# GREEN AUDIT REPORT 2024

Periyar Nagar, Vallam, Thanjavur - 613 403, Tamilnadu, India


**Report Prepared By**

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**TO WHOM SO EVER IT MAY CONCERN**

This is certify that myself **Dr.M.Vivekanandan**, Certified Energy Auditor of Bureau of Energy Efficiency, India bearing the registration no. EA-19216, had reviewed Energy and Green audit at the Periyar Maniammai Institute of Science and Technology, Vallam, Thanjavur during March 2023 and recommendations to conserve energy is given in the report. I thank the management of Periyar Maniammai Institute of Science and Technology for providing me the opportunity, I also thank the team members of energy audit and green audit for rendering their support to the audit.

TryCAE Industrial Engineering Pvt. Ltd. TRICHY TAMILNADU

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**CONTENTS**

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# 1.0 INTRODUCTION

## 1.1 PERIYAR MANIAMMAI INSTITUTE OF SCIECNE AND TECHNOLOGY – A BRIEF PROFILE

Periyar Maniammai Institute of Science and Technology (PMIST) is situated at Thanjavur, the granary of South India in the state of Tamilnadu. It is celebrating the Silver Jubilee Year, (1988 – 2013) with 25 years of Yeoman Service in the field of education, especially for the underprivileged and women of the rural masses. It was started as an Engineering college exclusively for women, the First of its kind in the entire world, by the Rationalist and progressive futuristic philosopher Thanthai Periyar and his dedicated wife Annai Maniammai with the sole objective of breaking the shackle of suppression of the women to actively take part in education. With its sustained and successful achievements, it had blossomed into a Institute and the Ministry of Human Resources Development (MHRD) and the Institute Grants Commission (UGC) had accorded the status of Deemed Institute under Section 3 of the UGC Act of 1956.

## 1.2 ENVIRONMENTAL FRIENDLY TOPOGRAPHY AND ECO-FRIENDLY LOCATION

Periyar Maniammai Institute of Science and Technology spans a lush green campus of 216 acres, once a barren, dry laterite quarry. Over time, this land has been transformed into a vibrant hub of dense foliage, thriving vegetation, and cutting-edge technology. The campus is energy-efficient, pollution-free, zero-waste, and eco-friendly, reflecting its commitment to sustainability.Located just 10 km from Thanjavur and 45 km from Tiruchirappalli, the institute is well-connected by road, rail, and air. The main campus at Vallam boasts a built-up area of 84,450 square meters. Vallam itself is not only a prominent environmental landmark but also occupies a central geographical position in Tamil Nadu, adding to the institute's significance.

Periyar Maniammai Institute strives to achieve the twin factors of Environmental Protection and Environmental Management by

- Rainwater Harvesting
- Demonstration on practical technologies in the Rural areas and at selected field sites
- Training, capacity building and awareness on Solid Waste Management

- Creating and maintaining the Bio diversity of the campus
- Solid Waste Management through Biomethanisation
- Enhancing the Green cover for reducing Carbon emission and increasing nitrogen cycle
- Zero waste management campus keeping the philosophy of ―Waste from Wealth
- Energy conservation steps right from the planning, execution and ensuring them throughfrequent green audits
- Demonstrations and usage of Bio-compost, Vermicompost, Biofertilizer, Protected cultivation, Water harvesting, Cultivation of medicinal & aromatic plants, Bio fencing,Bio briquetting etc. have been set up in our campus.

### 1.3 GREEN AUDIT CONTEXT

The National Assessment and Accreditation Council, New Delhi (NAAC) has made it mandatory that all Higher Educational Institutions should submit an annual Green Audit Report. Moreover, it is part of Corporate Social Responsibility of the Higher Educational Institutions to ensure that they contribute towards the reduction of Environmental pollution and global warming through Carbon Footprint reduction measures.

In view of the NAAC circular regarding Green Auditing, the Management decided to conduct an external Green Evaluation by a competent Green Auditor along with a Green Audit Assessment Team headed by Dr.J.Santhosh, Director i/c, Centre for Energy & Environment & Dr.D.Thayalnayaki, Head, Department of Civil Engineering, Periyar Maniammai Institute of Science and Technology, Vallam, Thanajvur

Green Audit or Environment Audit focuses on the Water and wastewater Management, Solid waste Management, Carbon Footprint reduction measures being implemented by the Management.

The auditing was done for the period extending from 01/07/2023 to 31/06/2024.

## 1.4 GREEN AUDIT CONCEPT

The term 'Environmental audit' or 'Green audit' means differently to different people. Terms like 'assessment,' 'survey' and 'review' are also used to describe similar activities. Furthermore, some organizations believe that an 'environmental audit' addresses only environmental matters, whereas others use the term to mean an audit of health, safety, and environment-related matters. Although there is no universal definition of Green Audit, many leading companies/institutions follow the basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication of Environmental Auditing (1989). The ICC defines Environmental Auditing as:

*A management tool comprising a systematic, documented, periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aimof safeguarding the environment and natural resources in its operations/projects*.

In the present scenario organizations are facing numerous challenges, issues and risks Environmental changes, depletion of natural resources. A flexible, secure, dynamic infrastructure must be devised to help organizations to address critical energy and power costs. Perhaps the time has come when it becomes immensely essential to unearth that up to what extent an organization is contributing towards environmental sustainability by adoption of techniques like Green Audit.

The Green Auditing is the process of determining whether our operations and practices are following regulatory requirements, institutional policies and procedures, and accepted standards. It is a systematic objective evaluation of facility activities for a finite review period designed to:

- Verify compliance with environmental regulations, internal policies, and accepted practices.
- Evaluate the effectiveness of environmental "management systems" in place, and identify and assess any reasonably foreseeable risks associated with hazardous conditions attributable to our operations and prevent or mitigate such risks.

## 1.5 OBJECTIVES OF GREEN AUDITING

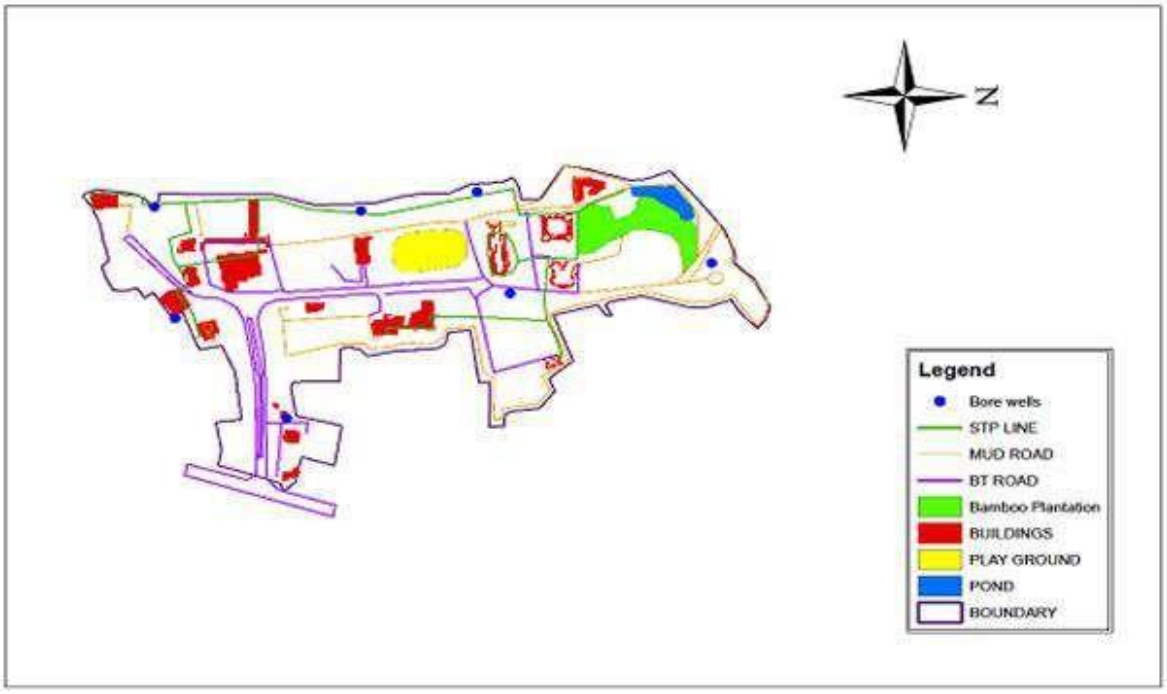
- To assess whether the measures implemented by PMIST have helped to reduce the Carbon Footprint.
- To assess whether investments made in increasing awareness among students regarding electricity, biodiversity and environment have helped the Institution achieve the required carbon dioxide emission and absorption in the campus.
- To assess whether non-academic activities of the Institution support the collection, recovery, reuse, and recycling of solid wastes that harm the environment.
- To identify gaps and suggest recommendations to improve the Green Campus status ofthe institution.

## 1.6 BENEFITS OF THE GREEN 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, solid- waste andwater recycling
- To create plastic free campus and evolve health consciousness among the stakeholders
- Recognize the cost saving methods through waste minimizing and managing
- Empower the organizations to frame a better environmental performance
- Financial savings through a reduction in resource use
- Development of ownership, personal and social responsibility for the institute and itsenvironment
- Green auditing should become a valuable tool in the management and monitoring of environmental and sustainable development programs of the institute.

## 1.7 TARGET AREAS OF GREEN AUDITING

Target areas included in this green auditing are water, energy, waste, green campus and carbon footprint.




*Layout map of Periyar Maniammai Institute of Science & Technology, Vallam*

Periyar Maniammai Institute of Science and Technology being one of the best green campuses in the city, responds to eco concerns with its ecofriendly initiatives. In our Institute, we have carried out energy audit and green audit in the areas of

1.0 Energy Conservation & Energy saving opportunities

2.0 Energy saving opportunities -Renewable Energy Devices

3.0 Water Quality and Conservation

4.0 Climate Change and Air Quality

5.0 Solid Waste Generation and Management

6.0 Alternating Building Materials

**2.0 Energy Conservation & Energy saving opportunities – A Separate report is prepared and submitted**

**3.0 Energy saving opportunities -Renewable Energy Devices**

**Bio-Mass Gasifier**

***200 kWe bio mass gasifier for power generation (100% producer gas mode)***
***Funded by MNRE, Govt. of India***

**200 kwe bio-mass gasifier**

| | |
|---|---|
| Usage | : For Power Requirement |
| Operational viability | : Attractive ROI and cost effective |
| Energy Savings | : 25,000units/month (` Rs.125000 / $2804.57) |
| Future Outlook | : Matches with conventional energy costs |

Tree branches and wood predominantly sourced from wastelands are utilized as feedstock. The selected wood is cut, dried, and processed for power generation, helping to mitigate environmental pollution. This sustainable approach meets 60% of the campus's electricity requirements through the use of a biomass gasifier.

**b) Thermal Gasifier**

The thermal mode gasifiers are used for hostel cooking

purpose.Usage : For cooking and heating

Operational viability : Attractive ROI

Energy Savings : 30-cylinder Month (Rs.37170/ $833.97)

Future Outlook : Matches with conventional energy cost

Cost : Rs.1, 50,000 (Approx)

***Biomass Thermal Gasifier 20kWe working at our Ladies Hostel]***

**c) Briquetting Unit**

Briquetting is the transformation of a powdery or granular product into a larger more convenient size. This is accomplished by compacting the product with a screw press sometimesin the presence of a binder material. A briquette is a block of flammable matter used as fuel tostart and maintain a fire. Rice husk, Sawdust and Coconut coir pith is used as feed materials. Collected materials are crushed into fine particles and dumped into the feed pit. From the pit the

material is raised through bucket elevator and fed into the heating chamber. Heating coils inside the chamber are heated up to a range of 350 ˚C to 400 ˚C. Hence the feed materials also get heated up to the coil temperature and at the same time pushed out by the screw. Pushed by the screw through the sleeve the feed material comes out as briquette in lengths.

***Briquetting machine***


***Briquettes***

**d) Biomethanisation Practice – Nodal Agency of MNRE, Govt. of India**

Periyar Maniammai Institute of Science and Technology is identified as the Nodal Agency by MNRE, Govt. of India for providing technical know-how and guidance for installing the bio-gas based power generation units in the institutions like SASTRA University, Thanjavur, Indian Express Esates, Annasalai, Chennai, Vellore Institute of Technology, Vellore, Karpaga Vinayaga College of Engineering and Technology, Chinnakalambakkam, Tamilnadu.

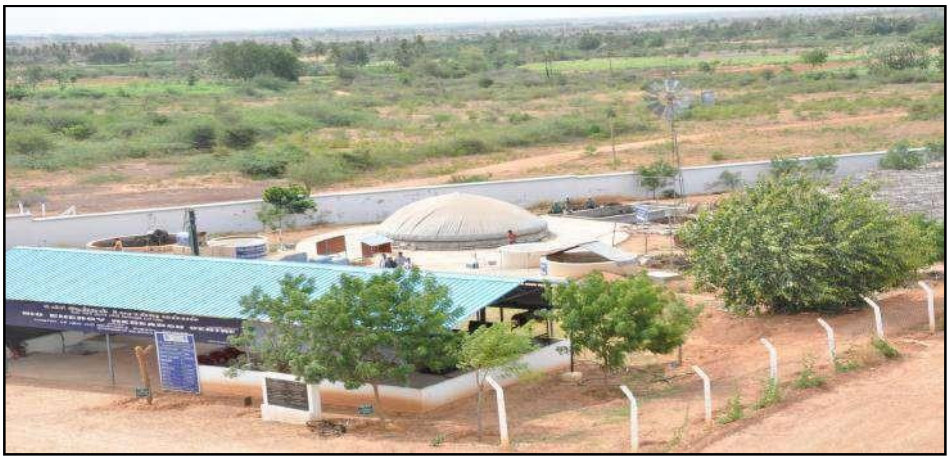
The Biomethanation plant at this institute is designed to process multiple feedstocks, including cattle dung, night soil, vegetable waste, and food waste. The digester has a gas production capacity of 500 cubic meters per day, sufficient to generate 60 kW of electricity. In addition to producing biogas, the plant generates digested material that serves as a high-quality soil conditioner.

The digester features a diameter of 16.2 meters and a height of 5.7 meters, with a daily feed requirement of 10 tons. Separate inlet units have been constructed to handle night soil, vegetable waste, and food waste.

Two inlet pipes are used to feed the digester—one exclusively for night soil and the other for other waste types. A single outlet pipe is provided to collect the digested effluent efficiently.

***60 KWe-500m$^3$ Biomethanisation plant inaugurated by former President of India, His Excellency Dr. A.P.J. Abdul Kalam on 27.7.2011***

Vegetable wastes and food wastes are pulverised using rasper and sent to mixing unit. Then it is allowed to the digester. Cattle dung is also mixed in the same mixing unit and sent to the digester. The hydraulic retention time for producing the gas in this digester is 42 days. The digester is provided with Tarpaulin hood for holding the gas. To prevent the formation of scum, a pump is provided for re circulating the wastes.



***An aerial view of the Biomethanisation plant. The gas production capacity of the plant is 500m$^3$/day. Utilizing this gas the power produced is 60 kwe / hr. The digested material is convertedinto nutrient rich soil conditioner through vermicomposting process.***

\

***Anaerobic Digester of Biomethanisation plant***

For generating power, Carbon di oxide and hydrogen sulphide gases are scrubbed off by providing a scrubber. The Scrubbed gas is stored in the Gas balloon and from there it is conveyed to the bio engine for power generation. Different sampling ports are provided for collecting the gas, influent and effluent samples for analysis purposes. Gas analyser, online pH indicator and Pressure Gauge are provided for monitoring the function of the digester. The following Research works are being carried out in this plant:

- Characterization of various solid wastes as input in this anaerobic digester
- Study of Suitable environmental factors which favours the anaerobic digestion.
- Lab scale study for optimization of the digestion using feed stocks

**e) Solar Power Utilization**

**Solar Panel**

**Solar Street Light**

**Solar Water Heater**

**Solar Cooker**

The unreliability of the rural electricity grid, made us decide to employ solar panels embedded in the arch for electricity generation. The arch hold the solar panels, oriented towards south-west, catering to the needs of the security cabins, entrance pathways and lights lighting the landscapes of Periyar Maniammai Institute of Science and Technology. Throughout the building proved to be a useful testing and teaming process for latest architectural technologies.It is a catalyst for further application of appropriate building, technologies in the interior and exterior constructions. And thus environmental sound solar energy trapping systems are maintained in the Periyar Maniammai Institute of Science and Technology campus.

Solar PV panels are installed at the hostels resulting in an annual savings of Rs.74,000/-. and also reduces 10 tonnes of $CO_2$ emission. Solar water heaters installed in the hostels saves electricity and an annual savings of Rs.1, 92, 000/- along with reduction of 198 tonnes of $CO_2$ emission.

This SOLAR CAMPUS RIDER is specially designed to ride inside the campus replacing bikes, cars and other vehicles which emits $CO_2$ leading to endangering Global warming. It is an electric rider which can be charged using both solar and electrical energy. It is cost effective.

Eco Challenger is solar powered battery-operated vehicle for differently abled people. This vehicle carries 120 kg, accelerates to about 25 kmphr and the mileage comes up to 45 km/ charge.

Solar Car Fabricated by our students Maruti 800 engine has remodeled by traction batteries and motors. Thus, by utilizing all the renewable energy resources, the wastes in our campus is minimized and the environmental pollution is avoided and the campus continues to flourish in a sustainable way.

**f) Paper Recycling Unit**

***Processes taking place in Paper recycling unit. Sources for the paper recycling unit are retrieved from our Institute and reinforcing materials (cotton waste) are added to strengthen the quality of the paper.***

Periyar TBI possess a Paper recycling unit called Periyar Paper Re-processing Unit. Sources for the paper recycling unit are retrieved from our Institute and reinforcing materials (cotton waste) are added to strengthen the quality of the paper. Two tonnes of paper/ year are produced by recycling because of this, 8.5 $m^3$ of wood pulp is saved as a part of our mission towards green initiatives, a paper recycling unit is functioning in the campus. All the paper waste generated in the campus is recycled in this unit and reused. In this way, 1.2 tonnes of recycled paper is produced per year and utilized for office purpose files, paper bags, packing materials etc. As per the available data, 500 tonnes of fresh paper equal 401 tonnes of carbon whereas recycled paper reduces the total carbon emissions by 329 tonnes of Carbon. In this way, *our green initiatives save 0.2 tonnes of carbon every year.* This unit is also serving as demonstration unit for an entrepreneur to establish recycle paper unit.

**g) Alternate Building Materials Research Unit**

Alternative building materials like hollow blocks, interlocking blocks, paver blocks are manufactured using innovative technologies to meet our own infrastructural requirements.


***Alternative Building material research unit - Building materials like hollow blocks, interlocking blocks and paver blocks are manufactured.***


Fly ash bricks reduce 7.2 tonnes of $CO2$ emission with less contribution to pollution**.**This technology has avoided deforestation and soil erosion due to which 36,337 tonnes of wood and 21,173 $m^3$ of fertile top soil are saved.

Cement less fly ash bricks are produced with same structural properties of conventional fly ash bricks that reduce 7.2 tonnes of $CO_2$ emission with less contribution to pollution.

## 4.0 WATER MANAGEMENT QUALITY AND CONSERVATION

### 4.1 Rainwater Harvesting (RWH):

Rainwater Harvesting (RWH) is the practice of collecting water from roof tops, paved or unpaved surface runoffs, storing and distributing rainwater to use it as an alternative source of water. Main advantages of RWH are that the resource is free and has very low contaminant level. For sustainable water resources development of the PMIST Campus,

rainwater harvesting and recycling of the domestic waste water are in addition to the utilization of ground water. The average annual rainfall, calculated from data collected for45 years, is 1314 mm (Vallam Town Panchayat meteorological Station). Quantity of the open area runoff for average rainfall is 88,010 cum. The quantity of roof rainwater 38,527 cum and the quantity of metaled road rainwater 5756 cum. The total quantity is 132,294 cum per annum.

The built-up areas in the main campus at Vallam are around 84,450 Sq.m. This campus is having 22,000 cum capacity percolation ponds to store rainwater and grey water, 10,000 cum capacity pond to store storm water and 1300 cum capacity open well to store rainwater.

**Contour Trench**

The Campus topography is so designed to have gentle slope contour terrain. By using the slope, created nearly 600 m length, 1m width and 1m depth contour trench at 60metre intervals of 6 Nos. of contour trenches. Since rainwater has been stored in this trench and there by ground water potential is in an enhanced condition.

### 4.2 Groundwater Resources

Ground water sources for the institute are only from the 7bore wells of depths vary from104 m to 162 m. Average pumping of water is around 100 cum per hour. Every day about 638 cum (2.32, 870 cum/year) of water is pumped out for domestic purpose. Water required for gardening purpose is 800 cum per day (2, 92,000 cum per annum). Total quantity of water required is 1438 cum per day (5, 24,870 cum per annum). But, only 55% of water is pumped out per day. To arrest the groundwater depletion due to pumping, it is practiced to recycle waste water to compensate the remaining requirements (45%).

### 4.4 Details of Over Head Water Tank & Sump

| Sl.No | Name of Building | Type of Tank | Capacity (lit.) |
|---|---|---|---|
| 1. | Periyar TBI | Over Head Tank (RCC) – 2 nos. | 20720 |
| 2. | Hospital | Sintex Tank | 1000 |
| 3. | TB -I | Over Head Tank (RCC) – 2 nos. | 65630 |
| 4. | | Sintex tank (RO) | 2000 |
| 5. | | Sump | 2230 |
| 6. | TB - II | Sintex tank (RO) – 2 nos. | 2000 |
| 7. | | Sump | 776970 |
| 8. | Education Block | Over Head Tank (RCC) | 22120 |
| 9. | | Sintex tank (RO) | 2000 |
| 10. | Chakaravarthy Hostel | Over Head Tank (RCC) – 3 Nos. | 72620 |
| 11. | | Sintex tank (RO) | 2000 |
| 12. | | Sump | 149320 |
| 13. | Millennium Cottage | Sintex tank (RO) | 500 |
| 14. | Cora Cottage | Sintex tank (RO) | 500 |
| 15. | Indoor Stadium | Over Head Tank (RCC) – 2 nos. | 17000 |
| 16. | PKC | Over Head Tank (RCC) | 24740 |
| 17. | | Sintex tank (RO) | 2000 |
| 18. | Nagammaiyar Hostel | Over Head Tank (RCC) – 2 nos. | 35000 |
| 19. | | Sintex tank (RO) | 2000 |
| 20. | | Sump | 104980 |
| 21. | Vittobai Hostel | Over Head Tank (RCC) – 2 Nos. | 39000 |
| 22. | | Sintex tank (RO) | 2000 |
| 23. | | Sump | 208190 |
| 24. | Sorna Renganathan Hostel | Over Head Tank (RCC) – 2 Nos. | 60000 |
| 25. | | Sintex tank (RO) | 1500 |
| 26. | Staff Quarters | Sintex Tank - 7 Nos. | 1000 |
| 27. | Bank | Sintex Tank | 1000 |
| 28. | Architecture | Sintex Tank | 5000 |
| 29. | Periyar TBI | Over Head Tank (RCC) | 5600 |
| 30. | Hospital | Over Head Tank (RCC) | 1000 |

| | | | |
|---|---|---|---|
| 31 | TB -I | Over Head Tank (RCC) | 20,000 |
| 32 | | Over Head Tank (RCC) | 20,000 |
| 33 | | Sintex tank (RO) | 2000 |
| | | Sump | 16000 |
| 34 | TB - II | Sintex tank (RO) | 1000 |
| 35 | Education Block | Over Head Tank (RCC) | 12600 |
| | | Sintex tank (RO) | 2000 |
| 36 | Chakaravarthy Hostel | Over Head Tank (RCC) – 3 Nos. | 12,000 |
| | | Sump | 16000 |
| 37 | Millennium Cottage | Sintex tank (RO) | 500 |
| 38 | Cora Cottage | Sintex tank (RO) | 500 |
| 39 | Indoor Stadium | Over Head Tank (RCC) | 2000 |
| 40 | PKC | Over Head Tank (RCC) | 22000 |
| | | Sintex tank (RO) | 2000 |
| 41 | Nagammaiyar Hostel | Over Head Tank (RCC) | 6000 |
| | | Sump | 12000 |
| | | Sump | |
| 42 | Vittobai Hostel | Over Head Tank (RCC) – 2 Nos. | 24,000 |
| | | Sintex tank (RO) | 2000 |
| 43 | Sorna Renganathan Hostel | Over Head Tank (RCC) – 2 Nos. | 30,000 |
| | | Sintex tank (RO) | 2000 |
| 44 | Staff Quarters | Sintex Tank - 8 Nos. | 1000 |
| 45 | Bank | Sintex Tank | 1000 |
| 46 | Architecture | Sintex Tank | 5000 |

### 4.5 Sump & Over Head Water Tank – Quantity Details

Tanks and Sumps Details with quantity at our Institute premises.

| | | | | |
|---|---|---|---|---|
| 1. | TB - I | 2-OHT | 65.63 $m^3$ | 65630 litres |
| 2. | TBI | 2-OHT | 20.72 $m^3$ | 20720 litres |
| 3. | Hospital | Sintex | 0.25$m^3$ | 250 litres |
| 4. | Architecture | OHT | 22.12$m^3$ | 22120 litres |
| 5. | Chakkaravarthy Hostel | OHT-3 | 72.62$m^3$ | 72620 litres |
| | | Sintex | 10$m^3$ | 10000 litres |
| 6. | Knowledge Centre | OHT | 24.74$m^3$ | 24740 litres |
| 7. | PKC -E | Sintex | 5$m^3$ | 5000 litres |
| 8. | Indoor stadium | OHT (O) -2 | 17$m^3$ | 17000 litres |
| 9. | Nagammaiyar Hostel | OHT-2 | 35$m^3$ | 35000 litres |
| 10. | Vittobai Hostel | OHT-2 | 39$m^3$ | 39000 litres |
| | | TOTAL | 312.03$m^3$ | **3,12,080 litres** |

### 4.6 SUMP Details:

| | | | |
|---|---|---|---|
| 1. | Chemistry Lab | 22.23 $m^3$ | 22230 litres |
| 2. | TB - I | 776.97 $m^3$ | 776970 litres |
| 3. | B.Ed. block | 20.7$m^3$ | 20700 litres |
| 4. | Chakkaravarthy Hostel | 149.32$m^3$ | 149320 litres |
| 5. | Nagammaiyar Hostel | 104.98$m^3$ | 104980 litres |
| 6. | Vittobai Hostel | 208.19$m^3$ | 208190 litres |
| | | Total | **12,82,390 litres** |

## 4.8: WATER QUALITY ANALYSIS

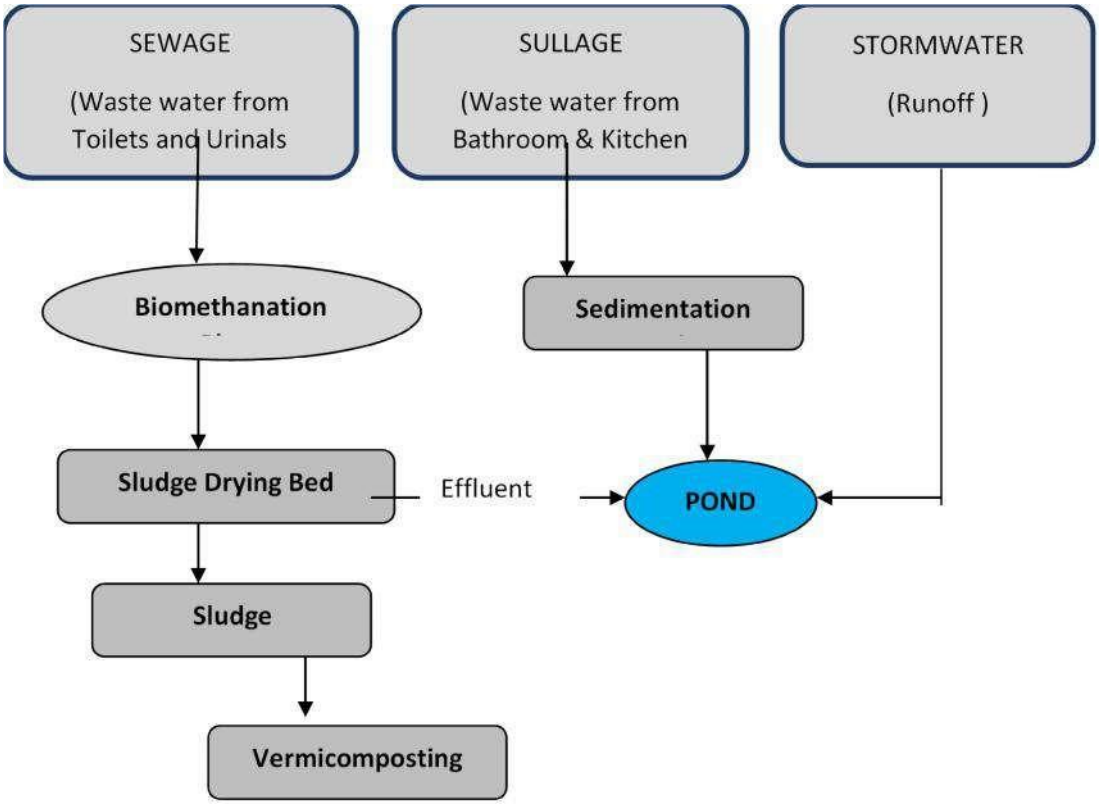
| Parameters | As per BIS 10500-2012 Limits for Drinking water Standards | July 2023 | Aug 2023 | Sep 2023 | Oct 2023 | Nov 2023 | Dec 2023 |
|---|---|---|---|---|---|---|---|
| **pH** | 6.5-8.5 | 6.59 | 6.59 | 6.59 | 6.59 | 6.59 | 6.59 |
| **Turbidity** (NTU) | 1 – 5 | 2.5 | 2 | 2 | 2.5 | 2 | 2.5 |
| **Total Dissolved Solids** (mg/l) | 500-2000 | 290 | 278 | 282 | 286 | 290 | 285 |
| **Total Alkalinity as $CaCO_3$** (mg/l) | 200-600 | 90 | 95 | 88 | 92 | 97 | 94 |
| **Total Hardness as $CaCO_3$** (mg/l) | 200-600 | 110 | 122 | 136 | 128 | 114 | 121 |
| **Sulphate ($SO_4$)** (mg/l) | 200-400 | 72 | 78 | 62 | 68 | 79 | 84 |
| **Chloride ($Cl_2$)** (mg/l) | 250-1000 | 174 | 178 | 192 | 175 | 168 | 165 |
| **Iron** (mg/l) | Not to exceed 0.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fluoride** (mg/l) | 1 – 1.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

| Parameters | As per BIS 10500-2012 Limits for Drinking water Standards | Jan 2024 | Feb 2024 | March 2024 | April 2024 | May 2024 | June 2024 |
|---|---|---|---|---|---|---|---|
| **pH** | 6.5-8.5 | 6.67 | 6.65 | 6.72 | 6.66 | 6.89 | 6.82 |
| **Turbidity** (NTU) | 1 – 5 | 2 | 2.5 | 2 | 1.5 | 1 | 1 |
| **Total Dissolved Solids** (mg/l) | 500-2000 | 287 | 264 | 282 | 284 | 289 | 282 |
| **Total Alkalinity as $CaCO_3$** (mg/l) | 200-600 | 92 | 89 | 94 | 95 | 98 | 91 |
| **Total Hardness as $CaCO_3$** (mg/l) | 200-600 | 114 | 124 | 134 | 138 | 127 | 132 |
| **Sulphate ($SO_4$)** (mg/l) | 200-400 | 82 | 88 | 72 | 78 | 87 | 91 |
| **Chloride ($Cl_2$)** (mg/l) | 250-1000 | 182 | 188 | 192 | 187 | 194 | 185 |
| **Iron** (mg/l) | Not to exceed 0.3 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Fluoride** (mg/l) | 1 – 1.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |

## 05. WASTEWATER MANAGEMENT

This campus is having 22,000 cum capacity percolation ponds to store rainwater and grey water, 10,000 cum capacity pond to store storm water and 1300 cum capacity open well to store rainwater.

The existing wastewater system in the institute is as shown below



### 5.1 Details of Toilet Facilities

| Sl.No. | Description | Floor | No. of Rooms | No. of Toilets | Total |
|---|---|---|---|---|---|
| 1. | Vittobai Hostel | Ground | 24 | 24 | **108** |
| | | First | 28 | 28 | |
| | | Second | 28 | 28 | |
| | | Third | 28 | 28 | |
| 2. | Sorna Renganathan Hostel | Ground | 16 | 16 | **126** |
| | | First | 26 | 52 | |
| | | Second | 26 | 52 | |
| | | Third | 11 | 22 | |
| 3. | Nagammiyar Hostel | Ground | 63 | 65 | **191** |
| | | First | 63 | 63 | |
| | | Second | 63 | 63 | |
| 4. | Chakkaravarthy Hostel | Ground | 37 | 24 | **166** |
| | | First | 37 | 27 | |
| | | Second | 37 | 27 | |
| | | Third | 37 | 27 | |
| | | Fourth | 37 | 27 | |
| | | Staff Room & Guest House | 17 | 34 | |
| 5. | Technology Block- I | | | 48 | **48** |
| 6. | Technology Block -II | | | 37 | **37** |
| 7. | Architecture Block | | | 24 | **24** |
| 8. | Education Block | | | 10 | **10** |
| 9. | Canteen | | | 10 | **10** |
| 10. | PKC | | | 83 | **83** |
| 11. | Indoor Stadium | | | 6 | **6** |
| 12. | Periyar TBI | | | 32 | **32** |
| | | | | **Total** | **841** |

Grey water is the domestic wastewater from bathrooms (bathing, Cloth washing) and Kitchens (Utensils washing). With minimum treatment, grey water can be recovered and used for applications such as toilet flushing, gardening and floor washing). Institute population is around 2300 numbers and water usage 130 cum per day. The waste water generated from our population is about 96.4 cum per day (35186 cu.m/year). The waste water (Grey water) is collected from all buildings through 150 mm diameter well laid conduits of PVC pipe. The total length of pipe line is 3258 m. Moreover, in order to collect storm water, 950m length open channel is provided. This grey water and storm water is allowed to sedimentation tank to remove settleable solids and it is collected in the 20,000 cum capacity percolation pond. This water will be pumped and used for watering to the entire campus plantations such as bamboo, coconut and lawns etc.

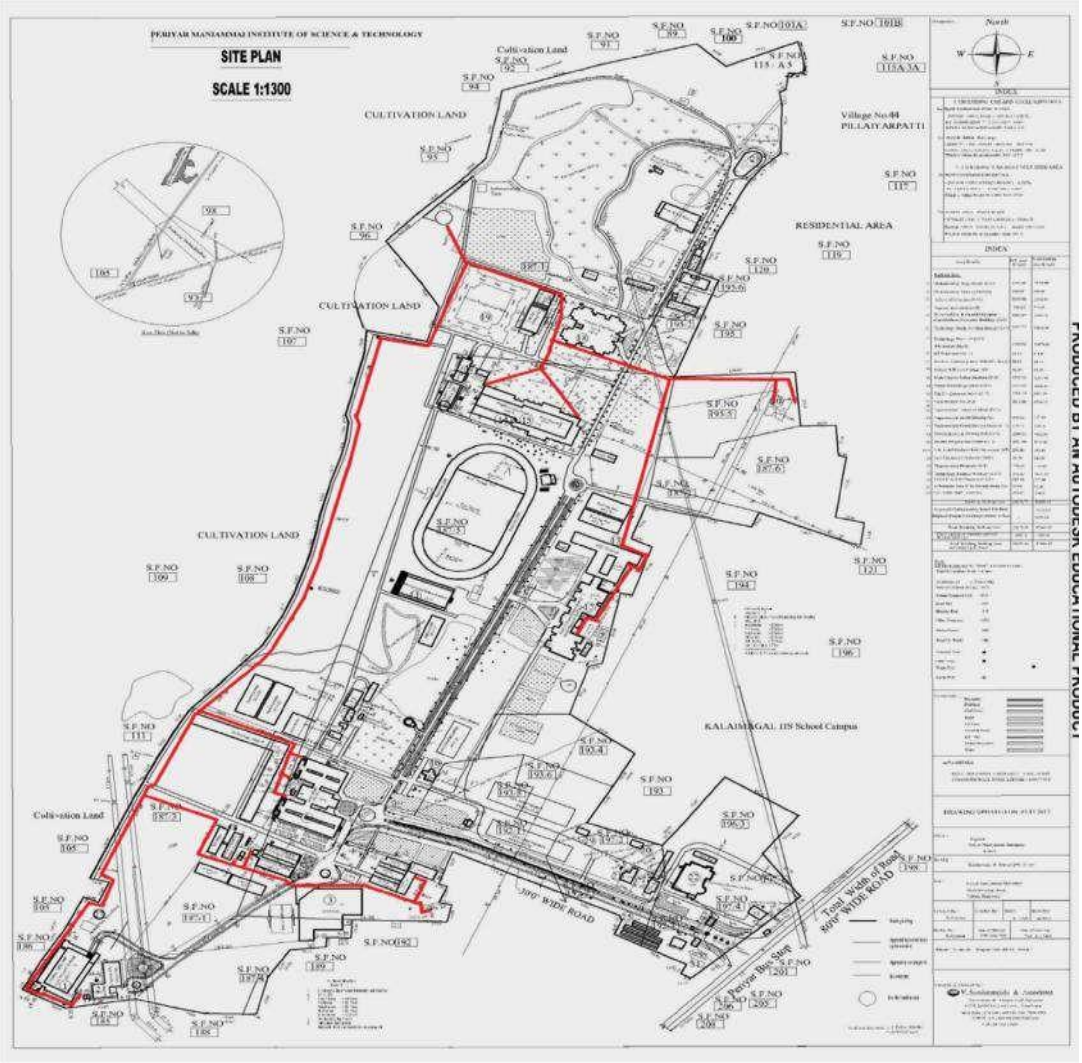



Fig 3.1 Waste water lines plotted in red in Institute layout

## 6.0 AIR QUALITY ($CO_2$, Temperature and Relative Humidity of various buildings)

| S.NO. | PLACES | $CO_2$ PPM | RELATIVE HUMIDITY | TEMPERATURE |
|---|---|---|---|---|
| 1 | TB-1 (EEE) LAB. | 519 | 61.9 | 27.6 |
| 2 | Transportation Lab | 472 | 55.9 | 28.8 |
| 3 | Civil HOD Room | 395 | 54.6 | 32 |
| 4 | Concrete Lab | 519 | 50.1 | 27.6 |
| 5 | Geotechnical Engg. Lab | 837 | 61.6 | 28.7 |
| 6 | Strength of Materials Lab | 623 | 57.3 | 28.8 |
| 7 | Electrical Machine Lab | 615 | 61.1 | 27.7 |
| 8 | EDC Lab | 477 | 58.4 | 30.5 |
| 9 | M & I LAB | 475 | 56.4 | 30.9 |
| 10 | Valluvar Hall | 550 | 51.4 | 34.1 |
| 11 | Main Office | 482 | 61.3 | 28.2 |
| 12 | VC Office | 547 | 53.6 | 28.2 |
| 13 | GIS Lab | 720 | 58.1 | 30.7 |
| 14 | Bio- Tech. Lab | 527 | 55 | 28.4 |
| 15 | Registrar Office | 784 | 52.3 | 28.3 |
| 16 | Control System Lab | 405 | 47.2 | 30.1 |
| 17 | Bio Process Lab | 542 | 53.5 | 28.3 |
| 18 | Chemistry Lab | 597 | 51.1 | 28.8 |
| 19 | Physics Lab | 620 | 52.2 | 29.0 |
| 20 | TB-1 302 | 453 | 49.2 | 30.1 |
| 21 | Civil Engg. Staff Room | 775 | 53.5 | 28.0 |
| 22 | Maths Dept. Staff Room | 804 | 53.3 | 29.9 |
| 23 | Director CSAS Room | 459 | 53.6 | 31.2 |
| 24 | Administrative Office | 502 | 53.2 | 28.3 |
| 25 | Arch Studio-1 | 506 | 60.3 | 29.4 |
| 26 | Studio-2 | 493 | 54.1 | 29.9 |
| 27 | Canteen | 542 | 53.1 | 29.4 |
| 28 | Academic Affair Office | 457 | 53.6 | 28.8 |
| 29 | Library | 573 | 51.5 | 34.6 |
| 30 | CSE Lab 208 | 811 | 47.7 | 30.4 |
| 31 | CSE Lab 207 | 790 | 53.1 | 29 |
| 32 | Indoor Stadium | 887 | 53.2 | 32.4 |
| 33 | Substation | 505 | 49 | 31.3 |
| 34 | Aerospace Lab | 481 | 49.1 | 31.6 |
| 35 | Mechanical Lab | 484 | 51.6 | 31.8 |
| 36 | Generator Room | 585 | 49.5 | 33.1 |

Using Digital Indoor Air Quality meter the $Co_2$ level, Relative Humidity, Temperature and Pressure at different points in the premises were measured and given below:

- **$Co_2$ level :** Min – 395 ppm ; Max.– 887 ppm ( *As per ASHRAE, above 1000ppm $CO_2$ – requires adjustment of building's ventilation system)*
- **Relative Humidity (RH) :** Min – 47 % ; Max.– 62 %

  *(As per ASHRAE Standard, indoor humidity levels to be maintained between 30 -65 percent for optimum comfort).*
- **Temperature:** Min – 27.6˚ C ; Max.– 34˚ C

  (*As per ASHRAE Standard, recommended temperature ranges termed "comfortable" are 22.8 to 26.1°C in the summer and 20.0 to 23.6°C in the winter).*

## 7.0 SOLID WASTE GENERATION AND MANAGEMENT

The 4R concept –REDUCE, REUSE, RECYCLE, RECOVER is being experimented with the solid waste collected in the campus. The wastes are segregated and composting of degraded materials in the process. To promote research and encourage young researchers National and International Level conferences are regularly hosted every year in collaboration with various agencies. Solid waste is segregated at source and recycled with focus on waste to wealth

- Periyar TBI possess a Paper recycling unit called Periyar Paper Re-processing Unit
- Sources for the paper recycling unit are retrieved from our Institute and reinforcing materials (cotton waste) are added to strengthen the quality of the paper.
- Two tonnes of paper/ year are produced by recycling because of this, 8.5 $m^3$of wood pulp is saved.



***Solid waste is segregated at source by using 3 colored bins and using naturallygrown bamboo bins instead plastics***

**7.1** Details of Garbage Bin Location

| Sl.No. | Description | Floor | No. of Dustbin | Total |
|---|---|---|---|---|
| 1. | Vittobai Hostel | Ground | 56 | 286 |
| | | First | 56 | |
| | | Second | 56 | |
| | | Third | 56 | |
| | | Common | 6 | |
| 2. | Nagammaiyar Hostel | Ground | 10 | 10 |
| 3. | Chakkaravarthy Hostel | Ground | 8 | 40 |
| | | First | 8 | |
| | | Second | 8 | |
| | | Third | 8 | |
| | | Fourth | 8 | |
| | | Fifth | 8 | |
| 4. | Technology Block- I | | | 50 |
| 5. | Technology Block -II | | | 14 |
| 6. | Architecture Block | | | 15 |
| 7. | Education Block | | | 5 |
| 8. | Canteen & Store | | | 10 |
| 9. | PKC | | | 31 |
| 10. | Indoor Stadium | | | 2 |
| 11. | Periyar TBI | | | 5 |
| 12. | Pathway (Tricolour Coded Bins) | | 10 | 30 |
| | | | Total | 498 |

The Biomethanation plant in Periyar Maniammai Institute of Science & Technology is multifeed with the following feeds like cattle dung, night soil, vegetable waste and food waste. The gas producing capacity of the digester is 500cum per day. The human waste collected from all buildings through 200 mm diameter PVC pipe. The total length of laid pipe line is 4250 m to the plant. The volume of gas produced will generate 60 KWe of electricity. This will not only generate significant quantity of Biogas but also generate the digested material about 120 metric tons in year a used as a high grade soil conditioner for in house and locals atnormal cost. The Digester is of 16.2m diameter and 5.7m height. Quantity of feeding requiredper day is 10 tons. Nearly 2960 cum per year of waste water is generated from this plant. The waste water collected is also used for recycling and reusing after treatment.

## 7.2 E WASTE MANAGEMENT

E-Waste for short - or Waste Electrical and Electronic Equipment (WEEE) - is the term used to describe old, end-of-life or discarded appliances using electricity. It includes computers, consumer electronics, fridges etc which have been disposed of by their original users.

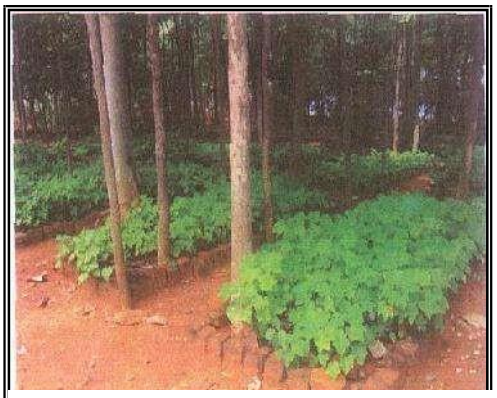
## 7.3 GREEN CAMPUS

The institute has area of 46964 Sq.m which has been transformed into a land of thick foliages, green vegetation 1618 Nos. of bamboo trees, 38,441 Nos. of other variety of trees such as Azadirachtaindica (neem), Ponganiapinnata (pongai), Pterocarpusindices (vengai), Albizialebbeek (vaagai), Casuarinauqisetifolia (casuarinas), Pterocarpus sandalinus (red sandals), Tacfonagranules (teak), etc. which were developed from waste water usage) and a technology-hub, energy efficient, pollution-free, zero waste and well-laid campus with an ambience for learning from barren and dry wasted land.

***Green Foliage of the Campus***

Establishment of Periyar Herbarium to introduce the 250 species of medicinal plants, Germplasm collection for medicinal plants to use the TBI. National mission on Bamboo application (NMBA) Project — Planting of bamboo seedlings 10 acres for demonstration plot

**Timber Tree**



**Bio-Diesel plant Jatropha**

- Seedlings are supplied at nominal price to individuals, farmers and for industrial green cover. Consultancy for industries, one public sector undertaking and private owners has been taken up.

**Cultivation of Bambosa Bamboo**

**Medicinal Plants**

- Every year, the Periyar Research Organization for Bio-Technic and Eco-System (PROBE) conducts a two-day national seminar concentrating mainly on revival of profitable farming practices for sustainable development

- Technical and entrepreneurial assistance is given to enterprising youth to establish rural industries. Industrious youth are identified and training is given to them to motivate entrepreneurship skills in them. Need-based training programmes are also conducted for those who opt for such skills.

## 8.0 GREEN PRACTICES

The following activities carried out in campus clearly prove that we are marching towards Clean Development Mechanism (CDM) and carbon footprint initiative.

Varieties of species and medicinal plants have been produced with the help of Tissue Culture (TC) techniques and quality seedlings produced by TC plant hardening centre.

*Plants produced by Tissue Culture*

**a) Green Foliage**

PMIST campus has around 4,500 shrubs and plant varieties, 26,000 native trees. Such thick foliage of vegetation releases oxygen of 8.4 tonnes per day and $CO_2$ absorption is around 1.6 tonnes per day.

*PMU students walking in the shadows of trees*

**b) Bamboo Cultivation**

Bamboo grove cultivated in the University requires one-tenth of the water compared to paddy cultivation and retains ground water. It has the survival of 40 years as a standing crop. Each bamboo clump liberates 850 grams of $O_2$ per day whereas the requirement of a single person per day is only 800 grams of $O_2$. Bamboo farm of 10 acres is developed inside the Institute campus in order to give training to the farmers. Bamboo minimizes Carbon-di-Oxide and generates up to 35% more Oxygen than equivalent stand of other trees.

***A view of Bamboo garden in our campus***

One acre of bamboo sequesters 25 tonnes of $CO_2$ /year. Apart from this, bamboo based home products are produced in the campus as substitute for plastics. These products are green and eco-friendly, stood as one of the important green practices. As one of our green practices, many important meetings are conducted in the bamboo groove which reduces the air conditioned hall electricity consumption and also feels good.

## c) Farm Activities

In one of our adopted villages namely Aachampatti we have established a farm has a very thick foliage of around twenty thousand timber trees like red sanders, rose wood, teak and vengai and native fruit trees like coconut, mango, jackfruit, sappota and medicinal plants like amla and aloevera. To guard this agri-farm, an ideal bio-fence like 'Sudan' shrubs is planted. The coconut yields obtained here are in surplus, that we use it in the hostel and also put out for sales. Generally, coconut groves require plenty of water but due to our effective irrigation systems, the water usage is minimal. Periyar Bio-farm is a development of team work of agriculturists, farmers and technocrats and has created job opportunities too many people in the surrounding areas.

The land and socio-economic values of the surrounding areas have excessively increased from Rs.12, 500 per acre to Rs.10 lakhs per acre over a period of 15 years. Technical knowhow is disseminated to the nearby farms at Aachampatti for a betterment of their farms. Water conservation is also adopted by means of drip irrigation, check dams and soil erosion control. Two rainwater collection ponds serve as water storage and as a source of drinking water for grazing animals.

***Aachampatti Farm***

**d) Organic Culture**

The farm is completely grown by organic vegetation. Organic manure like **vermicompost** is used.

***Vermicompost yard in our campus***


***Vermicompost Bags***

***Earth worms Eisenia Foetida***

Highly efficient systems such as micro-irrigation and mulching technology are practised. Best fittings like efficient single lever taps, toilet flush tanks and double plumbing are used in the campus.

***Mulching Technology***

***Micro Irrigation***

**e) Rainwater Harvesting Pond**

After the blooming of Periyar Maniammai Institute of Science and Technology in this laterite arena, not even a single drop of rainwater is being wasted in the educational campus. Traditionally, rainwater harvesting has been practiced in arid and semi-arid areas, and has provided drinking water, water for campus use, livestock, and small irrigation. It is the best way to recharge groundwater levels in and around Periyar Maniammai Institute of Science and Technology.

Rainwater harvesting systems are the needs of the hour that many educational institutions, industries, houses must install the harvesting tanks. Water harvesting in this campus presents as an exemplary technique. Rainwater from rooftops of buildings is collected and fed into the collecting sumps located in four different places of Periyar Maniammai Institute of Science and Technology. Surplus water from the earth surface is collected and fed into two water storage ponds. Water from the sewage, from the buildings and constructions (hostels and institutional buildings) is utilized after proper treatment. The rainwater thus harvested and collected in the sumps is directly used as irrigation water for botanical gardens by suitable sprinklers in the campus. The recharged groundwater through deep bore well is utilized for all institutional needs and construction of buildings and laboratories. Similarly, the sewage water after treatment is not at all wasted but is utilized for watering the ornamental plants and lawns.

Thus, the entire water needs of the Institute are satisfied from the rain fed subsoil resources and no external water supply is drawn from any other source.

***Rain water Harvesting Pond (4250m$^3$)***

*Percolation Pond (2 TMC)*

**Sustainable Institutions of India (SII): Green Institutional Ranking Result**

Periyar Maniammai Institute of Science & Technology has applied Green Institutional Ranking. The institute has been awarded with **"Green Institutional Ranking" in Gold Band across India from Sustainable Institutions of India (SII) organization** under R. World Institutional Ranking (R.WIR). This award explores the strength of the Institution and Comprehensive overview of the Environmental and Sustainable activities of the Institution. Further, PMIST aims for achieving Carbon Neutral through its Environmental promotional activities.

## 09. GREEN AUDIT RECOMMENDATIONS

### 01. WATER MANAGEMENT

The Management needs to consider the low –flow faucets, automatic faucets, and/or faucet aerators as the replacement for the existing conventional taps.

The management needs to install the metering arrangement to measure the water drawn from its main water sources.

### 02. RENEWABLE ENERGY

The Institute needs to chalk out long term strategy towards carbon neutrality and installrenewable electricity generation (solar PV) to offset emissions of grid- b a s e d electricity generation.

The Institute needs to provide Carbon foot print analysis data for every auditing period