



ENVIRONMENT AUDIT REPORT

PAVANATMA COLLEGE MURICKASSERY

2023

Executed by



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SEPTEMBER 2023





Environment Audit Report
PAVANATMA COLLEGE, MURICKASSERY
Report No: EA 1066
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Environment Audit Team

Ottotractions

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About OTTOTRACTIONS

OTTOTRACTIONS established in 2005, is an organization with proven track record and knowledge in the field of energy, engineering, and environmental services. They are the first Accredited Energy Auditor from Kerala for conducting Mandatory Energy Audits in Designated Consumers as per Energy Conservation Act-2001. Government of Kerala recognized and appreciated **OTTOTRACTIONS** by presenting its prestigious “**The Kerala State Energy Conservation Award 2009**” for the best performance as an Energy Auditor. Ottotractions is an ISO 9001-2015, ISO 17020-2012 and ISO 14001-2015 Certified organization, which ensures the quality of its services.

Acknowledgement

We were privileged to work together with the administration and staff of Pavanatma College, Murickassery for their timely help extended to complete the audit and bringing out this report.

With gratitude, we acknowledge the diligent effort and commitments of all those who have helped to bring out this report.

We also take this opportunity to thank the bona-fide efforts of team OTTOTRACTIONS for unstinted support in carrying out this audit.

We thank our consultants, engineers and backup staff for their dedication to bring this report.

Thank you.

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INTRODUCTION

Central Institute of **Pavanatma College, Murickssery** has entrusted Ottotractions to carry out an environment audit of their campus building.

Each section contains recommendations for improvements relating to environmental issues, which are consolidated in the action plan in section 4.

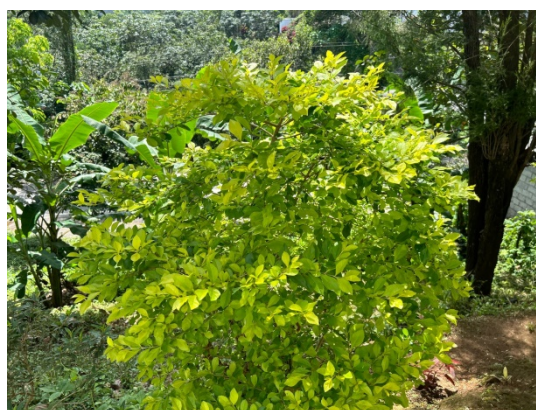


BACKGROUND

Nestled on a hillock, **Pavanatma College**, the beacon of knowledge, evokes mingled feelings of pride and hope in the passers-by. Surrounded by hills and foregrounded by coconut trees, the college affords a picturesque view, beckoning young minds to make intellectual pursuits by utilizing its tranquil ambience..

NAAC Reaccredited A Grade College, located at Murickassery, about 15 kms away from Idukki en route to Thopramkudy, in Vathikudy Panchayath, Udumbanchola Taluk, Idukki District. Pavanatma is affiliated to Mahatma Gandhi University, Kottayam. It was established in 1982

The Management was transferred to the Diocese of Idukki in the year 2005 followed by the bifurcation of the Kothamangalam Diocese. At present His Excellency Mar. John Nellikunnel, Bishop of Idukki is the Patron of the College. Under the efficient guidance of the corporate Educational Agency, Idukki, the College marches forward along the path of progress with 9 UG and 5 PG Programmes



Occupancy Details	
Particulars	2022-23
Total Students	997
Staffs	84
Total Occupancy of the college	1081

Total student strength of the campus is 997. For calculating per capita carbon emission estimation, the student strength is taken into account.



ENVIRONMENTAL ISSUES

This section is broken down into the following different areas: waste, water, energy, resource and materials use and procurement. A final 'other' section is also included for any additional issues.

1.1. Waste

The way communities generate and manage their waste plays an absolutely key role in their ability to use resources efficiently. All buildings contain bins for both general waste and mixed recyclables (plastic bottles, card, cans and paper). On average each floor in the buildings areas has its own general waste bin and one recycling bin. When the bins are emptied by the cleaning staff. Bins are marked and kept in different colors for identification, however in some locations throughout the building it was unclear which bins were for which waste streams.

There are four basic ways in which campus can do **plastic** recycling **collection** services for **plastic** bottles and containers – curbside, drop-off, buy-back or deposit/refund programs. The first, and most widely accessible, **collection** method is curbside **collection** of recyclables. The campus is installed bins to collect plastic bottles and single use plastics. The college has given a proper awareness on plastic waste problems and they are discouraging the students or teachers to carry plastics to the campus.



The major concern of waste management will be focused on the solid waste produced by the campus. Solid wastes produced in the campus are mainly of three types, food waste, paper waste, and plastic waste. Food wastes produced in the campus are mainly by two means. The vegetable wastes produced in the kitchen during the food preparation. The food waste produced by the students and staffs of the campus after the consumption of meals. The degradable waste can treated in the biogas plant.

Degradable Waste Generation	
Pavanatma College Murickassery	
Particulars	2022-23
Total Occupancy	1081
Waste generated in kg /day	21.62
Waste generated in kg /Yr	4756.4

Burning plastics shall be strictly restricted inside the campus. **Burning plastic** and other wastes releases dangerous substances such as heavy metals, Persistent Organic Pollutants, and other toxics into the air and ash waste residues. Such pollutants contribute to the development of asthma, cancer, endocrine disruption, and the global burden of disease.

Solid non degradable Waste Generation	
Pavanatma College Murickassery	
Particulars	2022-23
Total Occupancy	1081
Waste paper generated in kg /day	0.2162
Waste plastic generated in kg /day	0.3243
Waste paper generated in kg /Yr	47.56
Waste plastic generated in kg /Yr	71.35

WASTE MINIMIZATION AND RECYCLING		
1	Does your institute generate any waste? If so, what are they?	Yes, Solid waste, Canteen Waste paper, plastic, Horticulture Waste etc.
2	What is the approximate amount of waste generated per day? (in Kilograms/) (approx.)	22.15

3	How is the waste generated in the institute managed? By	Reuse of one side printed Paper for internal communication. Kitchen waste can used to generate manures and biogas. Two types of Waste bins are provided at campus for biodegradable and non-biodegradable waste.
	1 Composting	In-house
	2 Recycling	In-house
	3 Reusing	In-house
	4 Others (specify)	
4	Do you use recycled paper in institute?	Yes
5	Do you use reused paper in institute?	Yes
6	How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.	Awareness programs through Nature Club, Exhibition and NSS
7	Can you achieve zero garbage in your institute? If yes, how?	Yes

Green Cover Audit		
1	Is there a garden in your institute?	Yes
2	Do students spend time in the garden?	Yes
3	Total number of Plants in Campus	Plant type
		Trees
		Ornamental
		Approx. number
		595
		Not estimated
4	Number of Tree Plantation Drives organized by School per annum. (If Any)	Yes, through Nature club plantation drives are organized.
5	Number of Trees Planted in Last FY.	10
	Survival Rate	100%

All the activities including energy consumption and waste management have their equivalent carbon emission and they positively contribute to the carbon footprint of the campus. Carbon sequestration is the reverse process, at which the emitted carbon dioxide will get sequestered according to the type of carbon sequestration employed. Even though there are many natural sequestration processes are

involved in a campus, the major type of sequestration among them is the carbon sequestration by trees.

Trees sequester carbon dioxide through the biochemical process of photosynthesis and it is stored as carbon in their trunk, branches, leaves and roots. The amount of carbon sequestered by a tree can be calculated by different methods. In this study, the volumetric approach was taken into account, thus the details including CBH (Circumference at Breast Height), height, average age, and total number of the trees, are required. Detailed table is included in the technical supplement.

Carbon Sequestration	
Particulars	2022-23
Total No of Trees	595
Carbon sequestered by trees in the campus (tCO₂e)	20.82

Carbon sequestered by a tree can be found out by using different methods. Since this study is employed the volumetric approach, the calculation consists of five processes.

- Determining the total weight of the tree
- Determining the dry weight of the tree
- Determining the weight of carbon in the tree
- Determining the weight of CO₂ sequestered in the tree
- Determining the weight of CO₂ sequestered in the tree per year

Carbon sequestered by each species of trees in the campus compound is given in the Table. Detailed calculation results are listed out in the tables provided in the technical supplements of 'Carbon sequestration'.



List of trees in campus		
Sl.No	Name of Trees	Number
1	Teak	11
2	Mango tree	24
3	Jackfruit tree	12
4	Bamboo	4
5	Guava	13
6	Coconut tree	22
7	Vaka tree	1
8	Athi	3
9	Magnolia	1
10	Njaval tree	5
11	Manchiyam	2
12	Almond tree	3
13	Jathi tree	1
14	Champa tree	3
15	Cypress	15
16	Ramputtan	1
17	Cempakam	1
18	Anjili	4
19	Eucalyptus	1
20	Tamarind	2
21	Ilannji tree	1
22	Spruce tree	2
23	Lakshmitharu	1
24	Yukkali	1

25	Magnolia	1
26	Chaukka	38
27	Rubber	10
28	Unrecognized trees	412
Total		595

3.1.1 ENERGY

a. Electricity

The total emission of the carbon dioxide per student is 42.86 kg per year. Emission reduction plans were prepared to bring the existing per capita carbon footprint to zero or below so as to bring the campus a carbon neutral or carbon negative campus. All energy efficiency projects shall be implemented, So, the effective specific carbon emission per student is -1.57kg of CO₂ per year only. This can be achieved in many ways but, every alternate plan must be in such a way that, it must fulfill the actual purpose of each activity that is considered.

Here, three major methods are taken in to account as the plans for reducing the carbon emission of the campus.

- Resource optimization
- Energy efficiency
- Renewable energy

Electricity Consumption

Electricity Connection Details		
Pavanatma College Murickassery		
1	Name of the Consumer	Pavanatma College Murickassery
2	Tariff	LT-6A/Three, LT-7A/Three, LT-6A/Three, LT-6A/Single, LT-6A Ndom, LT-6B/single, LT-6F/Three
3	Consumer Numbers	1157110000001, 1157117010513 1157112015364, 1157110004561, 1166393000082, 1157114004596, 1157119013930
5	Connected Load Total (kW)	189
6	Annual Electricity Consumption (kWh)	36233

Annual Electricity Consumption (kWh)		
Consumer No	2022-23	Connected Load (kW)
1157110000001	12983	46
1157117010513	3716	89
1157112015364	72	30
1157110004561	19	1
1166393000082	1	2
1157114004596	5819	5
1157119013930	13623	16
TOTAL	36233	189

RESOURCE OPTIMISATION

The effective use of resources can limit its unnecessary wastage. Optimal usage of the resources (such as fuels) can save the fuel and can also reduce the carbon emission due to its consumption. This technique can be effectively implemented in the 'transportation' and 'waste' sectors of the campus.

WASTE MINIMISATION

Optimal utilization of paper and plastic stationaries can reduce the frequency of purchase of items. This can reduce the unnecessary wastage of money as well as the excess production of waste. In the case of food, proper food habits and housekeeping practices can optimize its usage.

Currently, College is taking an appreciable effort to reduce the unnecessary production of wastes. But the campus still has opportunities to reduce the generation of waste and can improve much more. Resource optimization can be effectively implemented in all type of waste generated in the campus and the campus can expect about 50% reduction the total waste produced.



ENERGY EFFICIENCY

Energy efficiency is the practice of reducing the energy requirements while achieving the required energy output. Energy efficiency can be effectively implemented in all the sectors of the campus.

FUELS FOR COOKING

The campus was installed a solar water heater to rise the water temperature to a much higher level, then it has to consume only very less amount of thermal energy for preparing the same amount of food. This can make a positive benefit to the campus by saving money, energy and can reduce the carbon emission of the campus due to thermal energy consumed for cooking.



TRANSPORTATION

Energy efficiency of the transportation sector is mainly depended on the fuel efficiency of the vehicles used. Here mileage of the vehicle (kmpl - Kilometres per Litre) is calculated to assess the fuel efficiency of the vehicle. Percentage of closeness is the ratio of actual mileage of the vehicle to its expected mileage. If the percentage of closeness of mileages of each vehicle is greater than that of its average, then the efficiency status of the vehicle is considered as 'Above average' and else, it is considered as 'Below average'

Renewable Energy

Solar power plant can be installed in the campus which helps offsetting the carbon foot print. The details of these projects are given in the concerned chapters.

After analyzing the historical and measured data the following projects are proposed to make the campus carbon neutral. The projects are from energy efficiency and renewable energy. The further additions in the green cover increase will also give positive impact in the carbon mitigation.

OTTOTRACTIONS- ENERGY AUDIT						
Pavanatma College Murickassery						
Greenhouse Gas Mitigation through Major Energy Efficiency Projects						
Sl No	Projects proposed	Energy saved(Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated through out life cycle
		(kWh)	MWh			
1	Energy Saving in Lighting by replacing existing 3 No's T8 (40W) Lamps to 18W LED Tube	63	0.06	10	0.05	0.46
2	Energy Saving in Lighting by replacing existing 3 No's CFL(15W) Lamps to 9W LED Bulb	13	0.01	10	0.01	0.09
3	Energy Saving by replacing existing 190 No's in-efficient ceiling fans with Energy Efficient Five star fans	3575	3.58	10	2.61	26.10
Total		3651	4	10	2.67	26.65

OTTOTRACTIONS- ENERGY AUDIT						
Pavanatma College Murickassery						
Greenhouse Gas Mitigation through Renewable Energy Projects						
Sl No	Projects	Energy saved (Yearly)		Sustainability (Years)	First year ton of CO2 mitigated	Expected Tons of CO2 mitigated through out life cycle
		(kWh)	MWh	Years		
1	Installation of 10kWp Solar Power Plant	13688	13.69	25	9.99	249.80

Water Conservation Activities	
List four uses of water in your institute	Basic use of water in campus:
	1. Drinking – Ground Water
	2. Gardening – Rain water
	3. Kitchen and Toilets –Ground water
	4. Others – Lab
How does your institute store water? Are there any water saving techniques followed in your institute?	Overhead Water Tanks and Sumps installed for storage of water.
	Rain Water Harvesting system in place
If there is water wastage, specify why and How can the wastage be prevented / stopped?	No
Record water use from the institute water meter for six months (record at the same time of each day). At the end of the period, compile a table to show how many liters of water have been used.	No logbooks are available
Does your institute harvest rain water?	Yes
Is there any water recycling system?	No

General Environmental Awareness Questionnaire	
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Dose Environmental Ambient Air Quality Monitoring conducted by the Institute?	No
Dose Environmental Water and Wastewater Quality monitoring conducted by the Institute?	Yes
Dose stack monitoring of DG sets conducted by the Institute?	No
Is any warning notice, letter issued by state government bodies?	No
Dose any Hazardous waste generated by the Institute? If yes explain its category and disposal method	No
Are you aware of any environmental Laws pertaining to different aspects of environmental management?	Yes
Does your institute have any rules to protect the environment? List possible rules you could include.	Yes
Does housekeeping schedule in your campus?	Yes
Are students and faculties aware of environmental cleanliness ways? If Yes Explain	Yes
Does Important Days Like World Environment Day, Earth Day, and Ozone Day etc. eminent in Campus?	Yes
Does Institute participate in National and Local Environmental Protection Movement?	Yes
Does the institute have any Recognition/certification for environment friendliness?	Yes
Does the institute use renewable energy?	Yes
Does the Institution conduct a green/environmental audit of its campus?	Yes
Has the institution been audited / accredited by any other agency such as NABL, NABET, TQPM, NAAC etc.?	Yes (NAAC)

Best Practices and Initiatives	
Renewable Energy	Yes
Solar Power Plant	Yes
Energy Audit and Green Audit Conducted	Yes
Biogas Plant installed	Yes
Biodiversity Conservation	Yes
Green Cover	Yes
Tree Plantation Drives	Yes
ECO clubs	Yes
Groundwater Recharge	Yes
Rain Water Harvesting System.	No
Pollution Reduction Public Transportation	Yes
E Waste Management	Yes
Connected to authorized recycler	Yes
Solid Waste Management	Yes
Lifting of garbage from the campus on alternate days by the Municipal Corporation.	Yes
Adoption of Village	No
CSR	Yes
Water Conservation	Yes
Energy Conservation	Yes



RECOMMENDATIONS

1. Implement a utility monitoring program.
 - Allocate staff to carry out meter readings for electricity, waste and water on regular basis
 - Add monitoring data to spreadsheet so results can be viewed graphically
 - Compare with the utility bills meter readings in order to ensure accuracy;
2. Consider adopting and implementing a sustainable procurement policy which takes into account the whole life cycle of a product, and make sure environmental issues are written into tenders when contracting out.

3. Consider trialing recycled paper again – many recycled brands today, such as Evolve, are just as good as virgin paper.
4. Trial the use of re-manufactured (i.e., refilled) ink and toner cartridges rather than purchasing new ones.
5. Consider producing some designated ‘environmental’ pages on the intranet to make it easier for staff to find environmental information. If possible, a discussion forum could be set up to allow easy internal communications and staff to make suggestions for environmental improvements.
6. Environmental training could be formalized and carried out for all staff. It does not have to be too long or onerous, providing it covers key points, particularly in relation to waste so all staff are aware of the legal requirements. At the very least, environmental information should be included in the induction pack.
7. It is strongly recommended that environmental information is also given to students and staff during induction. It is particularly important for them to be aware of what waste they can dispose of on site and where they can dispose of it, and what waste streams they must take away with them.
8. Consider implementing an environmental management system to incorporate all improvements and monitoring requirements. It does not need to be a complex system certified to any particular standard, merely a way of ensuring that baselines are set and progress is measured. Formation of Environment Policy and communicated to all faculties and other staff.
9. Plan for Zero Waste Campus Project
10. E-waste monthly inventory be maintained at campus as per E waste rules 2016.
11. A Water Meter should be installed at the institute for monitoring of water consumption per capita.
12. Increase in Environmental promotional activities for spreading awareness at campus.
13. Environment/Green committee formation for regulating eco-friendly initiatives at campus premises and periphery.



CONCLUSION

This audit involved extensive consultation with all the campus team, interactions with key personnel on a wide range of issues related to Environmental aspects. The audit has identified several observations for making the campus premise more environmentally friendly. The recommendations are also mentioned with observations for Pavanatma College, Murickassery team to initiate actions.

Carbon Foot Print			
Sl. No.	Particulars	2022-23	tCO ₂ e
1	Electricity (kWh)	40257	33.01
2	Diesel (L)	64	0.20
3	LPG (kg)	4104.00	6.16
4	Biogas (kg)	330.00	0.462
5	Degradable Waste in kg/yr.	4756.4	3.00
6	Paper Waste in kg/yr	47.56	0.03
Total Carbon Foot Print tCO₂e/yr			42.86

Net Carbon Emission after implementing Energy Efficiency projects and Renewable Energy Projects Proposed		
1	Total Carbon Foot Print tCO ₂ e/yr	42.86
2	Carbon Sequestered tCO ₂ e/yr	20.82
3	Carbon mitigated by Renewable Energy tCO ₂ e/yr (Installed)	10.94
4	Carbon mitigated by Renewable Energy tCO ₂ e/yr (Proposed)	9.99
5	Carbon mitigated by Energy Efficiency (Proposed) tCO ₂ e/yr	2.67
6	Effective Carbon footprint tCO ₂ e/yr	-1.56
7	Total No of Students	997
8	Specific Carbon Footprint kg CO ₂ e/Student/Yr	-1.57

However, there is scope for further improvement, particularly in relation to waste minimization and energy monitoring. By implementing a basic environmental management system, current good practice can be formalized and a framework can be set up for monitoring, implementation of action plans and continual improvement.

The audit team observed that the overall site is maintained well from an environmental perspective. There are no major observations but few things are important to initiate urgently are waste management records by monthly inventory of hazardous waste, rainwater harvesting recharge; water balance cycle and periodic inspection of buildings; environment policy and initiation of composting at campus.

References

- The Environment [Protection] Act – 1986 (Amended 1991) & Rules-1986 (Amended 2010)
- The Petroleum Act: 1934 – The Petroleum Rules: 2002
- The Central Motor Vehicle Act: 1988 (Amended 2011) and The Central Motor Vehicle Rules:1989 (Amended in 2005)
- Energy Conservation Act 2010.
- The Water [Prevention & Control Of Pollution] Act – 1974 (Amended 1988) & the Water (Prevention & Control of Pollution) Rules – 1975
- The Water [Prevention & Control Of Pollution] Cess Act-1977 (Amended 2003) and Rules- 1978
- The Air [Prevention & Control Of Pollution] Act – 1981 (Amended 1987) The Air (Prevention & Control of Pollution) Rules – 1982
- The Gas Cylinders Rules – 2016 (Replaces the Gas Cylinder Rules – 1981)
- E-waste management rules 2016
- Electrical Act 2003 (Amended 2001) / Rules 1956 (Amended 2006)
- The Hazardous Waste (Management and Handling and Trans-boundary Movement) Rules, 2008 (Amended 2016)
- The Noise Pollution Regulation & Control rules, 2000 (Amended 2010)
- The Batteries (Management and Handling) rules, 2001 (Amended 2010)
- Relevant Indian Standard Code practices



TECHNICAL SUPPLEMENTS

