing.

Retention time considered : 7.0 hrs @ average flow rate

Volume required : 525 m³

Volume considered : 810 m³

Size of the treated sewage storage tank: 15.0 x 12.0 x 4.5 (LD)+0.5(FB)

1.7 Layout of Sewage Treatment Plant

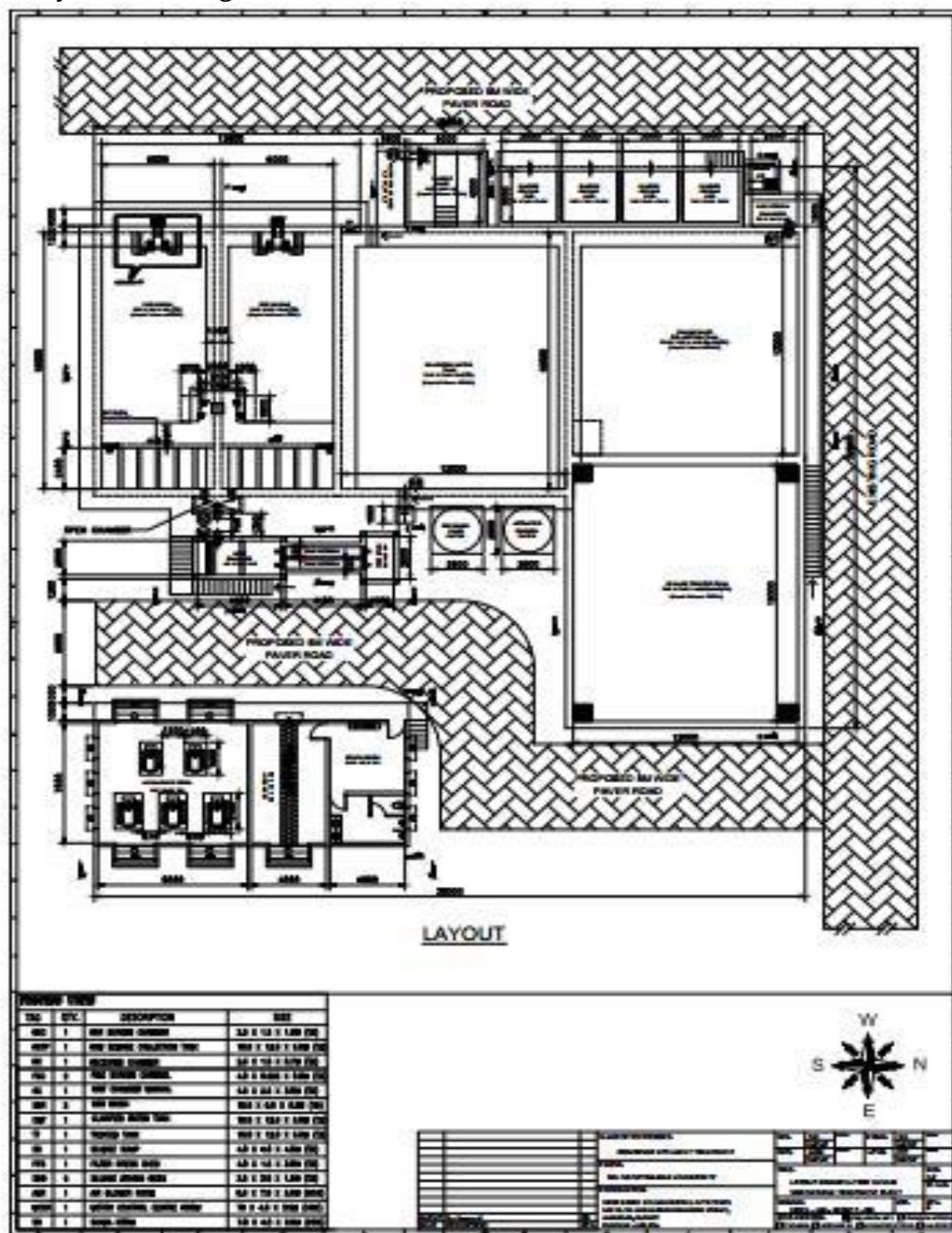


Figure 29: Layout of the STP

SIZE OF UNIT OPERATION OF SEWAGE TREATMENT PLANT

S.No	Description of unit operation of STP	Size/Capacity (M)	Liquid Volume (KL)	Free Board Volume (KL)
1	Bar Screen	2.5 × 1.5 × 1.0M (TD)	-	3.75
2	Raw Sewage Sump	15.0 × 12.0 × 4.0M (LD) + 1.0M (FB)	720	180
3	Receiving	2.5 × 1.5 × 0.7M (TD)	-	2.6

	Chamber			
4	Fine Screen Channel	$4.0 \times 0.525 \times 0.8\text{M (TD)}$	-	1.7
5	Grid Chamber Manual	$4.5 \times 2.5 \times 1.5\text{M (LD)} + 0.5\text{M (FB)}$	16.875	5.625
6	SBR Basins – I	$15.0 \times 6.0 \times 4.5\text{M (LD)} + 1.0\text{M (FB)}$	405	90
7	SBR Basins - II	$15.0 \times 6.0 \times 4.5\text{M (LD)} + 1.0\text{M (FB)}$	405	90
8	Clarified Water Tank	$15.0 \times 12.0 \times 2.8\text{M (LD)} + 2.2\text{M (FB)}$	504	396
9	Treated Tank	$15.0 \times 12.0 \times 4.5\text{M (LD)} + 0.5\text{M (FB)}$	810	90
10	Sludge Sump	$4.0 \times 4.0 \times 3.5\text{M (LD)} + 0.5\text{M (FB)}$	56	8
11	Sludge Drying Beds (4 Nos)	$3.0 \times 3.0 \times 1.5\text{M (TD)}$	28.8	25.2

SEWAGE TREATMENT PLANT PHOTOS



Figure 30: Unit operations of STP



Figure 31: Team Leader- Environmental Audit at STP



Figure 32: STP-SBR-Unit



Figure 33: STP-Sand Filtration, Carbon Filtration

2 CHAPTER

2.1 Pre-Audit Stage

A pre-audit meeting provided an opportunity to reinforce the scope and objectives of the audit and discussions were held on the practicalities associated with the audit. This meeting is an important prerequisite for the Environmental audit because it is the first opportunity to meet the expert and deal with any concerns. It was held at Sathyabama Institute of Science and Technology Chennai. The meeting was an opportunity to gather information that the WasmanPro team can study before arriving on the site. The audit protocol and audit plan was handed over at this meeting and discussed in advance of the audit itself.

In Sathyabama Institute of Science and Technology pre-audit meeting was conducted successfully and necessary documents were collected directly from the college before the initiation of the audit processes. Actual planning of audit processes was discussed in the pre-audit meeting. WasmanPro Team was also selected in this meeting with the help of staff and the college management. The audit protocol and audit plan were handed over at this meeting and discussed in advance of the audit itself. The WasmanPro team worked together, under the leadership of the lead auditor, to ensure completion within the brief and scope of the audit.



Figure 34: Sathyabama Officials and WasmanPro Officials during Pre-Audit Stage Meeting

2.2 Scope and Goals of Green Auditing

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. Green Audit is the most efficient and ecological way to manage environmental problems. It is a kind of professional care which is the responsibility of each individual who are the part of economical, financial, social, environmental factor. It is necessary to conduct Green audit in college campus because students become aware of the Environmental, its advantages to save the planet and they become good citizen of our country. Thus Green audit becomes necessary at the college level.

A very simple indigenized system has been devised to monitor the environmental performance of Sathyabama institute of Science and Technology. It comes with a series of questions to be answered on a regular basis. This innovative scheme is user friendly and totally voluntary. The aim of this is to help the institution to set environmental examples for the community, and to educate the young learners.

2.3 Benefits of the Green Auditing

- ✓ More efficient resource management
- ✓ To provide basis for improved sustainability
- ✓ To create a green campus
- ✓ To educate sustainable goals
- ✓ To enable waste management through reduction of waste generation, E-Waste management, solid-waste and water recycling
- ✓ To create plastic free campus and evolve health consciousness among the stakeholders
- ✓ Recognize the cost saving methods through waste minimizing and managing
- ✓ Point out the prevailing and forth coming complications
- ✓ Authenticate conformity with the implemented laws
- ✓ Empower the organizations to frame a better environmental performance
- ✓ Enhance the alertness for environmental guidelines and duties
- ✓ Impart environmental education through systematic environmental management approach and Improving environmental standards

- ✓ Benchmarking for environmental protection initiatives
- ✓ Financial savings through a reduction in resource use
- ✓ Development of ownership, personal and social responsibility for the College and its environment
- ✓ Enhancement of college profile
- ✓ Developing an environmental ethic and value systems in youngsters.
- ✓ Green auditing should become a valuable tool in the management and monitoring of environmental and sustainable development programs of the college.

2.4 Target Areas of Green Auditing

Green audit forms part of a resource management process. Although they are individual events, the real value of Green audits is the fact that they are carried out, at defined intervals, and their results can illustrate improvement or change over time. Eco-campus concept mainly focuses on the efficient use of energy and water; Minimize waste generation or pollution and also economic efficiency. All these indicators are assessed in process of “Green Auditing of educational institute”. Eco-campus focuses on the reduction of contribution to emissions, procures a cost effective and secure supply of energy, encourages and enhances energy use conservation, promotes personal action, reduce the institute’s energy and water consumption, reduce wastes to landfill, and integrate environmental considerations into all contracts and services considered to have significant environmental impacts. Target areas included in this Green auditing are water, energy, waste, green campus and carbon footprint.

2.4.1 Auditing for Water Management

Water is a natural resource; all living matters depend on water. While water is available in many natural environments, in human settlements potable (drinkable) water is less readily available. We need to use water wisely to ensure that drinkable water is available for all, now and in the future. A small drip from a leaky tap can waste more than 180 liters of water to a day; that is a lot of water to waste - enough to flush the toilet eight times! Aquifer depletion and water contamination are taking place at unprecedented rates. It is therefore essential that any environmentally responsible institution should examine its water use practices. Water auditing is conducted for the evaluation of facilities of raw water intake and determining the facilities for water treatment and reuse. The concerned auditor investigates the relevant method that can be adopted and implemented to balance the

demand and supply of water. It is therefore essential that any environmentally responsible institution examine its water use practices.

2.4.2 Auditing for Energy Management

Energy cannot be seen, but we know it is there because we can see its effects in the forms of heat, light and power. This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliances, and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment. An old incandescent bulb uses approximately 60W to 100W while an energy efficient light emitting diode (LED) uses only less than 10 W. Energy auditing deals with the conservation and methods to reduce its consumption related to environmental degradation. It is therefore essential that any environmentally responsible institution examine its energy use practices.

2.4.3 Auditing for Waste Management

Pollution from waste is aesthetically unpleasing and results in large amounts of litter in our communities which can cause health problems. Plastic bags and discarded ropes and strings can be very dangerous to birds and other animals. This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, and recycling. Solid waste can be divided into two categories: general waste and hazardous waste. General wastes include what is usually thrown away in homes and schools such as garbage, paper, tins and glass bottles. Hazardous waste is waste that is likely to be a threat to health or the environment like cleaning chemicals and petrol. Unscientific landfills may contain harmful contaminants that leach into soil and water supplies, and produce greenhouse gases contributing to global climates change.

Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, reduce, and reuse. Thus the minimization of solid waste is essential to a sustainable college. The auditor diagnoses the prevailing waste disposal policies and suggests the best way to combat the problems. It is therefore essential that any environmentally responsible institution examine its waste processing practices.

2.4.4 Auditing for Biomedical -Waste Management

Biomedical waste comprises human & animal anatomical waste, treatment apparatus like needles, syringes, and other materials used in health care facilities in the process of treatment and research. This waste is generated during diagnosis, treatment, or immunization in hospitals, nursing homes, pathological laboratories, blood banks, etc

These wastes are potentially hazardous, toxic and highly infectious because of their high potential for disease transmission. Indiscriminate disposal of such waste poses health risk to human population, especially to health care personnel, sanitary workers. It is of at most importance that biomedical waste is managed in an environmentally sound manner which requires proper understanding of risk associated with the disposal of such waste and methods of proper segregation, storage handling, treatment and disposal.

The auditor analysis whether biomedical waste management practices were satisfactory and in accordance with the prescribed rules given by biomedical waste management and handling rule 2016

The auditor diagnoses the prevailing Biomedical waste are segregated at source and put in color coded bags as per Schedule I of BMW RULE 2016 and sealed before giving it to Common Biomedical Waste treatment facility for treatment processing and disposal. The auditor also looks into the fact whether the awareness on biomedical waste segregation, disposal, effect and management amongst the doctors and the paramedical staff are adequate. The auditor will suggest the methods to be followed while disposing the Biomedical waste and record to be maintained in the institution.

2.4.5 Auditing for E -Waste Management

E-Waste or Electronic-Waste is the term used to describe old, end-of-life or discarded electronic appliances which includes computers, mobiles, consumer electronics etc. It majorly includes electronic equipment, completely or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes.

E-waste consists of toxic elements such as Lead, Mercury, Cadmium, Chromium, Polybrominated biphenyls and Polybrominated diphenyl. Non-Disposal and burning of e-waste can have serious implications on human health and can cause air, soil pollution and groundwater contamination.

Sathyabama University being an educational institution will fall under the category of Bulk Consumer as per E-Waste Management Rules 2016. The auditor will analyze whether e-waste generated by the University is channelized through authorized producer or dismantler or recycler. Auditor will also diagnose whether University is maintaining records of e-waste generated by them in Form-2 and make such records available for scrutiny by the concerned

State Pollution Control Board. Auditor will ensure that University is taking all steps required to ensure that e-waste is managed in a manner which shall protect health and environment against any adverse effects, which may result from such e-waste.

2.4.6 Auditing for Green Campus Management

Unfortunately, biodiversity is facing serious threats from habitat loss, pollution, over consumption and invasive species. Species are disappearing at an alarming rate and each loss affects nature's delicate balance and our quality of life. Without this variability in the living world, ecological systems and functions would breakdown, with detrimental consequences for all forms of life, including human beings. A significant density of trees will decrease the amount of carbon dioxide in the atmosphere. Trees play an important ecological role within the urban environment for its urban heat, climate, air pollutants entrapment, as well as support improved public health and provide aesthetic benefits to cities. In one year, a single mature tree will absorb up to 48 pounds of carbon dioxide from the atmosphere, and release it as oxygen. The amount of oxygen that a single tree produces is enough to provide one day's supply of oxygen for people. Trees in the campus impact student's mental health as well; studies have shown that trees greatly reduce stress, which a huge deal is considering many students are under some amount of stress.

2.4.7 Auditing for Carbon Footprint

Commutation of stakeholders has an impact on the environment through the emission of greenhouse gases into the atmosphere consequent to burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapor, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere.

An important aspect of doing an audit is to be able to measure the student's impact so that the institute can determine better ways to manage the impact. In addition to the water, waste, energy and biodiversity audits, we can also determine what is the carbon footprint of this campus, based on the amount of carbon emissions created. One aspect is to consider the distance and method travelled between home and college every day. It undertakes the measure of bulk of carbon dioxide equivalents exhaled by the organization through which the carbon accounting is done. It is necessary to know how much the organization is contributing towards sustainable development. It is therefore essential that any environmentally responsive institution shall examine its carbon footprint.

2.5 General Methodology of Green Auditing

The purpose of the audit was to ensure that the practices followed in the campus are in accordance with the Environmental Policy adopted by the institution is according to NAAC Criteria (MoEFF & CC Guidelines). The criteria, methods and recommendations used in the audit were based on the identified risks. The methodology includes: preparation and filling up of questionnaire, physical inspection of the campus, observation and review of the document, interviewing responsible persons and data analysis, measurements and recommendations. The methodology adopted for this audit was a step by step process comprising of:

- 1. Data Collection** – In preliminary data collection phase, exhaustive data collection was performed using different tools such as observation, survey communicating with responsible persons and measurements. Following steps were taken for data collection:
 - The team went to each department, Library, canteen, hostels, research centers etc.
 - Data about the general information was collected by observation and interview.
 - The power consumption of appliances was recorded by taking an average value in some cases.
- 2. Data Analysis** - Detailed analysis of data collected include: calculation of energy consumption, analysis of latest electricity bill of the campus, understanding the tariff plan provided by the Tamilnadu State Electricity Board (TNEB). Data related to water usages were also analyzed using appropriate methodology.
- 3. Recommendation/Suggestions**–On the basis of results of data analysis and observations, some steps for reducing power and water consumption were recommended.

The above target areas particular to the college was evaluated through questionnaire circulated among the students for data collection. Five categories of questionnaires were distributed. The formats of these are given below.

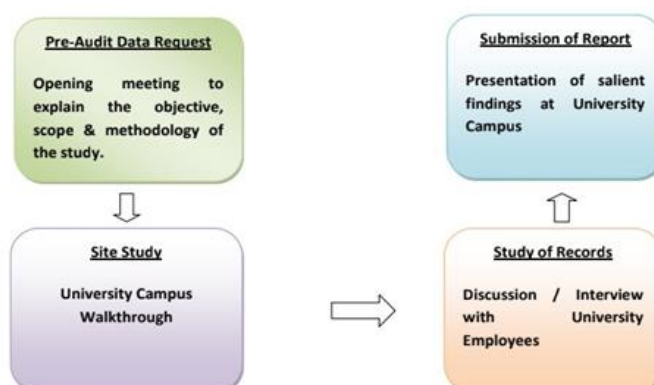


Figure 35: Audit Stages

3 CHAPTER

3.1 Survey Forms

3.1.1 Auditing for Water Management

1. List various sources of water in your college.
2. How many wells are there in your college?
3. Does the college buy water from tankers?
4. What is the depth of each well?
5. What is the present depth of water in each well?
6. No. of motors used for pumping water from each well?
7. What is the total horsepower of each motor?
8. Quantity of water stored in your overhead water tank?(in liters)
9. Quantity of water pumped every day?(in liters)
10. List out various uses of water
11. No. of water coolers. Amount of water used per day?(in liters)
12. No. of water taps. Amount of water used per day?
13. No. of bath rooms in staff rooms, common, hostels amount of water used per day?
14. No. of toilet, urinals. Amount of water used per day?
15. No. of water taps in the canteen. Amount of water used per day?
16. Amount of water used per day for garden use.
17. No. of water taps in laboratories. Amount of water used per day in each lab?
18. Total use of water in each hostel?
19. Is there any water used for agricultural purposes?
20. How many water fountains are there?
21. How often is the garden watered?

22. Quantity of water used to watering the ground?
23. Quantity of water used for bus cleaning?(liters per day)
24. Amount of water for other uses?(items not mentioned above)
25. At the end of the period, compile a table to show how many liters of water have been used in the college for each purpose
26. If there is water wastage, specify why.
27. How many of the taps are leaky? Amount of water lost per day?
28. Are there signs reminding people to turn off the water?
29. How many water fountains are leaky?
30. How can the wastage be prevented/stopped?
31. Locate the point of entry of water and point of exit of waste water in your college.
32. Where does waste water come from?
33. Where does the waste water go?
34. What are the uses of waste water in your college?
35. Is there any treatment for waste water?
36. What happens to the water used in your labs? Whether it gets mixed with ground water?
37. Is there any treatment for the lab water?
38. Whether green chemistry methods are practiced in your labs?
39. Write down four ways that could reduce the amount of water used in your college.
40. Record water use from the college water meter for six months.
41. Bimonthly water charges paid to water connections if any,
42. Is there any water conservation plan in the college?
43. Does your college harvest rainwater?
44. If yes, how many rain water harvesting units are there?(Approx .amount)
45. Is there any water less toilets?
46. Is drip irrigation used to water plants outside?

47. Area of the college land without tree/building canopy.
48. Is there any water management plan in the college?
49. Are there any water saving techniques followed in your college? What are they?
50. Please share some idea on how your college could save more water.

3.1.1 Auditing for Energy Management

1. List the ways of energy usage in your college. (Electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others).
2. Electricity bill amount for the last year
3. Amount paid for LPG cylinders for last one year
4. Weight of firewood used per month and amount of money spent? Also mention the amount spent for petrol/diesel/ others for generators?
5. Are there any energy saving methods employed in your college? If yes, please specify. If no, suggest some.
6. How much money does your college spend on energy such as electricity, gas, firewood, etc. in a month? (Record monthly for the year 2021).
7. How many CFL bulbs have your college installed? Mention use (Hours used/day for how many days in a month)
8. Energy used by each bulb per month? (Forexample-60watt bulb x 4hours x number of bulbs (kWh).
9. How many LED bulbs are used in your college? Mention the use (Hours used/day for how many days in a month)
10. Energy used by each bulb per month? (KWh).
11. How many incandescent (tungsten) bulbs have your college installed? Mentions use (Hours used/day for how many days in a month)
12. Energy used by each bulb per month? (KWh).
13. How many fans are installed in your college? Mention use (Hours used/day for how many days in a month)
14. Energy used by each fan per month?(kWh)
15. How many air conditioners are installed in your college? Mention use (Hours used/day, for how many days in a month)

16. Energy used by each air conditioner per month? (KWh).
17. How much electrical equipment including weighing balance is installed your college?
Mention the use (Hours used/day for how many days in a month)
18. Energy used by each electrical equipment per month? (KWh).
19. How many computers are there in your college? Mention the use (Hours used/day for how many days in a month)
20. Energy used by each computer per month?(kWh)
21. How many photocopiers are installed by your college? Mention use
(Hours used/day for how many days in a month).
22. How many cooling apparatus are in installed in your college? Mention use(Hours
used/day for how many days in a month)
23. Energy used by each cooling apparatus per month? (kWh) Mention use (Hours
used/day for how many days in a month)
24. Energy used by each photocopier per month? (kWh) Mention the use (Hours used/day
for how many days in a month) how many inverters your college installed? Mentions
use (Hours used/day for how many days in a month)
25. Energy used by each inverter per month?(kWh)
26. How many electrical equipment are used in different labs of your college? Mention
the use (Hours used/day for how many days in a month)
27. Energy used by each equipment per month?(kWh)
28. How many heaters are used in the canteen of your college? Mention the use (Hours
used/day for how many days in a month)
29. Energy used by each heater per month?(kWh)
30. No of streetlights in your college?
31. Energy used by each streetlight per month?(kWh)
32. No of TV in your college and hostels?
33. Energy used by each TV per month?(kWh)
34. Any other item that uses energy (Please write the energy used per month) Mention the
use (Hours used/day for how many days in a month)

35. Are any alternative energy sources/non-conventional energy sources employed/installed in your college? (photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.
36. Do you run switch off drills at college?
37. Are your computers and other equipment put on power-saving mode?
38. Does your machinery (TV, AC, Computer, weighing balance, printers, etc.) run on standby mode most of the time? If yes, how many hours?
39. What are the energy conservation methods adapted by your college?
40. How many boards displayed for saving energy awareness?
41. How much ash is collected after burning fire wood per day in the canteen?
42. Write a note on the methods/practices/adaptations by which you can reduce the energy use in your college campus in future.

3.1.2 Auditing for Waste Management

- What is the total strength of students, teachers and Non teaching staff in your college?

No. of Students	No. of Teaching Staff	No. of Nonteaching Staff
-----------------	-----------------------	--------------------------

- Which of the following are found near your college?

Mark the level of disturbance it creates for the college in a scale of 1to 9.

- Municipal dump yard Garbage heap
- Public convenience Sewer line stagnant water Open drainage Industry– (Mention the type)
- Bus/ Railway station
- Market/ shopping complex/ public halls

3.1.3 Waste Audit

Does your college generate any waste?

If so, what are they? How much quantity? Number or weight

- Paper Waste
- Plastic Waste
- Metal Waste

- Glass Waste
- Organic Waste
- Bio-Medical Waste
- E- Waste
- Hazardous Solid Waste
- Others(Specify)

1. What is the approximate quantity of waste generated per day?(In Kilograms)
2. Why waste is a problem?
3. Whether waste is polluting ground/surface water? How?
4. Whether waste is polluting the air of the college? How?
5. Is there any waste treatment system in the college? Methods
 - Composting
 - Recycling
 - Reusing
 - Others(specify)
6. How many separate boxes do you think you would need to put into a classroom to start a waste segregation and recycling campaign?
7. What should be the use for each box?(Develop a color code with reasons)
8. Do you use recycled paper in College?
9. Is there any waste wealth program practiced in the college?
10. How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.
11. Can you achieve zero garbage in your college? (Reduce, Recycle, Reuse, Refuse) If yes, how?

Bio Medical Waste

1. Whether Bio medical waste are segregated at source and put in color coded bags as per Schedule I of BMW RULE 2016 Is Color coding practiced?
2. Whether Performa of the label used on container/bag?
3. How much waste is generated per day/week/month/year?
4. Whether the Standard for treatment and disposal of waste is been followed?

5. Whether there is any mixing of general waste with bio-medical waste?
6. Is there adequate awareness on biomedical waste segregation, disposal, effect and management amongst the doctors and the paramedical staff?
7. Whether the workers involved in the biomedical waste handling were provided with gloves, face mask and head cap?
8. Is there Pre-treatment of the laboratory waste, microbiological waste, blood samples, and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO ?
9. Whether the liquid waste generated from health care facilities pretreated before mixing with other wastewater?
10. Whether training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year?
11. Whether Regular check up of Healthcare workers is conducted?
12. Whether health care workers and others, involved in handling of bio-medical waste are given immunization for protection against diseases that are likely to be transmitted by handling of bio-medical waste?

E-Waste

1. What the university does with working electronic/electrical products that you no longer use?
2. What the university does with broken electronic/electrical products?
3. How many electronic/electrical products does the university purchase a year?
4. On average, how many electronic/electrical products does the university choose to repair in a year?
5. Awareness about E-waste Laws among the students?
6. Awareness about what happens to E-waste if not recycled through proper channels?
7. What is the approximate quantity of E-waste generated per day?
8. Whether E-waste generated by them is channelized through authorized producer or dismantler or recycler?
9. Whether records of e-waste generated are maintained in Form-2?

10. Whether end-of-life electrical and electronic equipment are admixed with e-waste containing radioactive material?
11. Whether the annual returns are filed in Form-3, to the concerned State Pollution Control Board?

3.1.4 Auditing For Green Campus Management

1. Is there a garden in your college? Area?
2. Do student spend time in the garden?
3. List the plants in the garden, with approx. numbers of each species.
4. Suggest plants for your campus. (Trees, vegetables, herbs, etc.)
5. List the species planted by the students, with numbers.
6. Whether you halved is played scientific names of the trees in the campus?
7. Is there any plantation in your campus? If yes specify area and type of plantation.
8. Is there any vegetable garden in your college? If yes how much area?
9. Is there any medicinal garden in your college? If yes how much area?
10. What are the vegetables cultivated in your vegetable garden? (Mention the quantity of harvest in each season)
11. How much water is used in the vegetable garden and other gardens? (Mention the source and quantity of water used).
12. Who is in charge of gardens in your college?
13. Are you using any type of recycled water in your garden?
14. List the name and quantity of pesticides and fertilizers used in your gardens?
15. Whether you are doing organic farming in your college? How?
16. Do you have any composting pit in your college? If yes what are you doing with the compost generated?
17. What do you doing with the vegetables harvested? Do you have any student market?
18. Is there any botanical garden in your campus? If yes give the details of campus Lora.
19. Give the number and names of the medicinal plants in your college campus.

20. Any threatened plant species planted/conserved?
21. Is there a nature club in your college? If yes what are their activities?
22. Is there any arboretum in your college? If yes details of the trees planted.
23. Is there any fruit yielding plant in your college? If yes details of the trees planted.
24. Is there any grove in your college? If yes details of the trees planted.
25. Is there any irrigation system in your college?
26. What is the type of vegetation in the surrounding area of the college?
27. What are the nature awareness programs conducted in the campus?
28. What is the involvement of students in the green cover maintenance?
29. What is the total area of the campus under tree cover? Or under tree canopy?
30. Share your IDEAS for further improvement of green cover.

3.1.5 Auditing for Carbon Footprint

1. What is the total strength of students and teachers in your College?

No .of Students	No. of Teachers	No. of Non-teaching staff
Total Number of vehicles used by the stakeholders of the college. (per day)		
2. No. of cycles used?
3. No. of two wheelers used (average distance travelled and quantity of fuel and amount used per day)
4. No. of cars used (average distance travelled and quantity of fuel and amount used per day)
5. No. persons using common (public) transportation (average distance travelled and quantity of fuel and amount used per day)
6. No. of persons using college conveyance by the students, non-teaching staff and teachers (average distance travelled and quantity of fuel and amount used per day)
7. Number of parent-teacher meetings in a year? Parents turned up(approx.)
8. Number of visitors with vehicles per day?
9. Number of generators used per day (hours). Give the amount of fuel used per day.

10. Number of LPG cylinders used in the canteen (Give the amount of fuel used per day and amount spent).
11. Quantity of kerosene used in the canteen/labs (Give the amount of fuel used per day and amount spent).
12. Amount of taxi/auto charges paid and the amount of fuel used per month for the transportation of vegetables and other materials to canteen.
13. Amount of taxi/auto charges paid per month for the transportation of office goods to the college.
14. Average amount of taxi/auto charges paid per month by the stakeholders of the college.
15. Use of any other fossil fuels in the college (Give the amount of fuel used per day and amount spent).
16. Suggest the methods to reduce the quantity of use of fuel used by the stakeholder's /students/ teachers / non-teaching staff of the college.

4 CHAPTER

4.1 Audit Stage

In Sathyabama institute of Science and Technology, Chennai Green auditing was coordinated with WasmanPro Environmental Solutions LLP. The entire exercise was conducted by involving different student groups, teaching and non-teaching staff. The green audit began with the team conducting walk through inspections of all the different facilities at the college, determining the different types of appliances and utilities (lights, taps, toilets, fridges, etc.) as well as measuring the usage per item (Watts indicated on the appliance or measuring water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and their impacts. The staff and learners were interviewed to get details of usage, frequency or general characteristics of certain appliances. Data collection was done in the sectors such as Energy, Waste, Greening, Carbon footprint and Water use. College records and documents were verified several times to clarify the data received through survey and discussions. The methodology adopted for this audit was a step by step process comprising of:

- **Involvement of Student Clubs and Forums**
- **Site inspection**
- **Interviews**
- **Review of Policies**
- **Review of Documents and Records**



Figure 36: Audit Stage Meeting between Sathyabama and WasmanPro officials



Figure 37: Audit Discussion



Figure 38: The Audit Team of WasmanPro Environmental Solutions LLP with HOD, Centre for Solid Waste Management & Energy



Figure 39: Field visit to record the Environmental and Energy management activities



Figure 40: Audit Team visits the STP



Figure 41: Audit team visit to the hospital to observe the activity of Bio Medical Waste Management

5 CHAPTER

5.1 Post Audit Stage

The base of any Environmental audit is that its findings are supported by documents and verifiable information. The audit process seeks, on a sampled basis, to track past actions, activities, events, and procedures to ensure that they are carried out according to systems requirements and in the correct manner.

The real value of Environmental audits is when they are carried out at defined intervals, and their results can illustrate improvement or change over time.

Although Environmental audits are carried out using policies, procedures, documented systems and objectives as a test, there is always an element of subjectivity in an audit. The essence of any Environmental audit is to find out how well the organization, departments and equipment are performing keeping the environmental sustainability in mind. Each of the three components is crucial in ensuring that the organization's environmental performance meets the goals set in its green policy. The individual functioning and the success of integration will all play a role in the degree of success or failure of the organization's environmental performance.

5.2 Key Findings and Observations

5.2.1 Water

Main water uses in the campus

- ❖ Gardening
- ❖ Cleaning
- ❖ Drinking
- ❖ Toilets
- ❖ Bathrooms
- ❖ Hostel
- ❖ Cooking
- ❖ Washbasin
- ❖ Lab
- ❖ Canteen
- ❖ Office uses
- ❖ Floor Cleaning

Table 3: Source of Water

Number of Tankers	25-30 per day (during full strength), presently : 2-5(during Covid Lock down times) (of 12,000lts capacity)
Number of bore wells	3 bore well within 25-30 kms from institution (One owned, two hired)
Number of ponds	Nil

Table 4: Water Storage

Water Storage

Number of Raw Water Tank	4
Number of Fire Water Storage Tank	1
Number of Treated Water Tank	3 -(50,000lt) (3-4 days it will get filled)
Number of Rain Water Collection Tank	1
Number of water tanks for storage	9
Total capacity of water storage tank	1 MLD

Total Qty of Water Pumped from these Storage Structures to distribution tanks

- ❖ **No. of distribution tanks with Tank capacity :30 -50 thousand L**
 - Gents hostel : 3 tanks
 - Ladies : 4 tanks
 - Dental: 2 tanks
- ❖ **No. of distribution tanks with Tank capacity: 25-50 thousand L**
 - Small blocks : 3
 - Other blocks :7 tanks
- ❖ **Syntax tanks with capacity (5000L-20000L)**
 - Number of Syntax tanks -15

Table 5: Various points of Usage of Water

RO Plant 40000 L Capacity	2 tanks (20000 L each)
Number of Urinals and Toilets	688,1475
Number of water less urinals	nil
Number of bathrooms	975
Number of water taps	1685
Water taps in laboratories	114
Number of Washbasin	375
Water pumps–Nos. HP each	6 (10HP)
Quantity of water pumped	25 - 30 Lorries (12000L)

Table 6: Number of Water Cooler Details

SL.NO	Location	No's
1	Block (Research)	6
2	Block (admin)	6
3	Block (hospital)	12
4	Block (academics)	9
5	Block (dental)	8
6	Hostel	5
7	Hostel	4
8	Work shop 3 & 4	2
9	Library	8
10	Ladies Hostel	7
11	Mess	11
12	Canteen	Nil
	Grand Total	78

Table 7: Various Points of Water Wastage

Number of Leaky Taps	Nil
Number of leaky pipes	Nil
Number of Urinals	Nil

Number of Leaky Tanks	Nil
Overflow water Wastage	Max 5 mts overflow- immediate switch off followed
Any Evaporation Loss from Storage Tanks	No Evaporation Loss as the Storage Tanks are completely covered

Table 8: Treated Water

No. of water treatment system in place	1
Total Quantity Water being treated	1.1 MLD
Total Quantity Water Reused	0.88 MLD

Table 9: Overall Utilization of water in the college

- ❖ Total water consumption in the university = 330 KLD (from water tankers) and rest of the water demand is met from bore well.
- ❖ Water charges paid –Rs.4,00,000-8,00,000/ month.

5.2.2 Energy

List of Instruments Used

Following instruments were used to collect data related to energy systems:

1. 3 phase power analyzer
2. Lux meter
3. Power Clamp meter
4. Hygrometer
5. Anemometer
6. Measuring tape
7. Ultra-sonic flow meter

Table 10: Major Utilities at Sathyabama Institute

S.NO	Particular	Quantity	Rating
1.	Transformer	3	1000kVA × 2 630kVA × 1
2.	Capacitor Bank	4	100 kVA × 4
3.	Diesel Generators	6	725 kVA × 1 625 kVA × 1 500 kVA × 3 185 kVA × 1
4.	Single phase load (lights, fan, power sockets, etc.)	Multiple	Total 440kW
5.	Electric Motor	Multiple	Total 526 HP
6.	Power Load in facility	Multiple	Total 570 kW
7.	Power Load for UPS	Multiple	Total 669 kVA

Table 11: Transformer Ratings

S.NO	Transformer	Transformer Rating (in kVA)
1	Transformer	1000
2	Transformer	1000
3	Transformer	630

Table 12: Monthly consumption, demand and billing details

Consumption Month	Units consumed (in kWh)	Consumption in kVAh	Actual maximum demand (in kVA)	Power factor	Maximum demand (in kW)	Contract demand	Billing demand	Difference in billing and max demand	Monthly effective load factor	Billing amount (in Rupees)	Effective tariff
Jan-19	261980	279540	974	0.937	912.82	2000.00	1800	826	0.386	₹ 28,50,037.00	10.88
Feb-19	420940	431100	1208	0.976	1179.53	2000.00	1800	592	0.531	₹ 41,89,396.00	9.95
Mar-19	429346	438100	1455	0.980	1425.93	2500.00	2250	795	0.405	₹ 43,61,340.00	10.16
Apr-19	443259	455100	1595	0.974	1553.50	2500.00	2250	655	0.396	₹ 45,59,940.00	10.29
May-19	308633	327850	1275	0.941	1200.27	2500.00	2250	975	0.346	₹ 34,27,094.00	11.10
Jun-19	409482	431900	1545	0.948	1464.81	2500.00	2250	705	0.388	₹ 35,77,890.00	8.74
Jul-19	408381	424775	1545	0.961	1485.37	2500.00	2250	705	0.370	₹ 35,76,261.00	8.76
Aug-19	487896	503650	1530	0.969	1482.14	2500.00	2250	720	0.442	₹ 41,01,496.00	8.41
Sep-19	469758	485250	1640	0.968	1587.64	2500.00	2250	610	0.411	₹ 39,90,834.00	8.50
Oct-19	330366	348775	1455	0.947	1378.20	2500.00	2250	795	0.333	₹ 30,54,981.00	9.25
Total/Average	4266441	4431660	1370.91	0.961	1318.39			756	0.42	₹408,26,404.00	9.69

Air-Conditioning Systems

Air-Conditioners are used to maintain comfort in working environment. People working in offices require a certain ambient condition to be comfortable to perform the task. Here at Sathyabama Institute, packaged type AC units are used. The units used are as follows:

- Split – High wall
- Split – Cassette
- Duct type

The units used are of different capacities, depending on the space and number of people occupying that space. Due to large number of ACs installed, auditors did the study on sample basis.

Table 13: Detailed performance assessment of Air-Conditioners

S.NO	Location	Rated Capacity in (TR)	Type	Compressed Load (in kW)
1	Auditorium AC unit 1	11.5	Ducted	10.85
2	Auditorium AC unit 1	11.5	Ducted	11.06
3	Auditorium AC unit 1	11.5	Ducted	10.97
4	Auditorium AC unit 1	8.5	Ducted	8.89
5	Auditorium AC unit 1	8.5	Ducted	8.93
6	Library Auditorium	2	Split	2.45
7	Library Auditorium	2	Split	2.2

Table 14: List of lighting load

Area	Equipment	Rating(W)	Quantity	Total load (in kW)
Block No.1	Tube Light	40	156	6.24
Block No.2	Tube Light	40	34	1.36
Block No.3	Tube Light	40	37	1.48
Block No.4	Tube Light	40	37	1.48
Block No.5	Tube Light	40	35	1.4
Block No.6	Tube Light	40	29	1.16
Block No.7	Tube Light	40	35	1.4
Block No.8	Tube Light	40	35	1.4
Block No.10	Tube Light	40	156	6.24
Block No. 11	Tube Light	40	136	5.44
Block No.12	Tube Light	40	156	6.24
Block No.14	Tube Light	40	156	6.24
Block No.15	Tube Light	40	156	6.24
Block No.16	Tube Light	40	156	6.24
Block No.18	Tube Light	40	156	6.24
Dr.MGRillam(Boys hostel)	Tube Light	40	320	12.8
Dr.Gopalakrishananillam (boys hostel)	Tube light	40	320	12.8
3 rd year hostel(Boys hostel)	Tube light	40	203	8.12
Panimalarhostel(Ladies hostel)	Tube light	22	203	4.466
Janakiammalhostel(Ladies hostel)	Tube light	40	156	6.24
Janakiammal hostel-I(Ladies hostel)	Tube light	40	156	6.24
Janakiammal hostel-II(Ladies hostel)	Tube light	40	200	8
Janakiammal hostel-III(Ladies hostel)	Tube light	40	206	8.24
Administrative office	Tube light	40	156	6.24
Old office	Tube light	40	31	1.24
Ladies mess	Tube light	40	250	10
PG mess	Tube light	40	22	0.88
Boys mess	Tube light	40	250	10
CSC block	Tube light	40	80	3.2
ECE block	Tube light	40	80	3.2
E&C AND E&I block	Tube light	40	30	1.2
EEE block	Tube light	40	55	2.2
Machine shop	Tube light	40	30	1.2
CAD lab	Tube light	40	20	0.8
Production lab	Tube light	40	50	2
Welding lab	Tube light	40	60	2.4
Civil block	Tube light	40	97	3.88
Bio-tech block	Tube light	40	130	5.2
M.sc block	Tube light	40	30	1.2
ETC block	Tube light	40	90	3.6
Area	Equipment	Rating(W)	Quantity	Total load

				(in kW)
Thermal lab	Tube light	40	30	1.2
Mech & production	Tube light	40	30	1.2
Aeronautical lab	Tube light	40	156	6.24
B.Arch.	Tube light	40	156	6.24
Nano-tech block	Tube light	40	60	2.4
Auditorium	Tube light	40	156	6.24
Transport shed	Tube light	40	10	0.4
Library	Tube light	40	30	1.2
Play ground	Tube light	120	22	2.64
Sewage & drainage	Tube light	40	2	0.08
Dobi room	Tube light	40	4	0.16
Street light	Tube light	120	20	2.4
			Total	214.5

Table 15: Performance assessment of lighting system

Performance assessment of lighting system					
LUX Measurement					
S.No	Location	Wattage	No.of.Fittings	Avg LUX	Remarks
1	Library hall	1572	44	155	No day light available
2	Library hall Ground floor (student sitting area)	3960	15	115	Daylight available
3	Library 2nd Floor (HR discussion panel)	180	10	64	
4	Interview panel room	220	1	219	No day light available
5	Auditorium	30	1	186	
6	Janakiamal Hostel	36	2	85	
7	St Mother tresailum	72	2	47	
8	Mother of Rosery illum	80	2	48	
9	Immaculate Marry illum	44	2	85	
10	Gopal Krishnan illum	44	2	189	
11	MGR illum	72	2	66	
12	Col Dr Jeppiarillum	72	2	72	
13	Class Room Block 15	240	6	60	Daylight available, with daylight average lux will be 170
14	Class Room Block 18	320	8	85	Daylight available, with daylight average lux will

					be 185
15	Class Room Block 8 (Room 9)	108	6	95	Daylight available, with daylight average lux will be 200

Table 16 : Standard lux level in different areas

Activity	Illumination (lux, lumen/m ²)
Public areas with dark surrounding	20-50
Simple orientation for short visits	50-100
Working areas where visual tasks are only occasionally performed	100-150
Warehouse, Homes, Theaters, Archives	150
Easy Office work, Classes	250
Normal Office work, PC work, Study library, Groceries, Show room, Laboratories	500
Supermarkets, Mechanical workshops, Office landscapes	750
Normal Drawing work, very detailed mechanical works	1000
Detailed Drawing work, very detailed mechanical works	1500-2000
Performance of visual tasks of low contract and very small size for prolonged periods of time	2000-5000
Performance of visual tasks of low contract and very small size for prolonged periods of time	2000-5000
Performance of very prolonged and exacting visuals tasks	5000-10000
Performance of very special visual tasks of extremely low contract and small size	10000-20000

Table 17 : Assessment of Pumps

Particular	Location	Value	Unit
Pump No 1	Boys Hostel	15.00	HP
Pump No 2	Girls Hostel	15.00	HP

Table 18 : Financial analysis of energy savings in lighting system

Lighting technology	Present rating (in W)	Number of fixtures	Connected load (in kW)	Average running hours per day	Daily energy consumption (kWh)
Conventional FTLs	40	5371	215	5	1074
LED Tube lights	22	5371	118	5	591
Savings per day	18				483
Average tariff	₹ 7.50	Per kWh			
Annual energy savings (in kWh)					159519
Monetary savings per day					₹ 3625.43
Annual benefits					₹ 11,96,390.25
Economics of project					
Cost of one LED tube light					₹ 400.00
Cost of installation per light					₹ 50.00
Total cost for one light					₹ 450.00
Number of lights					5371
Total investment					₹ 24,16,950.00
Simple payback					2.02

Table 19 : Fans installed at the facility

Area	Equipment	Rating(W)	Quantity	Total load (in kW)
Block No.1	Fan	80	65	5.2
Block No.2	Fan	80	38	3.04
Block No.3	Fan	80	36	2.88
Block No.4	Fan	80	36	2.88
Block No.5	Fan	80	37	2.96
Block No.6	Fan	80	28	2.24
Block No.7	Fan	80	45	3.6
Block No.8	Fan	80	43	3.44
Block No.10	Fan	80	65	5.2
Block No. 11	Fan	80	65	5.2
Block No.12	Fan	80	55	4.4
Block No.14	Fan	80	55	4.4
Block No.15	Fan	80	65	5.2
Block No.16	Fan	80	65	5.2
Block No.18	Fan	80	65	5.2
Dr.MGRillam(Boys hostel)	Fan	80	180	14.4
Dr.Gopalakrishananillam (boys hostel)	Fan	80	180	14.4
3 rd year hostel(Boys hostel)	Fan	80	155	12.4

Panimalarhostel(Ladies hostel)	Fan	80	155	12.4
Janakiammalhostel(Ladies hostel)	Fan	80	65	5.2
Janakiammal hostel-I(Ladies hostel)	Fan	80	50	4
Janakiammal hostel-II(Ladies hostel)	Fan	80	150	12
Janakiammal hostel-III(Ladies hostel)	Fan	80	150	12
Administrative office	Fan	80	8	0.64
Old office	Fan	80	12	0.96
Ladies mess	Fan	80	140	11.2
PG mess	Fan	80	13	1.04
Boys mess	Fan	80	140	11.2
EEE block	Fan	80	24	1.92
Machine shop	Fan	80	30	2.4
Production lab	Fan	80	20	1.6
Welding lab	Fan	80	10	0.8
Civil block	Fan	80	10	0.8
Bio-tech block	Fan	80	30	2.4
M.sc block	Fan	80	18	1.44
ETC block	Fan	80	20	1.6
Thermal lab	Fan	80	20	1.6
Aeronautical lab	Fan	80	65	5.2
B.Arch.	Fan	80	65	5.2
Nano-tech block	Fan	80	30	2.4
Auditorium	Fan	80	50	4
Transport shed	Fan	80	4	0.32
Library	Fan	80	12	0.96
Sewage & drainage	Fan	80	1	0.08
Dobi room	Fan	80	1	0.08
			2571	205.7

Table 20 : Financial analysis of implementing energy efficiency in ceiling fans

Lighting Technology	Present Rating (in W)	Number of Fixtures	Connected load (in kW)	Average running hours per day	Daily energy consumption (kWh)
Conventional Fans	80	2571	206	7	1440
BLDC fans	30	2571	77	7	540
Saving per day	50		129		900
Average tariff	₹ 7.50	per kWh			
Annual Energy savings (in kWh)					296951
Monetary savings per day					₹6,748.88
Annual benefits					₹22,27,128.75
Economics of project					
Cost of	one LED tube light				₹ 3,250.00
Cost of	Installation per light				₹ 50.00
Total	cost for one light				₹ 3,250.00
Number of	Of lights				2571
Total	Investment				₹ 83,55,750.00
Simple	Payback				3.75

Table 21 : Economic feasibility for 5 Star ACs

Air Conditioner Rating	EER (kW/kW)	AC Cooling Capacity (in TR)	Power Consumption (in kW)
1 Star	2.7	2.5	3.25
5 Star	4.5	2.5	1.95
Savings (in kW)			1.3
Running House per day			24
Duty Cycle (Compressor running)			0.65
Energy Savings per day			20.28
Annual Energy Saved (for 365days)			7402.2
Number of ACs			6
Total Savings (Annual)			44413.2

Electricity Charges paid -

LPG Cylinders used-25 to 30 (for two days)

Cost of Gas Cylinder = Rs 24363/ month

5.2.3 Waste

E-Waste Generated

- ❖ E-wastes- computers, electrical and electronic parts – Disposal by selling/Exchange (Vendors)-M/S EARTH SENSE RECYCLE PVT LIMITED
- ❖ Name & Details of authorized collection centre /dismantler/recycler / refurbisher to whom waste is given--M/S EARTH SENSE RECYCLE PVT LIMITED, Thenmelpakkam Village, Chengalpattu, Chennai
- ❖ Records of e-waste generated- attached in the annexure
- ❖ Total Quantity of e-waste generated--
- ❖ Types of E Waste Generated in the campus--2400 to 2500 batteries are are used in the UPS unit across the institute. Those batteries are refilled frequently. Old batteries are exchanged upon replacement of new batteries.

Solid Waste Generated

- ❖ Paper Waste -Newspaper, Magazines, Card Board, Box Board-Disposal by giving it to vendor
- ❖ Plastic waste–Disposal by selling(milk covers, Plastic covers–Source segregation)
- ❖ Other Solid waste–Disposal by selling giving it to vendor
- ❖ Food wastes – Disposal to Pig farm (Canteen and Mess waste) – as per the Solid Waste Management Hierarchy.
- ❖ Laboratory Wastewater sent to –STP
- ❖ Glass waste –Recycling

Table 22 : Various Types of Waste Generated

Type of Waste	Quantity	Disposal Mechanism adopted
Paper Waste , tea cups, tetra packs, juice bottles	Collected in bin of 4.5 * 3.5*3.5 - 36 such bins get filled in three days	1)Of the total waste collected 1-3% is recycled through recyclers who take recyclable papers and return A4 sheets in return of 50% lesser weight 2)Other wastes and is being collected by Corporation vehicles once in three days; probably it may be accounted as 12 bins daily
Plastic Waste	Major quantum is diverted to architecture department for sustainable building research	Given away to corporation along with paper waste
Metal Waste : Steel chairs, scrap cupboards, racks	2015-2016; 2016-2017;2017-2018; 2018-2019 32 metal racks, 50 steel cupboards, Plastic chairs :300 2019-2020; 2020-2021 3 metal racks, 20 steel cupboards, Plastic chairs :50 Wooden tables : 50 Wooden racks :30	Scrap dealers, sold for money
Food Waste including vegetable/fruit peels, waste food	900-1200 kg per day full strength Pandemic -100 to 150 kg	Pig feed

The Solid Waste Management Hierarchy

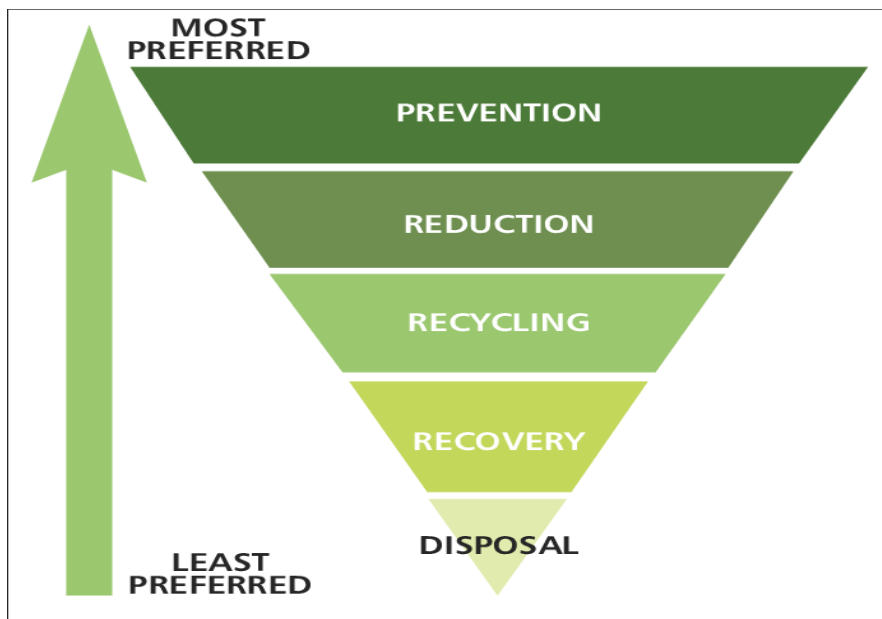


Figure 42: Solid Waste Management Hierarchy

Biomedical Waste Generated

- ❖ Sathyabama University Dental College and Hospital established in 2009 is an autonomous institution affiliated to Sathyabama University, Chennai, Tamil Nadu, India. The college has gained an unsavory reputation and has been accredited by the National Assessment and Accreditation Council (NAAC) with 'A' grade.
- ❖ Sathyabama University Dental College and Hospital has 18 functioning departments and has its own pharmacy. These departments are under the supervision of 60-90 doctors and 20-35 paramedical staff. The total numbers of patients coming to have treatment are about 150-250 per day.
- ❖ They have color coded bins for all types of Bio Medical Wastes and Domestic Wastes generated from the Dental College and Hospital.
- ❖ The authorized recycler to whom waste is given for further treatment & disposal- G.J.Multiclave (India) Pvt. Ltd Adyar, Chennai.

Table 23 : Generation of waste (infectious and non-infectious) in different departments of Sathyabama University Dental College and Hospital

Department	Types Of Waste Generated	Quantum Of Waste (Approximately)	No Of Person Involved In Waste Handling
Department of oral maxillofacial pathology	Sharps, body fluids, Discarded medicine	2-3 kg/week	>5
Department of public health dentistry	Gloves, mask, washed water	Variable	+2
Department of oral medicine and Radiology	Gloves ,mask, instrument pouches	Gloves-40 pieces Mask-30 pieces Instrument pouch-75 pieces per day	
Department of oral maxillofacial surgery	Sharps, outdated Medicine	1(red, blue, black) bag/day	2
Department of prosthodontics and implantology	Plaster of paris, Alginate	POP -40kg/week Alginate -10kg/week	4
Department of Biochemistry	Blood and urine samples	-----	-----
Department of Pedodontics	Cotton, gloves, needles, bandages	10kg/week	2
Department of Conservative dentistry and endodontics	Soiled cotton, needles, syringes, amalgam	01.5 kg/day	4
Casualty	Sharps, plastics container , anatomical organs	3 kg/day	2

Color Coding Biomedical Waste

- ❖ **Yellow**-Human &Animal Anatomical Waste ,Discarded Chemicals, Chemical Waste, Lab Waste
- ❖ **Red**- Contaminated Waste (Recyclable) – Wastes generated from disposable items such as tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (syringe without needle)
- ❖ **Blue**-Broken or discarded and contaminated glass vials including medicine vials and ampoules
- ❖ **White**-Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades.

Table 24 : Quantity of Bio-Medical waste generated

Years	Red			Yellow			Blue		
	Avg/ day	Avg/ Week	Avg/ month	Avg/ day	Avg/ week	Avg/ month h	Avg/ day	Avg/ week	Avg/mo nth
2019	2.33	16.31	70	1.66	11.62	50	1.33	9.31	40
2020	3.75	26.25	112.5	2.25	15.75	67.5	1.75	12.25	52.5
2021	3.25	24.64	97.5	2	14	60	0.5	3.5	15

Quantity of waste generated:-

- ❖ Biodegradable – Paper, dried leaves, Vegetation garden, Woods except food waste.
The average quantity of wastes generated 1123.84 m³/month.
- ❖ Biodegradable -food waste generated is given away to farm as pig feed.
The average quantity of wastes generated 31500 kg/ month
Non-biodegradable – Plastic bags, Wrappers-Major quantum is diverted to architecture department for sustainable building research
- ❖ E- Waste
- ❖ Biomedical Waste -.The average quantity of biomedical waste generated- 232.5kg/month.

Table 25: List of Various Chemicals used in the Laboratories

S.No	Chemical name
1	Di-Sodium hydrogen orthophosphate
2	Hydrazine Sulphate
3	Gelatin Bacteriological
4	D-Sorbital
5	Potassium Hydroxide
6	Potassium Iodide
7	Ammonium Ferrous Sulphate
8	Ammonium Ferric Sulphate
9	Calcium Carbonate
10	Acetone
11	Liquor Ammonia
12	Ammonia Solution
13	Ammonium Chloride
14	Sodium Chloride
15	Eriochrome black-T
16	Silver Nitrate
17	Silver Sulphate
18	Mercuric Sulphate
19	Hexamine
20	Ferroun Indicator
21	Sodium Sulphate
22	Acetic Acid
23	Sodium Methoxide
24	Sodium Metal
25	Sodium Hydroxide
26	Methanol
27	Isopropyl Alcohol
28	Ammonium Purpurate
29	Potassium chromate
30	Phenolphthalein
31	Buffer Capsule pH(9.2)
32	Buffer Capsule pH(4)
33	Manganous Sulphate
34	Zinc Chloride
35	Potassium Chloride
36	Hydrogen iodide
37	Methylamine

38	Lead iodide
39	Lead chloride
40	Tin fluoride
41	Ammonium fluoride
42	Ammonia
43	Potassium chloride
44	Sodium sulphate
45	Sodium sulphide
46	Ethanol
47	Acetone
48	Dimethyl formamide
49	Ethylene glycol
50	Isopropyl alcohol

5.2.4 Green Campus

Area under green cover- 33.705sq.m

Marshy land area-5,120 sq m

Table 26 : Campus Trees

S.No	Tamil Names	Botanical Names
1	Pungai	<i>Millettia pinnata</i>
2	Neem	<i>Azadirachta indica</i>
3	Thoongumoonjimaram	<i>Samanea saman</i>
4	Like coconut-	<i>Cocos nucifera</i>
5	Idly poo	<i>Ixora coccinea</i>
6	Savukku	<i>Casuarina equisetifolia</i>
7	Badam	<i>Terminalia catappa</i>
8	Hibiscus	<i>Hibiscus rosa-sinensis</i>
9	Jasmine/mullai	---
10	Coconut	<i>Cocos nucifera</i>
11	Australian babul plant	<i>Acacia auriculiformis</i>
12	Ashoka maram	<i>Saracaasoca</i>
13	Munkil	<i>Bambusoideae</i>
14	kagitha poo	– <i>Bougainvillea</i>
15	Tamanu maram	<i>Calophylluminophyllum</i>
16	mayilkondraimaram	<i>Delonix regia</i>
17	Koyyamaram	<i>Psidium guajava</i>
18	Kondraimaram	<i>Cassia fistula</i>
19	Elumiccai	<i>Citrus × limon</i>

20	Mhaliammaram	<i>Mimusopselengi</i>
21	Vep pammaram	<i>Azadirachta indica</i>
22	Badammaram -	<i>Terminalia catappa</i>
23	Pungaimaram -	<i>Millettia pinnata</i>
24	Thoongumoonjimaram -	<i>Samanea saman</i>
25	Perunkondraimaram -	<i>peltophorum-pterocarpum</i>
26	Periya-takarai	<i>Leucaena leucocephala</i>
27	Savukkumaram -	<i>Casuarina equisetifolia</i>



Figure 43: Banners of different functions of the Eco Club



Figure 44: Tree plantation in the college campus



Figure 45: Plantation drive by NSS



Figure 46: Students engaged in the Eco Club activities

5.2.5 Carbon Footprint Auditing

Feasible emission inventories are to be selected to analyze the Carbon footprint of the campus. The inventory survey is to be done for one academic year. The selected inventories are Human Factor, Transportation, Electricity, Solid Waste, Production and Consumption of Food, LPG, Natural Gas, Buildings.

Data keepers are identified and the primary details are collected. Parameter wise and zone wise details are collected. The received data are assembled and the missing gaps are recognized.

- **Human factor**

Carbon dioxide emitted by a person per day is not negligible. It is equivalent to the emission of a car in a 5km stretch. Humans emit 26 giga tons of carbon dioxide per year while CO₂ in the atmosphere is rising by only 15 giga tones per year. Just for breathing, humans emit per person each day 1140 grams of CO₂, assuming that they eat normally and follow a mean diet

of 2800kcal.

The population details of each zone include the total number of teaching faculty; non-teaching staff and students were collected. The carbon dioxide emissions will be larger in the Zone having highest population.

- **Transportation**

Fossil fuels are used for transportation. The carbon dioxide emitted by different fuels is indifferent amounts. The engine of the vehicle burns fuel and creates a certain amount of CO₂, depending upon its fuel type, fuel consumption and the driving distances. One liter of petrol and diesel emits 2.3kg and 2.7kg of carbon dioxide, respectively. Travelling by car for 1000km can produce about 200-230kg of carbon dioxide into the atmosphere. If a person travels by a bus for 1000km, it can add 1075kg of CO₂ to his/her Carbon foot print. Worldwide, the fossil fuels used for transportation contribute over 13% of GHG emissions.

The transportation details for the college campus include the type of vehicle, No. of vehicles and the fuel used were collected. The details give us the idea that the vehicles using petrol or diesel is more in the college premises. The carbon dioxide emitted from petrol is less compared to that of diesel. The Carbon footprint by the emission inventory transportation will be quite high.

It was noted that the University run buses with 15% biodiesel blends along with the diesel. The buses were reported to run smoothly with lesser emissions and noise and improved mileage on average of 5 to 7 km/L which was about 4 to 6 km/L with Diesel alone.

- **Electricity**

Electricity is one emission inventory which contributes much to the Carbon footprint of the institution. Heating of the buildings with electricity generates a certain amount of CO₂ due to the generation of electric power. On an average, electricity sources emit 1.297lbs CO₂ per kWh i.e. 0.0005883 metric tons of CO₂ per kWh. The emission factor given by GRID 2010 version 1.1 for hydro electricity is 6.8956 x10⁻⁴ metric tons CO₂/kWh. 50 grams of CO₂ is emitted from 1 unit of solar power.

The details of the consumption of electricity and the use of generators in different zones are surveyed. If the number of classrooms and labs are more in a zone, consumption of electricity in that zone is more.

It was noted that the University uses a lot of Renewable power especially Solar and Wind and the Hybrid Model as a supplement to conventional power thereby reducing emission of GHG

to the atmosphere also contributing to the INDC commitment pledged by GoI

- **Solid waste**

Generally, 1kg of solid waste is generated per capita per day. For high income countries, the solid waste generation is 1.1-5kg per capita per day. For middle income countries, it is 0.52-1kg and for low income countries the value is 0.45-0.89kg/capita/day. One kilogram of solid waste can emit about 0.125kg of carbon. The details regarding the solid waste generated in each zone is collected including the waste produced in canteen and hostels.

The solid waste generated in the canteen and hostel which is taken out of the campus comes under other indirect emissions. Solid Waste emits less amount of carbon dioxide compared to Other emission inventories considered.

- **Food Production and Consumption**

Food is one of the consumption categories which cause the highest environmental impact on the climate. According to the study conducted by the European commission (2006), the food and drink category causes 20-30% of the various environmental impacts of total consumption. Worldwide, agriculture contributes to nearly 14% of total GHG emissions.

The Carbon footprint of an average diet is 0.75 tons CO₂-eq, without accounting for food transportation. The amount of GHGs produced by the production of food differs much from one food type to other. Meat products have a larger Carbon footprint than fruits, vegetables and grains. The Carbon footprint of an average meat eater is about 1.5 tons CO₂-eq larger than that of a vegetarian. Consumption details of different zones are collected for the carbon footprint analysis.

- **LPG And Natural Gas**

The consumption of one liter of LPG can release 1.5kg of carbon dioxide to the atmosphere. Also burning of wood (250kg) can add 33kg of carbon dioxide to the Carbon footprint. The consumption details of LPG and Natural Gas in canteen and hostels are surveyed.

It was noted that the University uses the solar power to run the kitchens. It is Asia's largest solar powered Kitchen.

Table 27: Details for Carbon Foot Print Auditing

S.No	Details	Data for 2019-2020	Data for 2020-2021
1	Total number of Students	12019	
2	Total number of Faculty Members	1063	
3	Total number of Non-teaching staff	Office staff including Accounts section:50 Lab technician:40 Attenders:85 Drivers:60-80 Cleaners:10-15 Sweepers:195-210 Electricians:15-20 Plumbers:15-20 Mess Workers:100-120	
4	Total number of Four wheelers	Buses: 80-100 Cars:25 Auto:10	Vans : 8 Cars:70 Cabs:25 Auto:40
5	Total number of Two wheelers	25-50	150
6	Total number of Generators used	6 100 HP (from grid) Usage of generator has reduced Diesel requirement Per day 250 L	6 100 HP (from grid) Usage of generator has reduced

		diesel when operated with full student capacity	
7	Total number of LPG cylinders	25-30 with full capacity (19 kg cylinder – 25 to 30 cylinder for 2days)	4-5 cylinders only for staff
8	Any Carbon Footprint reduction strategy battery powered vehicles biodiesel run buses no vehicles days etc	4 (overnight charge battery capacity) 5 (12%) 20L short routes, 50 long route	4 (overnight charge battery capacity) 5 (12%)

6 CHAPTER

6.1 Evaluation of Audit Findings

6.1.1 Water

Water is precious. Water management is important for every community for its conservation. The principles of circular economy defined to have better water usage, treatment, Recycling and Conservation. The institution should be aware on establishing water quality and effluent standards, as well as monitoring wastewater quality.

The main source of water for the University is water bought from the lorry tankers. 12,000 litres capacity tankers nearly 25-30 per day are bought on a daily basis. This water is used by the college for its different uses. The three bore wells are located 25-30 kms from institution. Two of these wells are own wells and one rental. Water from the public water supply is not utilized. Totally 4 water storage tank are located inside the Campus to store water of capacity 10,00,000 liters.

The Storm water drainage was present in the campus roadways connecting each building whereas rainwater is collected during the rainy seasons. Only Minimum amount of water is lost per day through the Improper closing of the taps, overflow and other misuses. This can be prevented by generating more awareness. There are no water leakages as the leaky taps are repaired whenever such leaks come to the notice of the authority.

The University has two Reverse Osmosis plant of 20000 L capacity each which is used to meet the drinking water demand of the inmates of the hostel.

Sewage treatment Plant of Capacity 1.5MLD of one No is installed to treat the amount of wastewater that were recycled and utilized for gardening.

Awareness programs about conservation and management of water for sustainable use is highly beneficial in this college.

Sewage Treatment Plant

Sewage treatment plant with a capacity of 15, 00,000 liters /day. The process adopted for this treatment is by Sequential Batch Reactor. The major parts of this system are as follows:

- Bar Screen
- Raw Sewage Sump

- Receiving Chamber
- Fine Screen Channel
- Grid Chamber Manual
- SBR Basin
- Clarified Water Tank
- Treated Water Tank
- Sludge Sump
- Sludge Drying Beds
- Sand filter
- Activated carbon filter
- Treated water collection tank

6.1.2 Recommendations

- ❖ Liquid waste generated from health care facilities shall be pretreated before mixing with other wastewater
- ❖ Display Posters to motivate students to conserve water (close the taps immediately after use)
- ❖ Develop Portal where students can report leaky taps whenever it comes to their notice
- ❖ Replace conventional flush system with Latest Dual model Flush system to conserve water- as at present the toilet commodes have 10 litre flush which can be replaced with 3/6 litres or 2/4 litres dual flush cisterns. This can reduce water use by around 30-40%
- ❖ Installation of water meter to analyze water consumption
- ❖ It is recommended that flushing should be avoided for disposing toilet paper
- ❖ Need monitoring and controlling overflow from storm water drains in case of heavy rains.
- ❖ Installation of more Rainwater Harvesting pits is recommended.
- ❖ Installation of artificial ground water recharge structure
- ❖ Flow fixtures could be installed on the taps that are used for watering the plants as it controls, deliver a precise volume of water at faucets, showerheads, and hose outlets
- ❖ Use of Drip Irrigation is recommended for gardening

6.1.3 Energy

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliance, natural gas and vehicles. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment.

Current saving methods adopted in the college

- ❖ Turn off electrical equipments when not in use
- ❖ Use energy efficient light-emitting diode (LED) bulbs instead of incandescent and CFL bulbs
- ❖ Maintain appliances and replace old appliances.
- ❖ Use computers and electronic equipments in power saving mode
- ❖ Use of Renewable Energy (Solar, Wind & Hybrid) to as source of power
- ❖ Energy saving through the replacement of incandescent bulbs, CFL lamps and tube lights to LED light is being done to save power.

The total energy utilization of the college for different purposes is approximately 1,25,200- **KWH/month**. Increased production of solar energy, wind a type of non-conventional category of energy will be a good energy management system for the college. Average Electricity charges per month are **Rs.16,02,988 /month**.

Solar Power Plant of capacity 6 kVA. This solar power plant produces maximum of 24kwh. Generally in the range of 16-24 kWh. Solar panels are located near the walk way. Solar street lights are also located in the campus.

6.1.4 Recommendations

- ❖ Support renewable and carbon-neutral electricity options on any energy purchasing Consortium, with the aim of supplying all university properties with electricity that can be attributed to renewable and carbon-neutral sources.
- ❖ Periodic electrical maintenance is to be done to optimize the power usage.
- ❖ Enhance awareness among students about energy efficiency and energy conservation through training and other in-formal methods.
- ❖ Display posters urging students to conserve energy (turn lights and fan off when not in use)

- ❖ Use of Star rated Electric/Electronic Appliances
- ❖ Ensure that air conditioners are set at 24-25C with fans on to conserve energy
- ❖ Install motion sensors, dimmers, and separate lighting circuits to allow turning off unneeded lights
- ❖ Install a programmable or smart thermostat- to eliminate wasteful energy use from heating and cooling automatically turn off or reduce heating and cooling once the set temperature is achieved
- ❖ Clean or replace all filters regularly as dirty filters make your system work harder and run longer than necessary.

6.1.5 E-waste

E-waste can be described as consumer and business electronic equipment that is near or at the end of its useful life. Electronic-Waste majorly includes electronic equipment, completely or in part discarded as waste by the consumer or bulk consumer as well as rejects from manufacturing, refurbishment and repair processes. This makes up about 5% of all municipal solid waste worldwide but is much more hazardous than other waste because electronic components contain cadmium, lead, mercury, and Polychlorinated biphenyls (PCBs) that can damage human health and the environment. UPS, Computers and other appliances are recycled and exchanged while buying. E-Waste is sent back to the local vendors.

6.1.6 Recommendations

- ❖ Use reusable resources
- ❖ Ensure to follow Extended Producer Responsibility
- ❖ Ensure that e-waste generated is channelized through authorized producer or dismantler or recycler for treatment, dismantling and disposal
- ❖ Ensure that E-waste generated is not stored for a period not exceeding one hundred and eighty days
- ❖ Maintain a record of collection, sale, transfer and storage of wastes and make these records available for inspection
- ❖ Ensure that electrical and electronic equipment are not admixed with e-waste containing radioactive material
- ❖ University shall comply with the E-Waste Management Rules 2016 in all aspect.

- ❖ University shall ensure that no damage is caused to the environment during storage and transportation of the E-Waste
- ❖ The E-waste storage area shall have water proof roofing and impermeable surfaces
- ❖ The E-waste storage area shall have separate containers for storage of batteries, capacitors containing PCBs (Poly Chlorinated Biphenyls) or PCTs (Poly Chlorinated Terphenyls)

6.1.7 Biomedical Waste

Biomedical waste comprises human & animal anatomical waste, treatment apparatus like needles, syringes, and other materials used in health care facilities in the process of treatment and research. This waste is generated during diagnosis, treatment, or immunization in hospitals, nursing homes, pathological laboratories, blood banks, etc

These wastes are potentially hazardous, toxic and highly infectious because of their high potential for disease transmission and indiscriminate disposal of such waste poses health risk to human population, especially to health care personnel, sanitary workers. It is of at most importance that biomedical waste is managed in an environmentally sound manner which requires proper understanding of risk associated with the disposal of such waste and methods of proper segregation, storage handling, treatment and disposal.

6.1.8 Recommendations

- ❖ Phase-out the use of chlorinated plastic bags, gloves, and blood bags within two years (as per BMW Management Rules, 2016)
- ❖ Conduct more vaccination camps, blood donation camps, surgical camps, or any other healthcare activity possible.
- ❖ Pre-treatment of the laboratory waste, microbiological waste, blood samples, and blood bags through disinfection or sterilization on-site in the manner as prescribed by WHO or NACO needs to be done
- ❖ Treatment of liquid waste generated from health care facilities due to use of chemicals in production of biological and used or discarded disinfectants, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, housekeeping and disinfecting activities etc. shall be pretreated before mixing with other wastewater
- ❖ Provide training to all its health care workers and others, involved in handling of bio medical waste at the time of induction and thereafter at least once every year and the details of training programs conducted, number of personnel trained and number of personnel not undergone any

training shall be provided in the Annual Report

- ❖ Conduct Regular check up of Healthcare workers and immunize all its health care workers and others, involved in handling of bio-medical waste for protection against diseases including Hepatitis B and Tetanus that are likely to be transmitted by handling of bio-medical waste to be done

6.1.9 Waste

This indicator addresses waste production and disposal of different wastes like paper, food, plastic, biodegradable, construction, glass, dust etc and recycling. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Solid waste generation and management is a need of the hour issue. Unscientific handling of solid waste can create threats to everyone. The survey focused on volume, type and current management practice of solid waste generated in the campus. The different solid wastes collected as were broadly categorized into – Biodegradable, Non- Biodegradable, E Waste and Biomedical Waste

- ❖ Biodegradable – Paper, dried leaves, Vegetation garden, Woods except food waste. The average quantity of wastes generated 1123.84 m³/month.
- ❖ Biodegradable -food waste generated is given away to farm as pig feed. The average quantity of wastes generated 31500 kg/ month
- Non-biodegradable – Plastic bags, Wrappers-Major quantum is diverted to architecture department for sustainable building research.
- ❖ Biomedical Waste -.The average quantity of biomedical waste generated- 232.5kg/month.
- ❖ E-waste

General wastes are generated from the Garden, Mess, College, Hostel, Sweeping areas, Kitchen, Laboratories and Stores sections. E-Waste is generated from various Department/Schools especially electric and electronics department, Mechanical department, IT department, Administrative Building.

Biomedical Waste Biomedical Waste is generated from the Hospital located in Sathyabama University Campus and also from the Dental College inside the campus.

The source Segregation of the waste from the entry level at each stage was done. The Food waste generated at the Mess was given to the pig farms on a daily basis. The garden waste was collected by the sweepers on a daily basis and disposed. Bottles, plastic covers & Plastic

materials, cans, broken glass wares, tins etc., may be recycled or sold out. In each and every block also in each and every room in both the boys and girls hostel were provided with the bin. The campus verandah drums are located for the collection of waste. Large trolleys are operated by the each section for the collection of waste from their source.

Color coded dustbin are located in the general hospital and dental block for the disposal of biomedical waste. E -Waste are stored in separate rooms in every departments and given to the vendor at the end of the month

6.1.10 Recommendations

- ❖ Reduce the absolute amount of waste that is produced.
- ❖ Provide sufficient, accessible and well-publicized collection points for recyclable waste, with responsibility for recycling clearly allocated
- ❖ Installing Bio-methanation plant will lead to the gaining of renewable energy and waste reduction
- ❖ Install Composting plant to treat old leaves and other organic waste that can't be diverted to pig farm
- ❖ Try to achieve Zero Waste which refers to producing, consuming and recycling products without throwing anything away
- ❖ Installation of color coded bins across University campus too segregates Dry Waste, Wet Waste, and Non-Biodegradable waste.

6.1.11 Green Campus

This includes the plants, greenery and sustainability of the campus to ensure that the buildings conform to green standards This also helps in ensuring that the Environmental Policy is enacted, enforced and review during various environmental awareness programs.

- Total Area under green cover –33,705 sq m
- Marshy land area –5,120 sq m

The campus has numerous species of plants, trees and shrubs. Area demarcated for the establishment of a gardens of medicinal plants, paddy field and vegetable garden, the extent of which may be increased.

6.1.12 Suggestions

Indoor Gardening Details

Indoor plants are commonly used for their aesthetics benefits but they also have vital role

reducing airborne pollution. The right choice of plants can be an excellent way of improving indoor air quality and general health. Local landscape contractor can be contacted for supply and rotation of these plants.

Table 28 : List of Few Indoor Plants with their Benefits

Plants	VOC it removes	Indoor source of VOC's	Plant care
 Aloe Vera	Formaldehyde, Trichloroethylene and Benzene	Chemical based cleaners and paints	Easy to grow with enough sunlight
 Bamboo Plant	Formaldehyde, Trichloroethylene and Benzene	Paints, Plastics, Wood products etc.	Thrives under lowlight conditions as well as easy to maintain
 Chinese Evergreen	Benzene	Paints	Low maintenance plant that prefer slow light conditions.
 English Ivy	Formaldehyde, Benzene, Airborne fecal matter particles	Wood, Paper products, Airborne fecal –matter particles from pests	Easy to maintain

6.1.13 Recommendations

- ❖ Reviews periodically the list of trees planted in the garden, allot numbers to the trees and Keep records of these.

- ❖ Promote environmental awareness as a part of course work in various curricular areas, independent research projects, and community service.
- ❖ Create awareness of environmental sustainability and takes actions to ensure environmental sustainability.
- ❖ Ensure that an audit is conducted annually and action is taken on the basis of audit report, recommendation and findings.

6.1.14 Carbon Footprint

Feasible emission inventories are to be selected to analyze the Carbon foot print of the campus. The inventory survey is to be done for one academic year. The selected inventories are Human Factor, Transportation, Electricity, Solid Waste, Production and Consumption of Food, LPG, Natural Gas, Buildings.

Data keepers are identified and the primary details are collected. Parameter wise and zone wise details are collected. The received data are assembled and the missing gaps are recognized.

Carbon Footprint Analysis

Carbon footprint analysis can be done by suitably combining data collected with respective emission factor of the selected emission inventories. Table represents emission factors of the selected inventories.

S.No	Emission Inventory	CO₂Emitted
1	Human Factor	1.14kgper person per day
2	Petrol	2.3 kg per liter
3	Diesel	2.7kgper liter
4	Hydro Electricity	0.68956kgper kWh
5	Solar based Electricity	0.05kgper kWh
6	Solid Waste	0.125kgperkg
7	LPG	1.5kgperkg
8	Natural Gas	0.775kgperkg

The total carbon foot print of campus is determined, zone-wise and on the whole. Values are tabulated below as shown in Table.

Total CO₂ Emission from a College Campus

S.No	Emission Inventory	Total(Kg of CO ₂ /Month)	
		2019-2020	2020-2021
1	Human Factor	469.29	51.06
2	Transportation	28831.5	16661.328
3	Electricity	218115.3626	69478.8183
4	Solid Waste	252932.136	31390.716
5	Food	78750.00	8568.261
6	LPG	33088.23	5514.69
	TOTAL	612186.5186	131664.8733

Note: The entry of the values will be based on the emission inventories of various zones and the emission factor of each inventory.

It was noted that University uses battery powered vehicles to move inside the campus and blending of biodiesel with Conventional fuel is done while fuelling the buses.

6.1.15 Recommendation

The following effective measures can be suggested to reduce the present carbon foot print value in the next academic year.

- ❖ Use energy efficient fuels for transportation, especially in the case of college & school buses.
- ❖ Use vehicles adhering to emission norms.
- ❖ Purchase vehicles with competitive mileage & fuel efficiency.
- ❖ Encourage use of public transport facilities.
- ❖ Car pooling can be encouraged.
- ❖ Ensure proper inflation of vehicle tyres.
- ❖ Use of Bicycles can be encouraged.
- ❖ Encourage walking when it comes to short distances.
- ❖ Remove unnecessary weight from vehicles.

- ❖ Use un-leaded petrol in vehicles.
- ❖ Reduce use of petroleum products
- ❖ Use electricity effectively.
- ❖ Use the “OFF” switch, rather than the “STANDBY” mode.
- ❖ Switch off fans & lights when not in use.
- ❖ Use LEDs instead of conventional light sources.
- ❖ Check for Green Tags before purchasing goods.
- ❖ Air Conditioning should be minimally used.
- ❖ Keep equipments in power save mode.
- ❖ Use solar power.
- ❖ Make use of wind energy.
- ❖ Avoid wasting paper.
- ❖ Avoid burning of paper waste.
- ❖ Recycle waste if possible.
- ❖ Reuse resources whenever possible.
- ❖ Adopt proper waste management techniques
- ❖ Do not waste food items.
- ❖ Avoid wastage in kitchen.
- ❖ Use local and seasonal fruits & vegetables.
- ❖ Reduce use of non-vegetarian food.
- ❖ Encourage use of organic food
- ❖ Use LPG efficiently.
- ❖ Use of Biogas made from waste can be encouraged.
- ❖ Use natural Gas efficiently.

Analysis of the Carbon footprint is basically a fair evaluation of the Carbon dioxide potency in the region under study. This gave us an idea as to how contaminated our environment is. It also

provided us with the details regarding the amount up to which the inventories affect emission levels, helping us to know how and up to what extent each of our actions effect changes in the environment. This study is a sure shot that would help us realize and look back at each of our activities, and how exactly it have changed the very world we inhabit. The scope of such a study is very much relevant in the current scenario of rising CO₂ levels in our very own ecosystem.

The Carbon foot print is to be treated seriously as a quantitative yield of the quality of our very own surroundings. Necessary activity monitoring can be followed to contribute to the wellness of the planet in our own little ways. Awareness and Commitment can go a long way in keeping our environment clean. This study was undertaken with the sole motive to identify those factors that contribute to the excessive CO₂ emission, and to suggest measures that are to be put into practice for a cleaner, greener tomorrow.

LIST OF ECO- FRIENDLY ACTIVITIES GOING ON IN THE CAMPUS

- Planting and caring of trees in and around the campus
- Timely disposal of wastes from the campus
- Segregation of waste from its source in the each section of waste generation
- Restriction of Vehicle inside the campus enhancing reduction of carbon foot prints
- Use of battery operated Vehicles inside the campus
- Blending of Conventional fuel with biodiesel generated from Waste Cooking Oil
- Use of Solar and Wind Energy to reduce the use of Conventional power
- Use of Solar Lamps to light the Walkways
- Use of Solar power to Run the Kitchen
- Various plantation drives involving the students in the campus
- Treatment of waste water and reusing it
- Production of Eco Friendly soap from waste cooking oil
- Technology Development for conversion of food waste to organic pots
- Technology Development for Conversion of Organic Waste into Electricity
- Smart Compost development from solid waste

- Technology Development for Recycle of Ritual Waste Materials to Incense Sticks- An Eco-Friendly Approach for Rural Industrialization and Entrepreneurship Development
- Recycling of Paper Waste
- Diversion of Plastic Waste to architecture department for sustainable building research
- Diversion of Food Waste including vegetable/fruit peels, waste food to Pig farms as feed, which is one of most preferred form of disposal in food waste
- Generation of Biodiesel from Waste Cooking Oil to Run Biodiesel powered buses
- Technology Development for Generation of Bio diesel from Waste Cooking Oil to run the pump sets for farmers
- College is maintaining the Marshy Land in its natural form there by helping in Ground Water Recharge and even act as a habitat for the birds nearby.

ECO- CLUB ACTIVITIES GOING ON IN THE CAMPUS

1. ECO FARMING

- As a first step towards going green, the club developed an eco farm in the university campus, growing vegetables using organic fertilizers.
- Seeds of various crops like coriander, pulses, tomatoes, sour soup were planted by the club members.
- Farmers were felicitated during the official conduct of the function and certificates were given to students who had actively participated in farming.

2. EARTH HOUR 2014

- To ensure the support and encourage students, the management of Sathyabama University has organized an event-“EARTH HOUR-2014” on 29th March, 2014, in joint association with Youth Exnora International, Trailblazers and Velammal Institutions at Spencer Plaza and many students could participate in the event.
- The motive was to create awareness among the upcoming generation that electricity is being wasted and we all have the sole responsibility to conserve it.

3. AWARENESS ON PLASTIC POLLUTION

- Students prepared paper bags and distributed to various shops in Chollinganallur area.
- These bags were exchanged for plastic bags to create awareness on the detrimental effects of using plastic bags.

4. ECO MARKET

- Students made an eco market by making products out of recycled waste products.
- The club organized Eco quiz, Wealth out of waste (WOW) and Eco treasure hunt where students from various colleges participated and won prizes.

5. ECO WORKSHOP

- Eco club students conducted a workshop on 3rd September, 2014, on making useful things from waste pet bottles, paper, glass, cardboards, ice cream sticks etc.
- Students from neighboring colleges participated and got benefited from it.

6. AWARENESS PROGRAM AT Govt. HIGH SCHOOL, HASTINAPURAM

- Eco club conducted an awareness program and drawing competition at Government High School, Hastinapuram on 21st December, 2014 and distributed gifts to students' family.

7. MUSHROOM & LADIES FINGER CULTIVATION

- Students cultivated mushrooms in waste pet bottles during December, 2014 and January, 2015.
- Ladies finger was cultivated in the ladies hostel during February, 2015.

8. FEMFEST

- An initiative to encourage girls in bringing themselves out of the crowd, girl students were exclusively called upon to make value added and fashionable products from waste scraps, and those were shelved for sale.

9. EARTH HOUR 2015

- The Management of Sathyabama University in association with WWF Chennai and eco club members observed the Earth Hour on 28th March, 2015 at 8.30 pm in the university campus.

10. EARTH HOUR 2016

- The event was organized by the Eco Club students of the University. Director, Dr. Mariazeena Johnson, Col. Sanath Gopinath, Head of WWF Tamil Nadu State Office, Dr. Kanagavel, Additional Director of National Institute of Wind Energy, Ms. TiffianyBrar, Founder of Jyothirgamaya foundation, Mr. Patrick and Mr. Thankaraj, NGO coordinators were the delegates of the event.

11. ORGANIC FARMING

- Terrace garden was inaugurated at the Chemical Engineering Department on 5th April, 2016.

➤ In view of rising global warming and to reduce greenhouse gases along with an additional benefit of smart way of using available space, terrace gardening was done to encourage young minds.

➤ Seeds of various crops like green chillies, lady's finger, tomato and pumpkin were sown.

12. TERRACE GARDENING

➤ Eco club along with Rotaract club of Sathyabama University arranged for a 100sq.ft.terrace garden in Administration building, International Research Centre, ECE Block, CSE Block, 14th classroom Block, Biotechnology Department and Chemical Engineering Department.

➤ Directors of the institute sponsored and inaugurated the terrace gardens on 15th August, 2016.

13. V PHASE TERRACE GARDENING

➤ V phase of terrace gardening incorporated with 'PET-bottle-watering method' was done.

➤ A seminar on this also was conducted along with the gardening practices, during the month of January, 2018.

14. CAMPUS CLEANING

➤ During the month of February, 2018, the campus were cleaned by the active participation of students, staffs and the house keeping staffs of the institute, to remind that it is the duty of each citizen of the nation to maintain their surroundings neat and clean.

15. BIOMANURE PREPARATION

➤ With the coordination of staffs and students at the institute, students were demonstrated the scientific methodology in preparation of Bio Manure and organic pots were made stuffing this as the prime bed for sprouting seeds.

16. WORKSHOP ON VERMI COMPOSTING/CARBON CREDITS

➤ A workshop was conducted emphasizing the Vermi Composting practices, Carbon Credits and generating Wealth out of Waste (WOW).

17. SEED BALL WORKSHOP

➤ A one day workshop on seed balls, a permaculture technique for growing seeds in an easy and effective way was conducted.

➤ 145 students participated in the event and expressed their interest in making the university green and eco friendly.

6.2 Consolidation of Audit Findings

We hope that students will have developed a greater appreciation and understanding of the

impact of their actions on the environment. They have successfully been able to determine the impacts on the environment through the various auditing exercises. Participating in this Environmental auditing procedure they have gained knowledge about the need of sustainability of the college campus. It will create awareness on the use of the Earth's resources in their home, college, local community and beyond.

6.2.1 Water Audit

The Study observed that the source of water for the University is water from the tankers. Observations made are-

- There is no water consumption monitoring system like water meters in the college campus.
- The waste water from college, hostel, laboratories, canteen and kitchens are directly connected to the drains and there by reaching the STP
- The STP treated water is used for the gardening purposes
- Automatic switching system/alarm is not installed for pump sets used for over head tank filling
- Display boards against the misuse of water use are were not seen.

6.2.2 Energy Audit

- The Monthly use of electricity in the college is Medium
- University is promoting power generation from Renewable source of energy
- Regular monitoring of equipment and immediate rectification in case of any problems is been done.
- The communication process for awareness in relation to energy conservation is found
- Use of Solar Lamps to light the Walkways
- Use of Solar power to Run the Kitchen
- Blending of Conventional fuel with biodiesel generated from Waste Cooking Oil is done in the campus

6.2.3 Waste Audit

Source segregation of waste is done in each sector like gardening, sweeping, kitchen, bakeries, stores, college etc.

- The college has proper communication with the local body for regular collection of solid waste from the campus
- University is focusing on Implementation of sustainable projects like converting the waste cooking oil to energy, Operation of pump set using Biodiesel generated from Waste Cooking Oil etc
- Waste bins in the classrooms, veranda, canteen and campus are adequate
- E-Waste is properly handed over to the recycler
- Biomedical Waste is discarded with at most care with the use of colour coded bags
- Green chemistry labs are present

6.2.4 Green Campus Audit

- Tree cover of the college with respect to the stake holder strength is enough
- Regular planting of trees in the campus needs to be encouraged.
- Naming of all plants to be done.
- Various plantation drives involving the students in the campus
- College is maintaining the Marshy Land in its natural form there by helping in Ground Water Recharge and even act as a habitat for the birds nearby
- There is only very few fruit trees in the college to attract birds.

6.3 Follow Up Action and Plans

Environmental Audits are exercises which generate considerable quantities of valuable information. The time and effort and cost involved in this exercise is often considerable and in-order to be able to justify this expenditure, it is important to ensure that the findings and recommendations of the audit are considered at the correct level within the organization and that action plans and implementation programs result from the findings.

Audit follow up is part of the wider process of continuous improvement. Without follow-up,

the audit becomes an isolated event which soon becomes forgotten in the pressures of organizational priorities and the passing of time.

6.4 Environmental Education

The following environmental education program may be implemented in the college before the next Environmental auditing:-

- Training programs to be given in solid waste management, liquid waste management, water management and conservation, tree plantation drives, energy management, E-Waste management, Biomedical Waste Management, pollution monitoring methods, rainwater harvesting methods, artificial ground water recharge methods, Plastic Waste Management.
- Increase the number of display boards for awareness such as – save water, save electricity, now a stage of food/water, no smoking, switch off light and fan after use, plastic free campus etc.
- Paste More Brochure to create awareness about disposal of waste to color coded bags
- Increase the awareness about segregation of waste at source itself- dry waste, wet waste, non- biodegradable waste, hazardous waste.
- Encourage to reuse Electronic Products rather than discarding
- Encourage students to give the damaged electronic product to the manufacturer while buying new product
- Activate the environmental clubs
- Set up model rain water harvesting system, rain water pits, for providing proper training to the students- even encourage them to transfer this knowledge from lab to land thereby benefitting the local people.
- Conduct exhibition of recyclable waste products and demonstration how it can be reused.

7 CHAPTER

Audit Conclusion

The Environmental audit for Sathyabama University, Chennai, brings out the commitment on Environment with a greater notification by the management and teaching professionals and student community.

The University has done a great work in managing the E-waste, Biomedical Waste and converting the waste to energy. Sathyabama University with around 10,000 occupants has a huge cooking facility that generates on an average 750 litres of waste cooking oil on a weekly basis. The University is following Trans esterification of Waste Cooking Oil for the production of biodiesel which used for the operation of the University buses with 15% biodiesel blends.

The buses were reported to run smoothly with lesser emissions and noise and improved mileage on average of 5 to 7 km/L which was about 4 to 6 km/L with Diesel alone. The Biodiesel powered buses in the University has lead the team to test the Waste Cooking Oil Biodiesel for the agricultural pump sets to cater to the needs of farmers who are looking for an alternate to the costlier crude based fuel. This initiative was successful and the farmers could operate the pump sets with Biodiesel generated from Waste Cooking Oil.

The farmers reported that the pump sets gave a Good pickup with less noise during operation. This attempt will definitely pave way in providing a Sustainable, Eco friendly fuel to the farmers in Mittappalli village and promote them on the economic grounds and motivate them to contribute towards greener India.

The University has put in a great effort towards water conservation and management. The University is maintaining Marshy Land having an area of 5,120 sq m. This will help in Ground Water Recharge and help in maintaining the ground water table in the nearby areas. It also acts as a habitat for the aquatic birds and a source of drinking water to small animals and birds in the nearby area. This Marshy land also acts as a natural rain harvesting structure also.

The University is having own STP to which all the waste water is been sent. The water is been treated using Sequential Batch Reactor and the water is further reused for gardening and other purposes. There by decreasing the water foot prints of the University. The Storm water is also diverted to the unit so the proper reuse of rain water is happening.

The University has installed many Solar Panels and Wind mills and the power generated is used for lightning of the walkway and buildings. The University has Asia's largest kitchen run

using Solar Power. University is taking a great effort towards contributing to the INDC commitment made by GoI which is highly appreciable. The energy inventory and energy audit seemed to have energy conservation and determined contribution to the climate change utilizing limited energy usage and lamps.

The University has green cover of 34,133 sq.m and Marshy Land of 5,120 sq m area. This will help in absorption of pollutant and nullifying the GHG emitted in the campus. Seeing the green campus with different plant species itself is a motivation for the staff and the students the students to contribute further.

The University is using battery powered vehicles for moving inside the campus which helps in reducing the GHG which will be emitted if other conventional vehicles are used. Pedestrian pathways are also encouraged that will encourage students to walk preventing them to use vehicles for commuting.

The audit has show a significant effort put in by the University in Waste Management, Water Management and Conservation, in Maintaining a Green and Eco friendly Campus focusing on reduction in Carbon Foot Print and Water Footprint. This shows the institutions commitment towards for its environmental and social responsibility.

I would like to appreciate the team effort and the commitment by the management for such a great campus activity.

7.1 Marks Awarded for Each Zone.

7.1.1 Economic Use of Water in the College Campus



7.1.2 Overall Utilization of Water in the College Campus



7.1.3 Energy Utilization



7.1.4 Waste Utilization



7.1.5 Routine Green Practices



7.1.6 Carbon Foot Print in Campus



7.1.7 Sewage Treatment in College

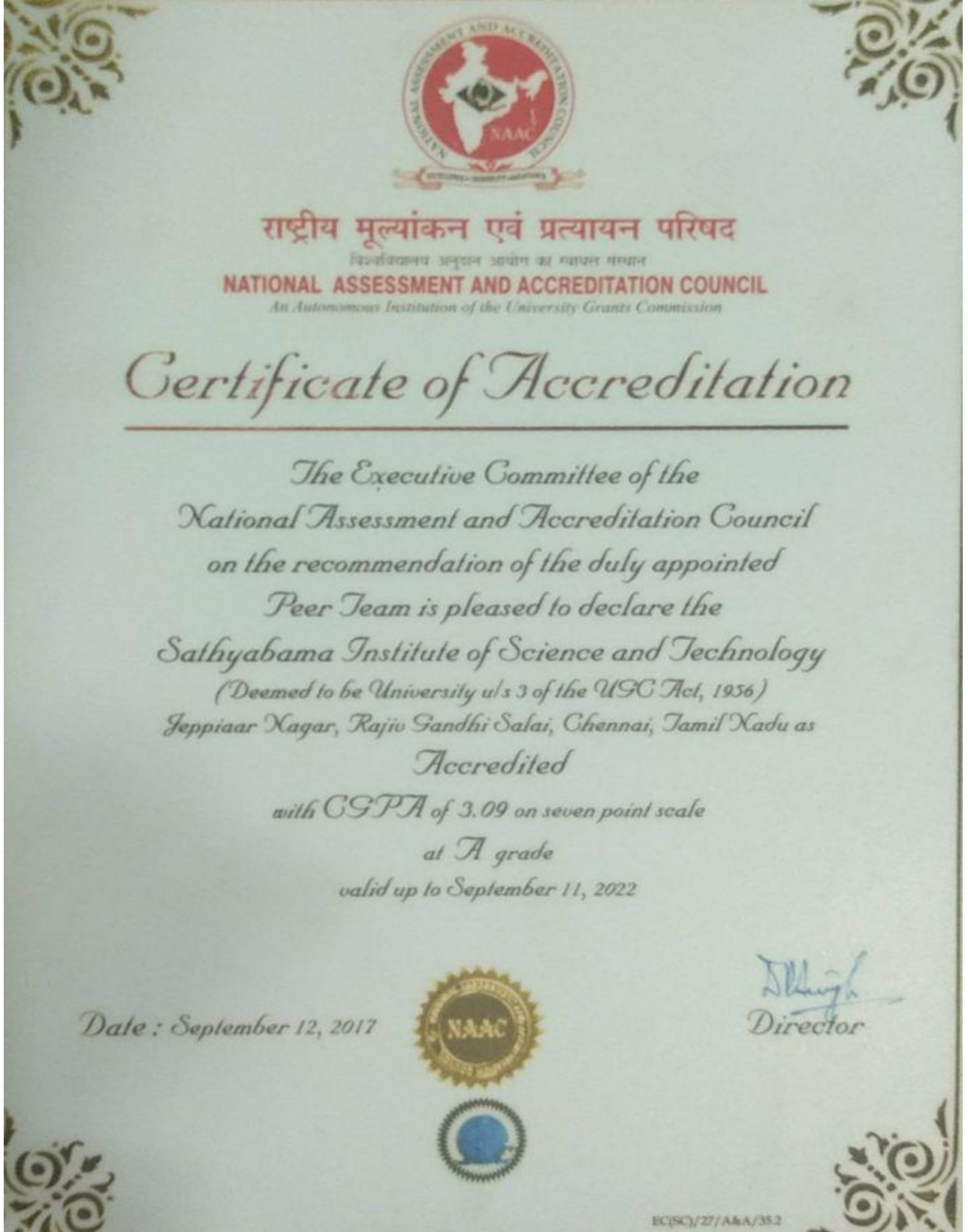


7.2 Overall Star value awarded based on Environmental audit is 4.6outof5.



8 ANNEXURE

8.1 Certification of Accreditation (National Assessment and Accreditation Council - NAAC)



8.2 National Board of Accreditation

NATIONAL BOARD OF ACCREDITATION

NBCC Place, East Tower, 4th Floor, Bhisham Pitamah Marg,
Pragati Vihar, New Delhi-110 003
Tel: +91 11 2436 0620-22, 2436 0654 ; Telefax: +91 11 4308 4903
Website: www.nbaiind.org



F.No- 33-105/2010-NBA

Date: 04-03-2020

To
The Vice Chancellor
Sathyabama Institute of Science and Technology,
Jeppiar Nagar, Rajiv Gandhi Salai,
Chennai- 600 119,
Tamil Nadu

Subject: Accreditation status of programs applied by Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai- 600 119, Tamil Nadu.

Sir,

This has reference to your application I.D. No. 3051-20/07/2018 seeking accreditation by National Board of Accreditation in Tier-I format to UG Engineering programs offered by Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai- 600 119, Tamil Nadu.

2. An Expert Team conducted on-site evaluation of the programs from 31st January to 2nd February, 2020. The report submitted by the Expert Team was considered by the concerned Committees constituted for the purpose in NBA. The competent authority in NBA has approved the following accreditation status to the programs as given in the table below:

Sl. No.	Name of the Program(s) (UG)	Basis of Evaluation	Accreditation Status	Period of validity	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Computer Science & Engineering	Tier-I	Accredited	Academic Years 2020-2021 to 2022-2023 i.e. upto 30-06-2023	Accreditation status granted is valid for the period indicated in Col.5 or till the program has the approval of the competent authority, whichever is earlier
2.	Electrical & Electronics Engineering		Accredited		
3.	Biotechnology		*Accredited		

*Observations made during the course of evaluation are indicated in annexure to this letter.

3. It may be noted that only students who graduate during the validity period of accreditation, will be deemed to have graduated with an NBA accredited degree.

4. The programs have been granted accreditation for 3 years. Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai- 600 119, Tamil Nadu should submit the Compliance Report at least six months before the expiry of validity of accreditation mentioned above to be eligible to be considered by the concerned Committee in NBA for further processing of the accreditation status. This could entail further extension of accreditation or a visit, as deemed appropriate by NBA Committees.

5. The accreditation status awarded to the programs as indicated in the above table does not imply that the accreditation has been granted to Sathyabama Institute of Science and Technology, Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai- 600 119, Tamil Nadu as a whole. As such the Institution should nowhere along with its name including on its letter head etc. write that it is accredited by NBA because it is program accreditation and not institution accreditation. If such an instance comes to NBA's notice, this will be viewed seriously. Complete name of the program(s) accredited, level of program(s) and the period of validity of accreditation, as well as the Academic Year from which the accreditation is effective should be mentioned unambiguously whenever and wherever it is required to indicate the status of accreditation by NBA.

Contd./...

8.3 All India Council for Technical Education (Approval Process 2020-21)

All India Council for Technical Education

(A Statutory body under Ministry of HRD, Govt. of India)
Nelson Mandela Marg, Vasant Kunj, New Delhi-110070 Website: www.aicte-india.org



APPROVAL PROCESS 2020-21

Extension of Approval (EoA)

F.No. Southern/1-7011188073/2020/EOA

Date: 15-Jun-2020

To,

The Principal Secretary
(Higher Education) Govt. of Tamil Nadu,
N. K. M. Bld. 8th Floor Secretariat,
Chennai-600009

Sub: Extension of Approval for the Academic Year 2020-21

Ref. Application of the Institution for Extension of Approval for the Academic Year 2020-21

Sir/Madam,

In terms of the provisions under the All India Council for Technical Education (Grant of Approvals for Technical Institutions) Regulations 2020 notified by the Council vide notification number F.No. AB/AICTE/REG/2020 dated 4th February 2020 and norms standards, procedures and conditions prescribed by the Council from time to time, I am directed to convey the approval to

Permanent Id	1-3872332485	Application Id	1-7011188073
Name of the Institute	SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY	Name of the Society/Trust	SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY TRUST
Institute Address	JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI, KANCHIPURAM, Tamil Nadu, 600119	Society/Trust Address	JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI, CHENNAI, KANCHIPURAM, Tamil Nadu, 600119
Institute Type	Deemed to be University(Pvt)	Region	Southern

To conduct following Courses with the Intake indicated below for the Academic Year 2020-21

Program	Level	Course	Affiliating Body (University /Body)	Intake Approved for 2019-20	Intake Approved for 2020-21	NRI Approval Status	PIO / FN / OOI / Approval Status
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	900	900	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND COMMUNICATION ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	600	600	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	120	60	Yes	Yes

Application No:1-7011188073

Note: This is a Computer generated Report. No signature is required.

Printed By : aicte10922

ALL INDIA COUNCIL FOR TECHNICAL EDUCATION

Page 1 of 6

Letter Printed On:18 June 2020

ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND INSTRUMENTATION ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	30	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	MECHANICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	300	300	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	AERONAUTICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	AUTOMOBILE ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	120	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CIVIL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	120	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CHEMICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	BIOTECHNOLOGY	Sathyabama Institute of Science and Technology, Chennai	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	BIOMEDICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	APPLIED ELECTRONICS	Sathyabama Institute of Science and Technology, Chennai	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER AIDED DESIGN	Sathyabama Institute of Science and Technology, Chennai	18	18	Yes	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	STRUCTURAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	24	24	Yes	Yes

ENGINEERING AND TECHNOLOGY	POST GRADUATE	MEDICAL INSTRUMENTATION	Sathyabama Institute of Science and Technology, Chennai	18	18	NA	Yes
ENGINEERING AND TECHNOLOGY	POST GRADUATE	BIOTECHNOLOGY	Sathyabama Institute of Science and Technology, Chennai	18	18	NA	Yes
MANAGEMENT	POST GRADUATE	MBA	Sathyabama Institute of Science and Technology, Chennai	300	300	NA	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND COMMUNICATION ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
ARCHITECTURE AND PLANNING	UNDER GRADUATE	ARCHITECTURE	Sathyabama Institute of Science and Technology, Chennai	120	120	NA	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRICAL AND ELECTRONICS ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CIVIL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	CHEMICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	30	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	MECHANICAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	180	60	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	INFORMATION TECHNOLOGY	Sathyabama Institute of Science and Technology, Chennai	120	120	NA	Yes
ARCHITECTURE AND PLANNING	POST GRADUATE	BUILDING MANAGEMENT	Sathyabama Institute of Science and Technology, Chennai	20	20	NA	NA
ENGINEERING AND TECHNOLOGY	POST GRADUATE	POWER ELECTRONICS AND INDUSTRIAL DRIVES	Sathyabama Institute of Science and Technology, Chennai	18	18	NA	NA

ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	MECHATRONICS	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	Yes
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	POST GRADUATE	EMBEDDED SYSTEMS AND IOT	Sathyabama Institute of Science and Technology, Chennai	18	18	NA	NA
ARCHITECTURE AND PLANNING	POST GRADUATE	SUSTAINABLE ARCHITECTURE	Sathyabama Institute of Science and Technology, Chennai	20	20	NA	NA
DESIGN	UNDER GRADUATE	DESIGN	Sathyabama Institute of Science and Technology, Chennai	30	30	NA	NA
PHARMACY	UNDER GRADUATE	PHARMACY	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
PHARMACY	DIPLOMA	PHARMACY	Sathyabama Institute of Science and Technology, Chennai	60	60	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN ARTIFICIAL INTELLIGENCE	Sathyabama Institute of Science and Technology, Chennai	0	60 ^{###}	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN DATA ANALYTICS	Sathyabama Institute of Science and Technology, Chennai	0	60 ^{###}	NA	NA
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	COMPUTER SCIENCE AND ENGINEERING WITH SPECIALIZATION IN INTERNET OF THINGS	Sathyabama Institute of Science and Technology, Chennai	0	60 ^{###}	NA	NA

Approved New Course(s)

\$\$ Course(s) should be offered in Emerging Area

Course(s) Applied for Closure by the Institute for the Academic Year 2020-21

Program	Level	Course	Affiliating Body (Univ/Body)	Course Closure Status
ENGINEERING AND TECHNOLOGY	UNDER GRADUATE	ELECTRONICS AND TELECOMMUNICATION ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	VLSI DESIGN	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER SCIENCE & ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	APPLIED ELECTRONICS	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	COMPUTER AIDED DESIGN	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	STRUCTURAL ENGINEERING	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	VLSI DESIGN	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	MEDICAL INSTRUMENTATION	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	BIOTECHNOLOGY	Sathyabama Institute of Science and Technology, Chennai	Approved
MANAGEMENT	POST GRADUATE	MBA	Sathyabama Institute of Science and Technology, Chennai	Approved
ENGINEERING AND TECHNOLOGY	POST GRADUATE	BIO PHARMACEUTICAL TECHNOLOGY	Sathyabama Institute of Science and Technology, Chennai	Approved

It is mandatory to comply with all the essential requirements as given in APH 2020-21 (Appendix 8)

Important Instructions

1. The State Government/ UT/ Directorate of Technical Education/ Directorate of Medical Education shall ensure that 10% of reservation for Economically Weaker Section (EWS) as per the reservation policy for admission, operational from the Academic year 2020-21 is implemented without affecting the reservation percentages of SC/ ST/ OBC/ General. However, this would not be applicable in the case of Minority Institutions referred to the Clause (1) of Article 30 of Constitution of India. Such Institution shall be permitted to increase in annual permitted strength over a maximum period of two years beginning with the Academic Year 2020-21
2. The Institution offering courses earlier in the Regular Shift, First Shift, Second Shift/Part Time now amalgamated as total intake shall have to fulfil all facilities such as Infrastructure, Faculty and other requirements as per the norms specified in the Approval Process Handbook 2020-21 for the Total Approved Intake. Further, the Institutions Deemed to be Universities/ Institutions having Accreditation/ Autonomy status shall have to maintain the Faculty: Student ratio as specified in the Approval Process Handbook. All such Institutions/ Universities shall have to create the necessary Faculty, Infrastructure and other facilities WITHIN 2 YEARS to fulfil the norms based on the Affidavit submitted to AICTE.
3. In case of any differences in content in this Computer generated Extension of Approval Letter, the content/Information as approved by the Executive Council / General Council as available on the record of AICTE shall be final and binding.
4. Strict compliance of Anti-Ragging Regulation: - Approval is subject to strict compliance of provisions made in AICTE Regulation notified vide F. No. 373/Legal/AICTE/2009 dated July 1, 2009 for Prevention and Prohibition of Ragging in Technical Institutions. In case Institution fails to take adequate steps to Prevent Ragging or fails to act in accordance with AICTE Regulation or fails to punish perpetrators or incidents of Ragging, it will be liable to take any action as defined under clause 9(4) of the said Regulation.

Prof.Rajive Kumar
Member Secretary, AICTE

Copy to:

1. The Director Of Technical Education**, Tamil Nadu
2. The Registrar**,
Sathyabama Institute Of Science And Technology, Chennai
3. The Principal / Director,
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY
Jeppiaar Nagar,
Rajiv Gandhi Salai,
Chennai,Kanchipuram,
Tamil Nadu,600119
4. The Secretary / Chairman,
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI
CHENNAI,KANCHIPURAM
Tamil Nadu,600119
5. The Regional Officer,
All India Council for Technical Education
Shastri Bhawan 26, Haddows Road
Chennai - 600 008, Tamil Nadu
6. Guard File(AICTE)

Note: Validity of the Course details may be verified at <http://www.aicte-india.org/>

** Individual Approval letter copy will not be communicated through Post/Email. However, consolidated list of Approved Institutions(bulk) will be shared through official Email Address to the concerned Authorities mentioned above.

8.4 Atal Ranking Of Institutions on Innovation Achievements



8.5 Bar Council of India

Grams : ALINDIABAR, New Delhi
E-mail : info@barcouncilofindia.org
Website : www.barcouncilofindia.org



Tel : (91) 011-4822 5000
Fax : (91) 011-4822 5011

भारतीय विधिज्ञ परिषद् BAR COUNCIL OF INDIA

(Statutory Body Constituted under the Advocates Act, 1961)

21, Rouse Avenue Institutional Area, New Delhi - 110 002

BCI: D: 593 /2018 (LE/Std. 11/12.5.2018)

05.06.2018

The Registrar,
Sathyabama Institute of Science and Technology,
Jeppiaar Nagar, Rajiv Gandhi Road,
Chennai - 600 119

Sub: Recognition to Sathyabama Institute of Science and Technology University, Jeppiaar Nagar, Chennai, Tamil Nadu and Fresh approval to its School of Law for imparting five year BA LL.B (Hons.) course, five year BBA LL.B (Hons.) course and five year B.Com LL.B(Hons.) course with intake of two sections of 60 students in each section in each course for a period of two years i.e. for the academic year 2018-2019 and 2019-2020.

Sir,

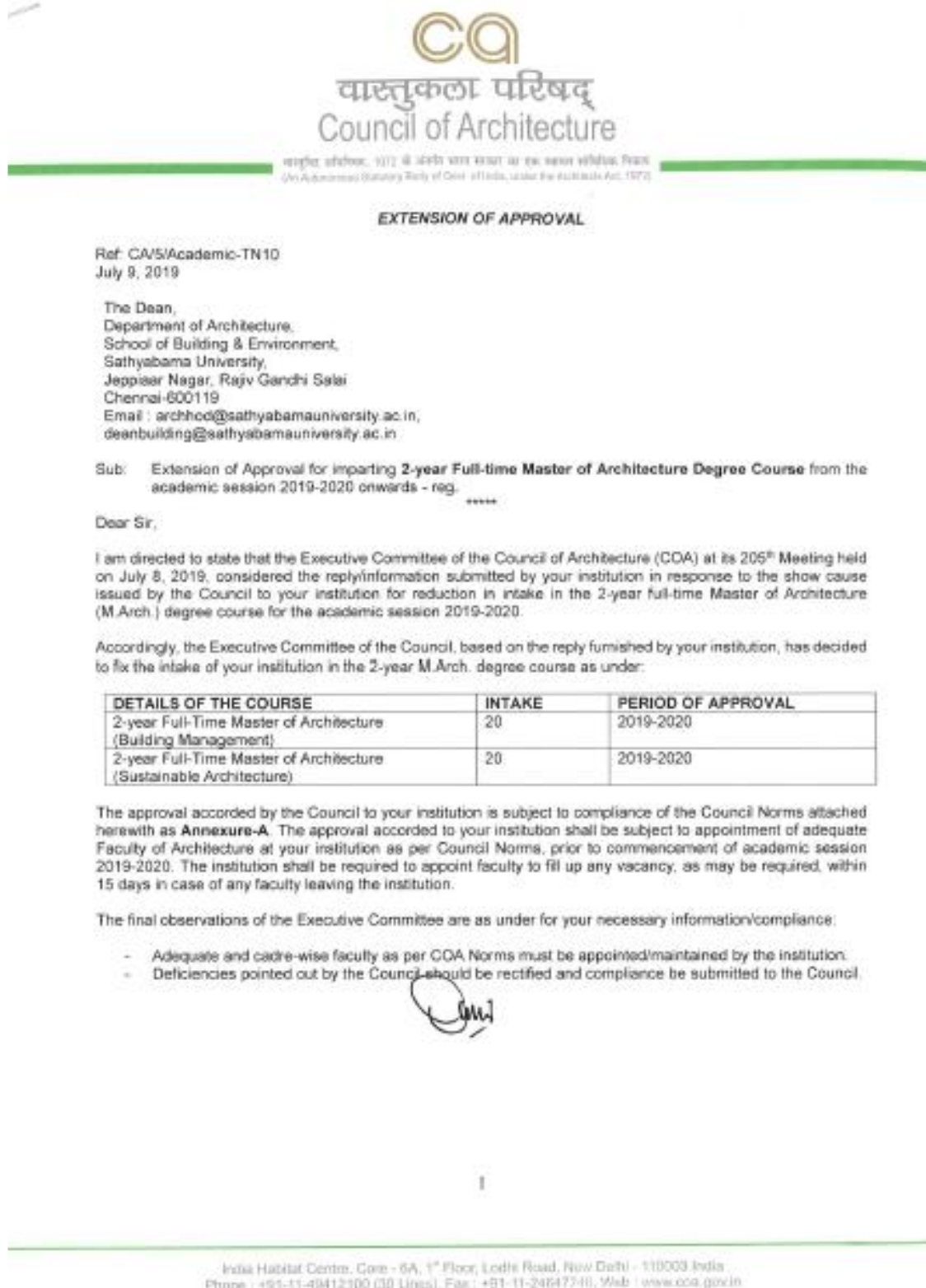
The Legal Education Committee of the Bar Council of India at its meeting held on 13th May, 2018 considered the inspection report of School of Law, Sathyabama Institute of Science and Technology University, Jeppiaar Nagar, Chennai, Tamil Nadu submitted by the inspection team. After consideration, Committee is of the view that as per Section 7 (1) (i) of the Advocates Act, 1961 Sathyabama Institute of Science and Technology University, Jeppiaar Nagar, Chennai, Tamil Nadu be granted recognition for the purpose of conferring the degrees of law for imparting five year BA LL.B(Hons.) course, five year BBA LL.B(Hons.) course and five year B.Com LL.B (Hons.) course from the academic year 2018-2019 and further fresh approval to its School of Law, Sathyabama Institute of Science and Technology University, Jeppiaar Nagar, Chennai, Tamil Nadu for imparting **five year BA LL.B (Hons.) course, five year BBA LL.B (Hons.) course and five year B.Com LL.B(Hons.) course with intake of two sections of 60 students in each section in each course for a period of two years i.e. for the academic year 2018-2019 and 2019-2020.**

Chennai
The Committee further finds that for running of three courses, the faculty members for law subjects are short. As per sanctioned strength, there are 5 law faculty members when it should be atleast 9. Thus, the University has to appoint four more law teachers after due selection as per rules within two months with intimation to the Bar Council of India within the same period.

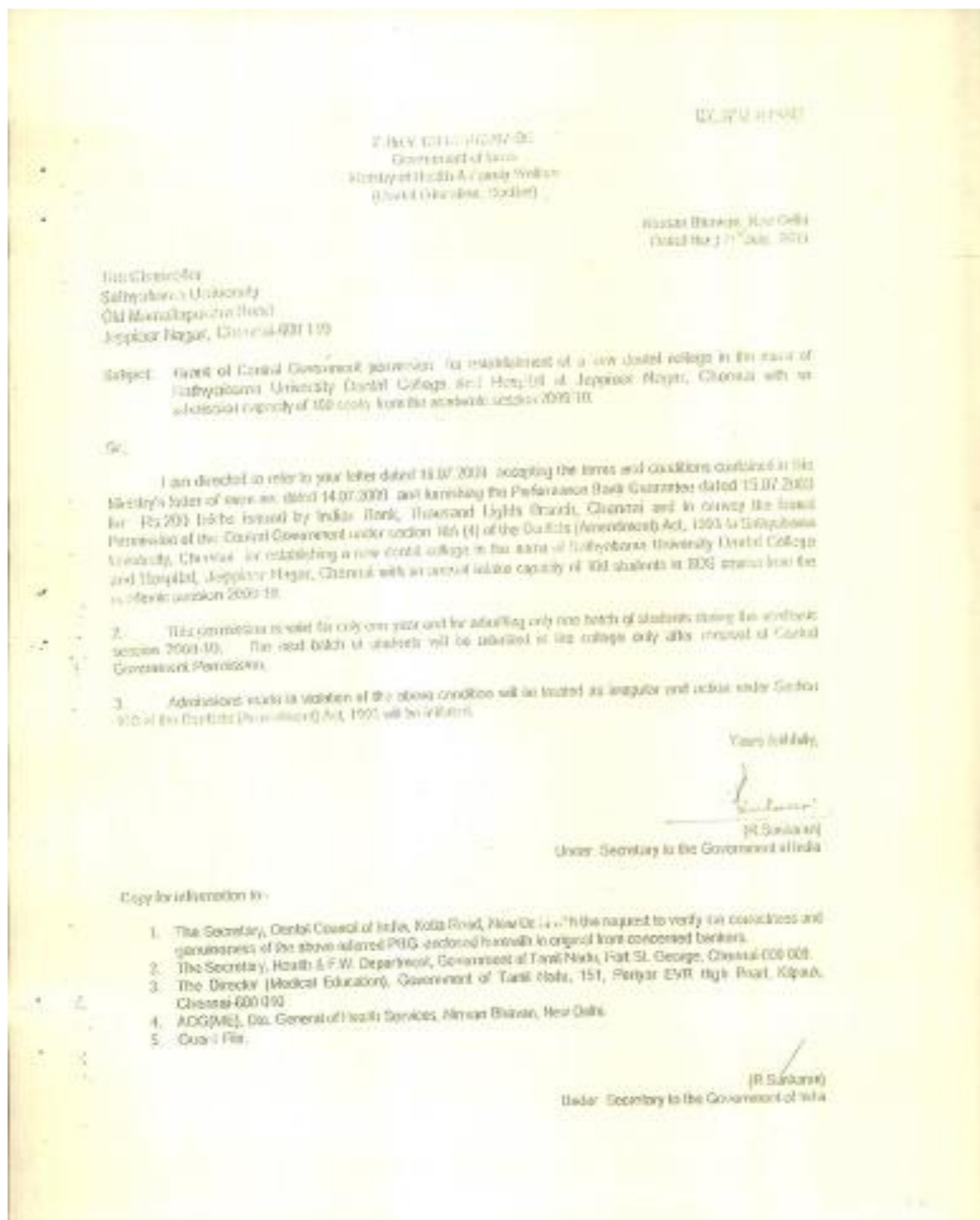
The Committee further finds so far five year BA LL.B(Hons.) integrated course, there are only one faculty member. There is shortage of two more faculty members for two more subjects in social science, which as per the rules has to be appointed. The University should appoint the same after due selection within a period of two months with intimation to the Bar Council of India within the same period.

Further, the faculty members are shown to be paid fixed salary which is against the rules. The faculty members are to be paid UGC scale. College is directed to file their reply within a period of six weeks.

8.6 Council of Architecture



8.7 Grant of Central Government Permission for Establishment of New Dental College (Sathyabama University Dental College and Hospital)



8.8 Renewal of Central Government Permission for MDs Course (Sathyabama University Dental College and Hospital)

BY SPEED POST

No.V.12017/8/2020-DE⁽⁵⁷⁾
GOVERNMENT OF INDIA
Ministry of Health and Family Welfare
(Dental Education Section)

Nirman Bhawan, New Delhi,
Dated the 16th February, 2021

To,
The Principal,
Sathyabama Dental College & Hospital,
Jeppiar Nagar, Rajiv Gandhi Road,
Chennai, Tamil Nadu – 600 119.

Subject: **Renewal of Central Government Permission for 4th Batch in MDS Course with original intake of seats at Sathyabama Dental College & Hospital, Chennai, Tamil Nadu for the academic year 2021-22 - reg.**

Sir,

I am directed to convey the permission of the Central Government for renewal of MDS Course (4th Batch) against original intake as indicated below in the following specialities at **Sathyabama Dental College & Hospital, Chennai, Tamil Nadu** for the academic year 2021-22.

4th Batch in MDS course renewal (Original intake)

SN	Speciality	Seats for which renewal sought for
1.	Conservative Dentistry and Endodontics	3
2.	Orthodontics & Dentofacial Orthopedics	2
3.	Paedodontics and Preventive Dentistry	2

2. The admission of next batch of students in MDS Course against original intake in the aforesaid specialities for the academic year 2022-23 shall be made only after grant of renewal permission/recognition of MDS Degree in the aforesaid specialities by the Central Government.

3. Any admissions made in violation of the above condition will be treated as irregular and action under the provisions of the Dentists Act, 1948 and Regulations made thereunder shall be taken.

Yours faithfully,


(Kumar Pranav)
Under Secretary to the Government of India
Tel.23061881

Copy forwarded for information & necessary action to:

1. Secretary, Dental Council of India, Kotla Road, New Delhi.
2. Secretary, Health & Family Welfare Department, Govt. of Tamil Nadu, Chennai.
3. The Registrar, Sathyabama University, Sathyabama Institute of Science & Technology, Japalar Nagar, Rajiv Gandhi Salai, Chennai - 119, Tamil Nadu.
4. Director (Medical Education), Government of Tamil Nadu, Chennai.
5. ADG (ME), Directorate General of Health Services, Nirman Bhavan, New Delhi.
6. Guard File.

8.9 Ministry of Human Resource Development

(TO BE PUBLISHED IN THE GAZETTE OF INDIA PART-I SECTION-1)

No.F.9-11/2001-U.3
Government of India
Ministry of Human Resource Development
Department of Secondary & Higher Education
Fax No.3381355, 3385278, 3382947
* * *

Shastri Bhawan, New Delhi.
July 16, 2001

NOTIFICATION

In exercise of the powers conferred by Section 3 of the University Grants Commission Act, 1956 (3 of 1956), the Central Government, on the advice of the University Grants Commission, hereby declares the Sathyabama Institute of Science and Technology, Chennai (formerly known as Sathyabama Engineering College, Chennai), Tamil Nadu as Deemed to be University for the purpose of the aforesaid Act with immediate effect.



(Champak Chatterji)
Joint Secretary to the Government of India

The Manager,
Government of India Press,
Faridabad (Haryana).

Copy forwarded for information to :-

1. The Secretary, University Grants Commission, New Delhi.
2. The Chairman, Sathyabama Institute of Science and Technology, Chennai (Tamil Nadu).

"The grant of Deemed to be University status to Sathyabama Institute of Science and Technology, Chennai (Tamil Nadu) is subject to the condition that it will adhere to the guidelines/instructions issued by UGC/AICTE from time to time as applicable to the Deemed Universities."

3. The Secretary, Department of Higher Education, Government of Tamil Nadu, Chennai.
4. Member Secretary, AICTE, I G Sports Complex, I P Estate, New Delhi.
5. All Ministries/Departments of the Government of India.
6. All State Governments and Union Territories.
7. Registrars of all Universities & Deemed Universities.
8. Press Information Bureau, Shastri Bhawan, New Delhi.
9. The Secretary-General, Association of Indian Universities, AIU House, 16 Kotla Marg, New Delhi 110 002.
10. All officers/sections in Department of Secondary & Higher Education.
11. Guard file/Coordination Assistant/Notification file.


(A K Chaturvedi)

Under Secretary to the Government of India

8.10 University Grants Permission

**UNIVERSITY GRANTS COMMISSION
BAHADUR SHAH ZAFAR MARG
NEW DELHI-110 001.**



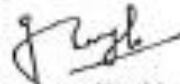
F. 6-5/2001 (CPP-1)

October, 2001

NOTIFICATION

15 NOV 2001

In exercise of the powers conferred by Section-3 of the University Grants Commission Act, 1956 (3 of 1956), the Central Government on the recommendation of the Commission vide its Notification No. F.9-11/2001-UG dated 16th July, 2001 has declared the Sathyabama Institute of Science and Technology, Chennai (formerly known as Sathyabama Engineering College, Chennai), Tamil Nadu as Deemed to be University for the purpose of the aforesaid Act with effect from 16th July, 2001.


(Gurcharan Singh)
Joint Secretary

Copy to:-

1. The Chairman, Sathyabama Institute of Science and Technology, Chennai (Tamil Nadu).
2. The Secretary, Government of India, Ministry of Human Resource Development, (Department of Secondary & Higher Education), Shastri Bhawan, New Delhi-110 001.
3. The Secretary, Department of Education, Government of Tamil Nadu, Chennai.
4. P.S. to Chairman, UGC, New Delhi.
5. The Joint Secretary, (NET) UGC, New Delhi.
6. Section Officer (Meetings Cell) with a request to include the name of the Institute in the list of Deemed to be Universities maintained by the Commission.
7. The Joint Secretary (DU), UGC, New Delhi.
8. Secretary-General, Association of Indian Universities, AIU House, 16, Kella Marg, New Delhi-110 002.
9. All Regional Offices of UGC.
10. Senior Statistical Officer, UGC, 35, Ferozshah Road, New Delhi.
11. Section Officer (FO-III Section), UGC, New Delhi.
12. Section Officer (DU Section), UGC, New Delhi.
13. All Sections in the UGC Office.
14. D.T.P. Cell, UGC, New Delhi.
15. Guard file.


(D.D. Mehta)
Under Secretary

8.11 Tamil Nadu Nurses and Midwives Council (B.Sc.,(N) Programme)

	TAMIL NADU NURSES AND MIDWIVES COUNCIL (Constituted Under Tamil Nadu Act III & XXVI of 1926 & 1960) Jeyaprahash Narayanan Malgai, Old No.148, New No.58, Sandhome High Road (Near Sandhome Church), Mylapore, Chennai – 600 094, Tel: 844-46706533. Web: www.tamilnadunursingcouncil.com E-mail: info@tamilnadunursingcouncil.com All communications to be addressed to the 'Registrar' and not by Name
Ref.No:933/NC/2019	30.08.19
To	
The Registrar, Sathyabama Institute of Science and Technology, (Deemed to be University), Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai – 600 119.	
Sir/Madam,	
Sub:Starting of B.Sc.,(N) Programme at Sathyabama College of Nursing, Chennai under Sathyabama Institute of Science and Technology, (Deemed to be University) -- Primary/Statutory inspection made on 13.08.19 — Grant of Provisional recognition by this Council for the academic year 2019-2020 with an annual intake of 60 students — Communicated – Reg.	
Ref: 1. G.O.(Ms)No.323 H&FW(PME-2) Department dated: 31.07.19 & G.O.(Ms)No.349 H&FW(PME-2) Department dated: 08.08.19 2. Your letter No.General/0010/2019 dated 31.07.19 along with application form dully filled in. 3. This Office Letter No.933/NC/2019 dated 01.08.19 4. Your Letter No.General/079/2019-2020 dated 02.08.19 5. This Office Letter No.933/NC/2019 dated 09.08.19 & 21.08.19 6. Your Letter No.General/176/2019-2020 dated 28.08.19 *****	
This has reference to your proposal which has been submitted by your institution to start B.Sc.,(N) programme for the academic year 2019-2020. Your institution was inspected on 13.08.19. After going through the report, comments of the inspectors, documents and compliance report submitted by the institution (vide ref.No:6), we are herewith communicating a copy of the resolution of the Council passed at its meeting held on 17.05.19 for information and necessary action.	
contd...2	

8.12 Pharmacy Council of India



PHARMACY COUNCIL OF INDIA

E-mail : registrar@pci.nic.in

Website : www.pci.nic.in

Contact : 011-61299900/01/02/03

NBCC Centre, 3rd Floor Plot No.2, Community Centre

Maa Anandamai Marg Okhla Phase I

NEW DELHI - 110020

DECISION LETTER

Institute Name / Inst ID : School Of Pharmacy Sathyabama University Rajiv Gandhi Salai Jeppiaar Nagar Chennai 600 119/PCI-1987

State : TAMIL NADU

District : KANCHIPURAM

Sub-District : Sholinganallur

Village/Town/City : CHENNAI

Pin Code : 600119



Sir / Madam

With reference to the subject cited above i am directed to convey the approval of PCI as per Following Details

Course	Name of Affiliation	Decision	Approval Status
B.Pharm	The Registrar Sathyabama University Chennai	Approval for conduct of 3rd year course for 2020-2021 for 60 intake (B.Pharm) Allowed 60 admission in 2020-2021 in 1st year (B.Pharm) course	Approved
D.Pharm	The Registrar Sathyabama University Chennai	Approval for us 12 from 2018-2019 to 2020-2021 for 60 D.Pharm	Approved

Date :10th April 2020

For
Archana

For Archana Mudgal
Registrar-cum-Secretary
PCI

Copy to:

- Registrar of the University
- Principal of the college
- Secretary/Chairman of the Trust/Society
- Guard File (PCI)

8.13 Rated for Excellence



Sathyabama Institute of Science and Technology (Deemed to be University)

The QS Intelligence Unit has, through rigorous and independent data collection and analysis of performance metrics as set out in the QS Stars™ methodology, rated Sathyabama Institute of Science and Technology (Deemed to be University) as a Four Star institution.



The QS Stars™ rating system is operated by the QS Intelligence Unit, the independent compiler of the QS World University Rankings® since 2004. The system evaluates universities across a wide range of important performance indicators as set against pre-established international standards. By covering a broader range of criteria than any world ranking exercise, QS Stars™ shines a light on both the excellence and the diversity of the rated institution.

CATEGORY	STAR RATING
Teaching	★★★★★
Employability	★★★★★
Research	★
Internationalisation	★★★★★
Facilities	★★★★★
Innovation	★★★★★
Sustainability	★★★★★
Program Strength Computer Engineering	★★★★★
Overall	★★★★★

Ben Sowter - Head of QS Intelligence Unit

QS Stars™ – © 2018 QS Intelligence Unit (a division of QS Company) Limited

QS INTELLIGENCEUNIT

8.14 Indian College & University Rating



• ③ → ④ → ⑤ → ⑥ → ⑦ •

Sathyabama Institute of Science & Technology

Cy-IRR India Pvt Ltd has, through rigorous and independent data collection and analysis against performance metrics as set out in the Cy-IR-GAUGE methodology, awarded Sathyabama Institute of Science & Technology with a Diamond University Status.

DIAMOND

Uga Hurdware is a custom-designed testing system for Indian universities and colleges. It provides Indian institutions with an opportunity to effectively benchmark their current performance in order to inform strategies for upgrading their educational services and all-around institutional performance.

CATEGORY RATING

Teaching and Learning	DIAMOND
Faculty Quality	GOLD
Employability	DIAMOND
Student University	DIAMOND
Facilities	DIAMOND
Social Responsibility	GOLD
Accreditation	DIAMOND
Entrepreneurship	DIAMOND
Research	DIAMOND

Schwarz

Ashwin Fernandes
CEO, Q5-ERA India Pvt Ltd

8.15 World University Ranking



Sathyabama Institute of Science and Technology

BREAKDOWN OF RANKING:

World University Rankings

2021 Rank: 1001+

View full ranking table

Overall

Teaching

Research

Citations

-

19.5

9.6

13.8

SELECT FROM ONE OF THE BELOW RANKINGS:

World University Rankings

Asia University Rankings

Young University Rankings

Engineering & technology

Physical sciences

Emerging Economies

116

8.16 Biomedical Waste Collection, Transportation , Treatment and Disposal Agreement with M/S G.J Multiclave (India) Pvt. Ltd.



2020

भारतीय गैर न्यायिक

बीस रुपये

रु.20

Rs.20

TWENTY RUPEES

INDIA NON JUDICIAL

2020

27 FEB 2020

TAMIL NADU

Multiclave (India) Pvt. Ltd.,
Old No. 20, New No. 37,
Teachers Colony, Kamarajar Avenue,
Adyar, Chennai-600 020.

73AB 773893

V.BEDHARAJAN
Stamp Vendor
L.No: 12144/B1/96
Ekkattuthangal, Ch-32.
Mobile No: 9710013475

AGREEMENT

FOR COLLECTION, TRANSPORTATION, TREATMENT AND DISPOSAL OF BIOMEDICAL WASTES

This Agreement made and entered into at Chennai on this 1st October 2020 BETWEEN
M/s. G. J MULTICLAVE (INDIA) PVT. LTD, incorporated under the Companies Act, 1956
having it's Registered Office at New No.37, Old No.20, Teachers Colony, Adyar, Chennai - 600
020 represented by its Manager, Mr.P.SIVAKUMAR, S/o. Sri.P.Pauldurai, hereinafter called
the **FIRST PARTY**.

AND

SATHYABAMA DENTAL COLLEGE & HOSPITAL, Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119, represented by its Chancellor, Dr.MARIA ZEENA JOHNSON, hereinafter
called the **SECOND PARTY**.

For GJ Multiclave (India) Pvt. Ltd.

P. Sivakumar
General Manager

Dr. MARIA ZEENA JOHNSON
CHANCELLOR
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119.

WHEREAS the **FIRST PARTY** has set up a Common Off-site Biomedical Waste Treatment Facility for Chennai in accordance with the standards prescribed in Biomedical Waste (Management & Handling) Rules, 2016 as amended to date for treatment and disposal of Biomedical Wastes generated by various Health Care Establishments in and around Chennai.

WHEREAS the **SECOND PARTY** is a Health Care Establishment, engaged in the service of providing various types of Health Care treatment facilities and generates Biomedical Wastes as defined under the Biomedical Waste (Management & Handling) Rules, 2016 in the course of such medical services to people.

WHEREAS the **SECOND PARTY** is enrolled with the **FIRST PARTY** for collection, transportation, treatment and final disposal by the **FIRST PARTY**, of such Biomedical Wastes generated in the **SECOND PARTY**'s Health Care Facility.

WHEREAS now the **SECOND PARTY** enters into an Agreement with the **FIRST PARTY** as per the following terms and conditions:-

1. The **SECOND PARTY** declares that its bed strength operational is 100 Beds.
2. The **SECOND PARTY** will segregate the Biomedical Wastes as per Schedule II of the Biomedical Waste (Management & Handling) Rules, 2016 at the point of generation in its Health Care Facility and store such segregated Medical Wastes in designated Colour Coded Containers/Bags prior to collection, transportation, treatment and final disposal by the **FIRST PARTY**.
3. The **SECOND PARTY** shall also label the Bio-Medical Waste consumable bags and containers with the service providers name with BAR CODE according to Schedule III of Biomedical Waste (Management & Handling) Rules, 2016.
4. The **FIRST PARTY** shall collect the Biomedical Wastes from **SECOND PARTY** everyday at a specified time to suit the convenience of collection mechanism of the **FIRST PARTY** and the **SECOND PARTY** shall render all assistance to the **FIRST PARTY** in this regard.
5. The **SECOND PARTY** agrees to pay a Service Charge of Rs.20000/- per month for the waste collected by the **FIRST PARTY**. In addition to the service charges, the **SECOND PARTY** has to pay any government taxes and levies as applicable on date to the **FIRST PARTY** for the services rendered by the **FIRST PARTY**.
6. Both the parties agree that the rate of service charges mentioned in Clause 5 above will be in force for a period of 1 year from the date of this agreement and thereafter the rate shall be revised by mutual consent after deliberations with Indian Medical Association Nursing Home Board.
7. Notwithstanding the above, the **SECOND PARTY** agrees to consider an increase in the rate if and when there is an increase in the fuel tariff by more than 20% over the prevailing rate. The prevailing rate now is Rs.77.49 per litre for diesel.
8. The **SECOND PARTY** has paid an amount of Rs.20000/- interest free advance for the service charges payable by it. Such advance amount shall not be adjusted against the recurring service charges payable by **SECOND PARTY** to the **FIRST PARTY** and shall remain intact during the period of the agreement.

For GJ Multiclave (India) Pvt. Ltd.


General Manager



Dr. M. SATHYABAMA
CHANCELLOR
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeppiaar Nagar, Rajiv Gandhi Salai,
Chennai - 600 119

9. The **FIRST PARTY** shall submit its bills towards Service Charges referred in Clause 5 above on a monthly basis to the **SECOND PARTY** at the end of each month and the **SECOND PARTY** shall pay the same before or on the 5th of the following month.

SECOND PARTY agrees to permit such authorised person/persons of the **FIRST PARTY** duly indicated in writing as and when the **FIRST PARTY** demands visual inspection of the segregated wastes stored in its premises before the same is collected by the **FIRST PARTY** from the said premises of the **SECOND PARTY**.

The **FIRST PARTY** agrees to provide Training on segregation of Biomedical Wastes to the **SECOND PARTY** Free of cost.

This agreement is subject to force majeure i.e. -

- i. war invasion, mobilization, requisition or embargo;
- ii. rebellion, revolution, insurrection or military or usurped power, or civil war;
- iii. Government orders restrictions, riots, fire, epidemics, sabotage, act of God like earthquake, floods, accidents, breakdown of machinery or any other reasons whatsoever beyond the reasonable control of **FIRST PARTY**.

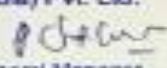
If any force majeure event outside the control of both parties arises during the currency of this agreement, which renders it impossible or unlawful for the **FIRST PARTY** to fulfil its agreement obligations, the **SECOND PARTY** shall not seek any remedy - legal or financial from the **FIRST PARTY**. However, the terms of this agreement shall be restored as far as both the parties are concerned, once the force majeure events cease to exist.

This Agreement shall be in force initially for valid upto **31st March 2022** and can be renewed thereafter for such period and on such terms and conditions as the parties mutually agree thereon.

If any dispute arises between the parties herein, or if any controversies or difference of opinion arises out of or in connection with the recitations of this agreement, the same shall be settled amicably. The jurisdiction shall be restricted to **CHENNAI ONLY**.

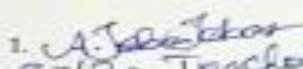
IN WITNESS WHEREOF the parties herein set out their hands on the day, date and place above written.

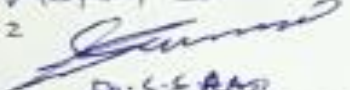
For GJ Multiclave (India) Pvt. Ltd.


General Manager

FIRST PARTY

WITNESSETH:

1. 
37/20, Teachers colony
Adyar, Chennai - 20

2. 
D. S. S. Rao
Flat 46, Road 5, Villa,
26, KARAIKAT ROAD I S,
COOGLAR KEDU, CH - 94


SECOND PARTY
Dr. NARAJEEVA JOHNSON B.E. MBA, MPH, PH.D.
CHANCELLOR
SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)
Jeeppur Nagar, Rajiv Gandhi Salai,
Chennai - 600 119

8.17 Biomedical Waste Collection Slip

HOSPITAL COPY

G.J. Multi Clave (India) Pvt. Ltd.,
New No.37, Old No.20, Teachers Colony, Kamarajar Avenue,
Adyar, Chennai - 600 020. Ph : 044 - 2445 1683

No. **46638** Veh.No. **5987**

Date : **16/10/2020** Time :

B.M.W. COLLECTION SLIP

1. HCE Name : **Sathiyabama.**

2. Collected By : **Anand**

3. Collected from :

a. Red : **6.000**

b. Yellow : **4.000**

c. White / Sharp Containers : **5.000**

d. Blue : **15.000**

4. Total Bags / Kg :

5. Waste Segregated : Yes ☒ No ☐

6. Barcoded Bags : Yes ☒ No ☐

7. Bags Sealed / Tied Properly : Yes ☒ No ☐

For GJM (I) P. Ltd.,

For HCE

8.18 Petroleum & Explosives Safety Organisation (PESO) Approval for Petrol Pump


Government of India
Ministry of Commerce & Industry
Petroleum & Explosives Safety Organisation (PESO)
No.140, Rukmini Laxmipati Road, Marshalls Road, Egmore,
Chennai - 600008

E-mail : jtccechennai@explosives.gov.in
Phone/Fax No : 044 - 28514848, 28514848

Dated : 08/10/2013

No. : P/SC/TN/14/5990 (P256236)

To,

✓ M/s. SATHYABAMA UNIVERSITY,
Jeppiaar Nagar,
Rajiv Gandhi Salai,
Chennai,
District: CHENNAI,
State: Tamil Nadu
PIN: 600119

Sub : Existing Petroleum Class A,B Retail Outlet at Plot No, Sy.NO.386/7, In the University campus-Old Mahabalipalipuram road, SHOLINGANALLUR, TIRUPORUR -taluk, District: KANCHIPURAM, State: Tamil Nadu, PIN: 999999 - Licence No. P/SC/TN/14/5990 (P256236) - Reg Renewal of Licence.

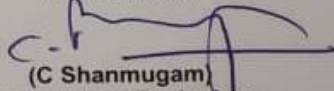
Sir(s),

Please refer to your letter No.: x, dated 01/10/2013

Licence No. P/SC/TN/14/5990 (P256236) dated 12/05/2011 is returned herewith duly renewed upto 31/12/2023.

Please follow the procedure strictly as laid down in rule 148 of the Petroleum Rules, 2002 and submit complete documents for the Renewal of the licence to **Jt. Chief Controller of Explosives, South Circle Office, Chennai**, so as to reach his office on or before 31/12/2023.

Please acknowledge the receipt.

Yours faithfully,

(C Shanmugam)
Controller of Explosives
For Jt. Chief Controller of Explosives
Chennai

(For more information regarding status, fees and other details please visit our website <http://peso.gov.in>)

<http://10.0.1.28/peso/licence/CustomizeLetterPrint.aspx>

10/8/2013

8.19 Fire License

TAMIL NADU FIRE & RESCUE SERVICE
FIRE LICENCE

Under Section 13 of the Tamil Nadu Fire Service Act No.40 of 1985 and with
Tamil Nadu Fire Service Rule 1990 Appendix – III

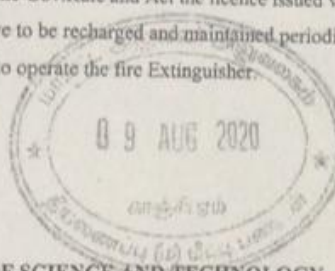
Licence No. ~~1666~~/2020
R.C.No.11125/B/2020
Date: 09/08/2020

Licence is hereby granted under section 13 of the Tamil Nadu Fire Service Act 1985 for
SATHYABAMA INSTITUTE OF SCIENCE & TECHNOLOGY within the Jurisdiction of
JAPPIAAR NAGAR Municipality/ Panchayat/ P.Union/ Township at the Name of Company M/s.
SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY, JEPPIAAR NAGAR,
RAJIV GANDHISALAI, OMR, CHENNAI – 600 119, THIRUPORUR TALUK,
KANCHEEPURAM DISTRICT subject to the conditions noted thereon and such other conditions as
may be prescribed. Inspected by Station Officer, Siruseri Sipcot, on 05/08/2019 and this Licence is valid
upto 08/08/2021.

CONDITIONS

As per 13 of Appendix V to the Rules under section 13 of the Act

1. As per National Building code of India 2016 Fire and Life Safety, Periodical maintenance and care should be taken to all fire production equipments with good working condition at all times and a register should be maintained.
2. The first aid fire fighting equipments should be maintained at all floors in accordance with the IS 2190:2010 requirements.
3. Staffs should be trained in preliminary fire fighting as per G.O.No.713 Home (Police-17), Dated:17.08.2005 with Fire and Rescue Services Department.
4. Fire drill should be conducted at least once in every six months with the local Fire and Rescue Service authorities and a permanent register should be maintained in part – I
5. This Licence is valid for one year from the date of issue.
6. The applicant will also get permission / No objection certificate from other department if necessary.
7. Regular Licence has to be obtained from competent authority.
8. If there is any deviation from the Gov.Rule and Act the licence issued will stand cancelled.
9. All the Fire Extinguishers have to be recharged and maintained periodically as per code practise in 2190/2010.
10. Advise to train the employee to operate the fire Extinguisher.



L. S. S. S. S.
DISTRICT OFFICER
FIRE & RESCUE SERVICES,
KANCHIPURAM

To:
M/s. SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY,
JEPPIAAR NAGAR, RAJIV GANDHI SALAI,
OMR, CHENNAI – 600 119,
THIRUPORUR TALUK,
KANCHEEPURAM DISTRICT

hi
9/8/2020

8.20 Electricity Bill (2021)

TamilNadu Generation and Distribution Corporation Ltd.

High Tension Bill (Provisional) for the Month of January 2021

TANGEDCO CIN No:U40109TN2008SGC073746

GST No:33AADCT4784E12C

HSN : 27160000

SAC : 996912

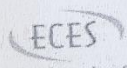
**** Electrical Energy & Distribution Services are exempted under GST ****

To:	SATHYABAMA INSTITUTE OF SCIENCE AND TECHNOLOGY		Service No.	099094011060		
	JEPPIAAR NAGAR,RAJIV GANDHI SALAI,OLD MAMALLAPURAM ROAD CHENNAI		Bill No.	H4011060012111		
	SHOLINGANALLUR - 2		Date of Bill	03-Feb-21		
	Sholinganallur		Due Date	09-Feb-21		
	Kancheepuram - 600119		Tariff App. / Bld.	HT IIB / HT IIB		
			GST No. :	111111111111111		
Permitted MD :		2500 KVA	Transformer Loss :	0units/0KVA	Tt. CAP.	0 KVA
DETAILS		RATE		CONSUMPTION	AMOUNT (Rs.)	
1. Industrial Consumption		6.35 per unit		69681	4,42,474.35	
2. Peak Hour Consumption		1.27 per unit		0	0.00	
3. Night Hour Consumption (5% Rebate)		0.3175 per unit		0 (-)	0.00(-)	
4. Quarters Consumption		0 per unit		0	0.00	
5. Commercial Consumption		8.05 per unit		24	120.00	
6. Temp. Supply Consumption		12 per unit		70	840.00	
7. Total Energy Charges					4,43,434.35	
8. Demand Charges		350 per KVA		2250	7,87,500.00	
9. Total Demand and Energy Charges					12,30,934.35	
ADD						
10. For Non-Availing the supply at the Required Voltage 11 KV at 0.10 Rs./unit						
11. Meter Rent(Including 9 %SGST&9 %CGST)					3,068.00	
12. Related Payment Surcharge for Govt service @0.5%						
13. Extra Levy for exceeding limits (Incl. 18% GST)						
a) Contracted Max. Dmd at		0 per KVA		0	0.00	
14. Compensation Charges for low PF					0.00	
15. Harmonics Compensation Charges (Incl. 18% GST)					0.00	
16. Cross Subsidy Surcharge (Incl. 18% GST)					0.00	
17. Electricity Tax					29,080.00	
18. Adjustment Charges(Affecting) (Incl. 18% GST)					0.00	
Rounding off					0.00	
19. Assessment Amount					12,63,082.00	
20. Adjustment Charges(Not Affecting) (Incl. 18% GST)					0.00	
21. SD Refund amount / ASD amount if any						
22. Self Generation Tax					0.00	
23. Self Generation Tax for Diesel Genset 0.10 /unit					0.00	
Net Total					12,63,082.00	
Less: Amount Deductible due to Court Case					0.00	
Less: Amount Deductible due to Advance CC					0.00	
Tax collected at source					12,631.00	
Net Amount Payable					12,75,713.00	
Rupees : Twelve Lakhs Seventy Five Thousand Seven Hundred and Thirteen Only						
Amount Payable after due date & upto		24-Feb-21		12,85,063.00		(i.e 15 days Notice Period)
If the last day of the due date happens to be a holiday, the due date shall be extended till the next working day.						
RTGS Payment should be made for the exact Bill Amount. Any Part/Excess/Short Amount will be rejected.						
This Bill is subject to the Audit, Outcome of the Court Cases, etc., if any, before the appropriate forum.						

E & OE

FOR DEPUTY FIN. CONTROLLER

8.21 Sewage Treatment Plant Test Report for Treated Sewage Sample (2019)


ECES
 Eco Care Engineering Systems

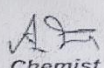
TEST REPORT

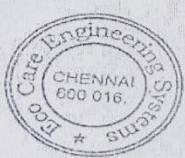
Report No	: ECES/LAB/2019-20/046	Report Date	: 27.11.2019
Sample Description	: Treated Sewage sample	Received on	: 22.11.2019
Sample Collected from	: M/s. Sathyabama Institute of Science and Technology Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 119		
Sample Drawn by	: M/s. Eco Care Engineering Systems	Commenced on	: 22.11.2019
		Completed on	: 27.11.2019

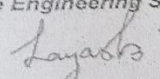
S.No	Test Parameters	Protocol	Results	TNPCB Tolerance Limit for Sewage
1.	pH at 25° C	IS:3025 Part: 11-1983 (Reaff:2012)	7.47	5.5 - 9.0
2.	Total Suspended Solids	IS:3025 Part 17-1984 (Reaff:2012)	10 mg/l	30 mg/l
3.	Total Dissolved Solids	IS:3025 Part 16-1984 (Reaff:2012)	1005 mg/l	—
4.	BOD @ 27° C for 3 days	IS:3025 Part 44-1993 (Reaff:2014)	13 mg/l	20 mg/l

Note: BDL: Below Detection Limit, DL: Detection Limit.

Note: This report relates only to the particular sample submitted for test. Any correction not attested shall invalidate this report. Retention period of tested sample is one month only. This report is strictly confidential. Its use for publicity, arbitration or as evidence in legal disputes is strictly forbidden.


 Chemist

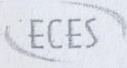


for Eco Care Engineering Systems

 Authorized Signatory

No.10/25, Egambara Dabedhar Street, Alandur, Chennai - 600 016. Tel : 044-22311125 Telefax : 044-22311125 E-mail : ecocare.cp@gmail.com

REDMI NOTE 9
 ALIQUOT CAMERA

8.22 Sewage Treatment Plant Test Report for Treated Sewage Sample (2020)


 Eco Care Engineering Systems

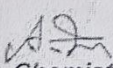
TEST REPORT

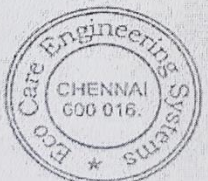
Report No	: ECES/LAB/2019-20/067	Report Date	: 27.01.2020
Sample Description	: Treated Sewage sample	Received on	: 23.01.2020
Sample Collected from	: M/s. Sathyabama Institute of Science and Technology Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 119		
Sample Drawn by	: M/s. Eco Care Engineering Systems	Commenced on	: 23.01.2020
		Completed on	: 27.01.2020

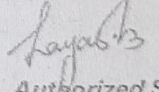
S.No	Test Parameters	Protocol	Results	TNPCB Tolerance Limit for Sewage
1.	pH at 25° C	IS:3025 Part: 11-1983 (Reaff:2012)	7.85	5.5 - 9.0
2.	Total Suspended Solids	IS:3025 Part 17-1984 (Reaff:2012)	17 mg/l	30 mg/l
3.	Total Dissolved Solids	IS:3025 Part 16-1984 (Reaff:2012)	1012 mg/l	--
4.	BOD @ 27° C for 3 days	IS:3025 Part 44-1993 (Reaff:2014)	11 mg/l	20 mg/l

Note: BDL: Below Detection Limit, DL: Detection Limit.

Note: This report relates only to the particular sample submitted for test. Any correction not attested shall invalidate this report. Retention period of tested sample is one month only. This report is strictly confidential. Its use for publicity, arbitration or as evidence in legal disputes is strictly forbidden.


Chemist



for Eco Care Engineering Systems

Authorized Signatory

No.10/25, Egambara Dabedhar Street, Alandur, Chennai - 600 016. Tel : 044-22311125 Telefax : 044-22311125 E-mail : ecocare.cp@gmail.com

PHOTOS OF TRESS AT SATHYABAMA UNIVERSITY CAMPUS



Australian babul plant – *Acacia auriculiformis*



Ashoka maram – *Saraca asoca*



Munkil – *Bambusoideae*



kagitha poo – *Bougainvillea*



Tamanu maram - *Calophyllum inophyllum*



Tennai maram - *Cocos nucifera*



mayilkondrai maram - *Delonix regia*



Koyya maram - *Psidium guajava*



Idly poo - *Ixora coccinea*



Jasmine/mullai – *Jasminum*



Kondrai maram - *Cassia fistula*



Elumiccai - *Citrus × limon*



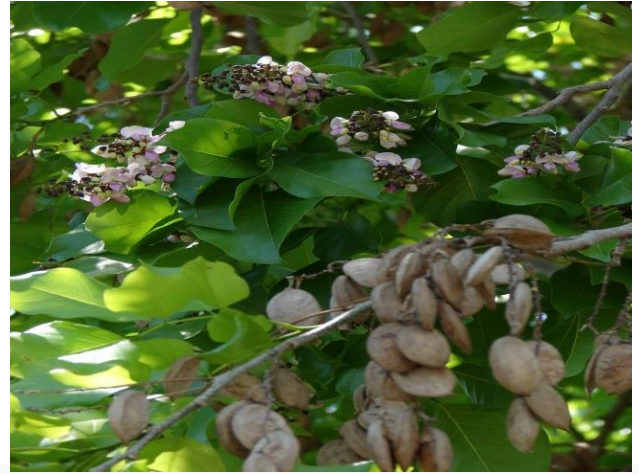
Mhaliyam maram - *Mimosa pudica*



Vepilam maram - *Azadirachta indica*



Badam maram - *Terminalia catappa*



Pungai maram - *Millettia pinnata*



Thoongu moonji maram - *Samanea saman*



sembaruthi - *Hibiscus rosa-sinensis*



Perunkondrai maram - *Pterocarpus pterocarpum*



Periya-takarai *Leucaena leucocephala*



Savukku maram - *Casuarina equisetifolia*