



ST. THOMAS COLLEGE, PALAI

**Reports of Green, Energy and
Environment Audits 2018 - 2019**

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REPORTS OF GREEN, ENERGY AND ENVIRONMENT AUDITS 2018 - 2019

THE BACKGROUND

Keeping our environment healthy is the responsibility of each and every individual. However, the rapid urbanization and economic development at local, regional and global level has made it difficult. It is necessary to determine how well the environmental management systems and equipment are performing in every Institution. It is required to verify compliance with the relevant national, local or other laws and regulations and to minimize human exposure to risks from environmental, health and safety problems. Hence the originated the concept of energy & environmental auditing, also known as green auditing.

An environmental audit is a systematic process destined to obtain, evaluate and report facts concerning conformance with criteria, thus making meaningful improvements that will minimize negative impacts to the environment and employee safety. Environmental auditing has its beginning in the early 1970s, when some industrial companies, working independently and on their own initiatives, developed environmental auditing programmes as internal management tools to help review and evaluate the status of the company's operating units.

As all the people around the world have realised the value of paying attention to environmental issues, the concept of environmental auditing itself has evolved to address wider issues than simply legal and regulatory compliance. After Rio Earth Summit in 1992, the concept of environmental audit was accepted by many countries. The concept of environmental auditing in industrial units in India was formally introduced in March 1992 with the overall objective of minimising consumption of resources, promoting use of clean technologies in industrial production and to minimise generation of wastes. Subsequently, green auditing became a common practice in academic institutions in India especially as the National Assessment and Accreditation Council (NAAC) has insisted environmental audit in accreditation process of Universities and Colleges. Green audit soon became an important criterion in the NAAC assessment of higher education institutions. Moreover, it is part of the social responsibility of the higher education institutions to ensure that they contribute towards the reduction of environmental deterioration.



THE CONCEPT

The rapid urbanization and economic development at local, regional and global level has led to several environmental and ecological crises. On this background it becomes essential to adopt the system of the Green Campus for the institutes which will lead for sustainable development and at the same time reduce different kinds of environmental pollution. A green auditing is the first step in this direction. Green audit is an official examination of the effects an institution has on the environment, especially the damage that it causes. It is conducted to check the compliance of environmental laws, audit of environment cost and environment impact assessment and carbon credit of environment laws under Green Audit should cover the National environment laws, rules and regulations; notifications issued by the government and the agencies thereof.

The green audits are tools that organizations use to identify their environmental impacts and assess their compliance with applicable laws and regulations, as well as with the expectations of their various stakeholders. It also serves as a means to identify opportunities to save money, enhance work quality, improves employee and other stakeholders' health, safety and morale, reduce liabilities and achieve other form of values.

Higher education institutions are considered role models in a community and should act as leaders in social and environmental responsibility. Being a premier HEI in Kerala, St. Thomas College, Palai does not lag behind in this. To assess its present position on environmental sustainability, St. Thomas College conducted green audit which includes both energy and environmental audit for the period extending from 01/04/2018 to 31/03/2019. The college has already adopted the 'Green Campus' system for environmental conservation and sustainability. The goal is to reduce pollution, manage natural resources in a sustainable manner, while creating an atmosphere where students can learn and be healthy. A team of faculty members hailing from different background is constituted for the auditing. The following objectives were set initially for the audit:

- To educate the students the need for environmental friendly approach in every aspects of life, to train them and empower them to contribute and participate in the environmental protection.
- To recognize the initiative taken by the institution towards environment.
- To recognize, diagnose and resolve the environmental problems.



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- To assess environmental performance and the effectiveness of the measures to achieve defined objectives and targets.
- To ensure development along with safeguarding the environment.
- To upgrade the environment condition in and around the College.
- To ensure that the natural resources are utilized properly and according to the best interest of the country.
- To reduce energy consumption to foster environment.
- To ensure more eco-friendly harvesting of water, minimize the consumption of water and monitor its quality.
- To set the procedure for eco-friendly disposal of all types of wastes.
- To ensure compliance with present legislations of the Nation, State and other legal requirements.
- To physically ensure installation of tools and devices that reduces pollution.
- To ensure optimum utilization of resources.
- To see whether provisions are made for liabilities arising out of unintentional pollution related damages and their compliance in cases so arose.
- To ensure that sufficient precaution has been taken by the institution to protect the community in the institution from pollution resulting from it.
- To identify gaps and suggest recommendations for the improvement in the system to promote safe and clean environment in the Institution.

METHODOLOGY

The purpose of the green audit of St. Thomas College, Palai is to check whether the practices followed in the campus are in accordance with the Green policy adopted by the institution as well as in conformity with local, national and international rules. The methodology include: preparation and filling up of questionnaire, physical inspection of the sites, review and analysis of the relevant data and documents, interviewing responsible persons, and taking necessary measurements and counts. A detailed survey was conducted to collect data from the various sources necessary for the audit. The team members repeatedly visited sites where various environment-related activities in the institution are going on and collected information. The team identified the following areas that are directly related to environment and decided to undertake a thorough auditing of all of them:

1. Carbon Footprint

A Carbon footprint is the total greenhouse gas (GHG) emissions caused by an organization, event, product or person through transport, land clearance, production and



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consumption of food, goods, materials, wood, buildings and services, expressed as CO₂ equivalent. Carbon footprint is typically given in tons of CO₂ equivalent per year. The Carbon footprint of St. Thomas College campus is calculated based on the method suggested in Mary Lissy P N (2012).

Individuals and institutions can take a number of steps to reduce their carbon footprints and thus contribute to global climate mitigation. A widely accepted method for the reduction of Carbon footprint is, planting of trees. St. Thomas College campus is a green campus with large number big old trees as well as herbs and shrubs are growing luxuriantly. These plants definitely will reduce the Carbon footprint of the campus. Actual status on this is studied in this audit to find if there is Carbon credit. Recommendations are made to make the campus Carbon neutral.

2. Water Audit

All of us are aware of the value of water, nowadays. Water is a very valuable resource which should be used judiciously. Efficient use of water with no or less wastage is the need of the hour as the availability of potable water is reducing day by day. Along with this, the possibility of rain water harvesting, purification and reuse of water are also sought. A status study on these aspects is made in the audit.

3. Waste Management Audit

This is another important area in an educational institution. Wastes of all types are generated in a higher education institution which conducts dozens of UG and PG programmes and having several research departments. The wastes generated include sewage, solid waste, e-waste and laboratory chemicals. This includes several hazardous materials which should be carefully managed.

4. Energy Audit

Consumption of energy is an indicator towards green environment. Lesser the consumption of energy, more the contribution to environment is. An institution fast developing cannot reduce energy consumption. However, more and more energy can be produced by eco-friendly means, e.g., installing energy-efficient lighting, equipments and instruments in laboratories, libraries and class rooms, adding insulation in buildings, or using renewable energy sources like solar energy to generate the electricity they require.



5. Environmental Quality Audit

This includes analysis of the air quality, noise level and other types of pollution in and around the campus. The environment in the campus directly affects the health status and quality of life of all the stakeholders.

6. Health Audit

It analyzes the occupational diseases and safety measures undertaken within the institution.

7. Audit of the Appliances, Equipments, Tools and Practices

A large number of appliances, tools and equipments like air conditioners, fridges, computers, and laboratory equipments are used in a College. They consume large amount of power and emit potential pollutants. Proper evaluation of this followed by replacement with green alternatives as far as possible is required.

8. Paper Usage

Large quantities of papers are used by teachers, students and administrative staff of the College. Manufacturing paper products produce greenhouse gases, causing deforestation and global warming. Recycling can offset some of the environmental impact, but not by much. Further, ink and toners contain volatile compounds and non-renewable substances which are damaging to the environment. It is much more sustainable to simply reduce paper use altogether by switching to a paperless office/classrooms. It gives many benefits, saves natural resources, space, money, time, and information transfer is made easy.

OBSERVATIONS AND FINDINGS

1. Carbon Footprint

Carbon footprint is a measure of how much someone is contributing to the gases that contribute to global climate change. More scientifically, it is the amount of anthropogenic Carbon Dioxide (CO₂) emissions (those resulting from or produced by human beings) attributable to an individual or a household or an organisation, generally resulting from their direct or indirect use of energy. A Carbon footprint is normally calculated in tonnes of CO₂ equivalent (tCO₂e) but occasionally footprints are calculated in tonnes of carbon equivalent (tC). For that, it is required to multiply with 44 and divide with 12.



Carbon footprints may also include other gases that contribute to global climate change – the so called ‘greenhouse gases’ (GHGs). However, the largest contributor to global warming is CO₂ itself, which is produced from burning fossil fuels such as coal, oil or gas. A Carbon footprint is made of the sum of two parts: (i) Primary footprint and (ii) Secondary footprint. The Primary footprint is a measure of our direct emissions of CO₂ from the burning of fossil fuels, including domestic energy consumption and transportation. The Secondary footprint is the measure of the indirect CO₂ emissions from the variety of products and facilities we use- those associated with their manufacture and eventual breakdown.

Emission inventories identified to analyze the Carbon footprint of the campus were Human factors, Transportation, Electricity, Solid waste, Production and consumption of food, LPG, Buildings. The emission factors for each of these inventories is given in Table 1 based on the reference, Mary Lissy P N (2012). Carbon footprint analysis is done by combining data collected with respective emission factor of the each of the selected emission inventory and is presented in Table 2.

Table 1: Emission factors

Sl. No.	Emission factor	CO ₂ emitted
1	Human factor	1.14kg/person/day
2	Petrol	2.3kg/liter
3	Diesel	2.7kg/liter
4	Hydro-electricity	0.68956kg/kwh
5	Solar-based electricity	0.05kg/kwh
6	Food	1.7kg/kg
7	Solid waste	0.125kg/kg
8	LPG	1.5kg/kg
9	Buildings	0.1867kg/sq.mt./year

Table 2: The total carbon footprint of campus determined assuming 190 working days, and another 110 days in which the college office is working in a year.

Emission factor	Annual emission
Human factor	730740 kg
Petrol	23000 kg
Diesel – including power generator	27000 kg



Hydro-electricity*	124120 kg
Solar-based electricity	500 kg
Food	987700 kg
Solid waste	3750
LPG	7254 kg
Building	5955.4 kg
Total	1910019.4 kg

*For calculation, entire purchased electricity is taken as Hydro-electricity

1.1. Carbon offsetting

A common method to reduce the Carbon footprint is to cultivate more plants. Plants are the Carbon sink and are responsible for significant reduction of GHGs in the atmosphere. St. Thomas College campus is rich in plants with large number big old trees as well as herbs and shrubs are growing in it. It is estimated that a full-grown tree absorbs 6.8 kg CO₂ per year and a 1 Sq ft area of herbs and grasses absorbs 1 gm of CO₂ per year. The reduction in the Carbon footprint made by the total plant cover in the campus is thus calculated and the total Carbon credit of the campus is determined.

Table 3: Reduction in Carbon foot print by the campus flora

Sl. No.	Types of flora	Amount of CO ₂ absorbed	Total number/area	Quantity of Carbon absorbed
1	Full-grown trees	6.8 kg per year	900	6120 kg
2	Semi-grown trees	3.4 kg per year	600	2040
3	Shrubs	1 gm per year/sq ft	150000 sqft	150
4	Lawn	1 gm per year/sq ft	200000 sqft	200
Total reduction in the Carbon foot print				8510 kg

The tC for the College is calculated to be about 7003.41. The reduction in the Carbon footprint in the campus is just 31.2 tC. Only a meagre quantity of CO₂ emission is sequestered by the so called green campus of the College. Concerted efforts are required to



reduce the Carbon footprint of the campus both by reducing emission and ensuring more absorption.

2. Water Management

Water is one of the most important resources, large quantity of which is used in every campus. Good quality potable water is quickly vanishing everywhere. Kerala is blessed with enough sources of potable water including large amount of rainfall. Even then judicious use of water is very important in the present juncture. A complete audit of the procurement and usage of water in the campus is done. The details are given in Table 4 and 5 below.

Table 4: Water usage in the campus

Sl. No.	Activity	Average amount of water used	Total amount of water used by the college community each day(x 3000)
1	Hand and face wash	2Litres/day/ person	6000
2	Toilet/urinal flush	4 Litres/day/person	12000
3	Drinking	1 Litre/day/person	3000
4	Canteen	10000 Litres/day	10000
5	Hostels	25000 Litres/day	25000
6	Gardening	1000 Litres/day	1000
7	Farming	Nil	--
8	Wastage	1000 Litres/day	1000
Total consumption per day			58000 Litres
Total consumption per year			21170000 Litres

Table 5: Water procurement in the campus

Sl. No.	Source	Quantity (litres)
1	Ground water from the well	20170000 Litres
2	Rainwater harvesting	1000000
3	Public water supply	Nil
4	Recycled water	Nil



58000 litres of water is used per day by the college for its different uses. The main source of water is ground water. Approximately 100 litres of water per day is lost through the leaking of pipes. This can be prevented and other sources of water loss may be identified. Drip irrigation should be practiced in gardens. Sufficient water for watering of the garden and the agricultural farm can be done using recycled water if water treatment plants are installed at least in the canteen and hostels. A major step should be taken to the recycling of water in the college for an efficient water management. Awareness programmes for the management of sustainable water use will be very helpful. Efficient water saving devices should be installed in all toilets and urinals. Amount of water saved also saves electricity and indirectly reduces Carbon foot print.

3. Waste Management

Waste management is the most important step towards a sustainable development. Wastes of many types are generated in all campuses. Proper waste management is necessary to keep the campus clean, sustainable and safe. The strategy for waste management includes minimize the generation of wastes and dispose the unavoidable wastes systematically and harmlessly. In the present audit it was found that such an approach is in place at St. Thomas College, even though a few more gaps remains to be filled.

St. Thomas College is in the course of adopting environment friendly practices for waste disposal, waste recycling, energy conservation, reducing Carbon foot print etc. More attention needs to be applied in this direction. The amount of various types of wastes generated and the methods used to dispose it are given below in table 6.

Table 6: Waste materials generated in the campus and the method of their disposal

Sl. No.	Type of waste	Quantity generated	Disposal
1	Waste water including washrooms, canteen and hostels	25000 Litres/day	Pits
2	Food waste including canteen and hostels	100 kg/day	Composting
3	Campus trash - degradable	10 kg/day	Composting and burning in incinerator
4	Campus trash – non-biodegradable, including plastic	1 kg/day	Recycling



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5	e-waste, electric and electronic parts	100 kg/year	Recycling
6	Laboratory chemicals including hazardous chemicals	Solid – 10 kg/year Liquid – 10 Litres/year	Deep pits
7	Glass waste	50 kg/year	Recycling
Total quantity of degradable wastes generated			27500 kg/ year
Total quantity of non-biodegradable wastes generated			250 kg/year
Total quantity of hazardous wastes generated			

3.1. Waste Treatment Systems Available in the College

- Waste segregation is done regularly
- Water treatment plant
- Biogas plant and compost system
- Incinerator for burning of solid wastes including plastic and sanitary napkins

3.2. Sewage Treatment

The sewage generated in the College canteen is treated in a septic tank system and the purified water is pumped outside. The sediments are cleared regularly.

3.3. Solid Waste Management

The solid waste generated in the campus is mainly treated by composting, burning and disposing in deep pits. Better and eco-friendly approach is necessary in this area also.

3.4. Hazardous Waste Management

No proper systems for the management of hazardous waste are in place. More recycling options are to be adopted in this area.

3.5. E-waste Management

Management of e-waste is more challenging, that becomes more severe day by day.



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The audit identified certain areas in which the College put excellent and committed efforts to maintain environmentally benign atmosphere, especially in growing new trees, shrubs and other types of vegetation, but there is some lag behind as far as waste management is concerned. The College has modern recycle mechanisms in recycling food wastes from canteen, hostels and common dining halls, but still missed few major recycling opportunities such as water recycling, plastic recycling etc. A composting pit for the treatment of bio degradable waste generated from the canteen, office, and the students dining hall is in place. Different methods such as pit composting, vermi-composting, bacterial composting may be scaled up to treat the bio degradable waste. The disposal of the hazardous waste materials generated in the College, especially from the laboratories need special attention. We advice the college to start recycling plants in collaboration with local Government authorities or NGOs because we feel that there should be system in place to ensure that the plastic bottles, other plastic items including the case of pens, cans, broken and unbroken useless glass wares, tins etc., are recycled.

Another area that requires more attention is waste water and sewage treatment. The water purified in such plants may be used for several purposes. At the moment no such systems are in place.

There are proper sign boards displayed asking students dispose the wastes in a segregated manner. There should be a proper method in place for the handling and disposal of hazardous materials. All laboratories that use chemicals should switch over to green chemistry methods. Another source of waste generation in this College is the conduct of various programmes for students and the faculty. All such events should be convened as zero-waste events. Additionally, students, faculty, and staff must be properly educated on proper waste management practices.

4. Energy Usage

4.1. Electricity

St. Thomas College, being a large college, with large built up area and several well equipped laboratories and a large library is functioning, consumes a large amount of electricity. On an average -561.64kWhrof electricity is used per day which turns out to be about 205000kW-hr per year only to maintain itsvolumetric activities throughout the year. A small fraction, i.e., 10000kW-hr of this powerrequirement is met through the solar power plant installed in the College and solar LED lights installed in the campus. The total power consumption and sources of power are given in the table 7 below.



Table 7: Power utilization/generation in the campus in a year

Sl. No.	Source	Quantity	
1	Purchased electricity	180000 units	
2	Generators	15000 units	
3	Solar energy	10000 units	

Table 8: Energy benefit made by using energy efficient lighting system

Sl. No.	Lighting system	Average energy consumed/lamp	Total annual consumption
1	Incandescent lamps used earlier	60 W	11520 kWhr
2	Fluorescent lamps installed earlier	40 W	18000 kWhr
3	CFL lamps	14 W	1988 kWhr
4	LED lamps	20 W	8000 kWhr
Total benefit in the consumption of energy with the use of CFL and LED lamps			25532 kWhr

The College took a model step in installing solar panels that generate 10000 kWhr electricity per annum. More such facilities may be installed so that the dependence on the polluting diesel generators are stopped or at least minimized. There is the need to avoid the large number of inverters installed in the College as all such inverters have hazardous batteries associated with them. The College authority has taken commendable steps to replace most of the incandescent lights and fluorescent lamps, with LED lamps. The contribution of LED bulbs and LED tubes to the net power consumption is 34%. There is the need to replace all lamps with the low energy consuming LED bulbs and LED tubes. The bulky high power consuming old fans and the old air conditioners consume a large quantity of electricity. There is the urgent need to replace such items with more energy efficient and environment-friendly items in order to keep the electricity consumption of the College as low as possible.

4.2. LPG

In addition to electricity, LPG is used as a fuel in the canteen, hostels and laboratories (Table 8). Use of biogas which can be generated from the solid waste produced in the campus is a better option.



Table 8: Use of LPG in the campus

Sl. No.	Place	Quantity used
1	Hostels	5000 kg
2	Canteen	2000 kg
3	Laboratories	254 kg
Total		7254 kg

5. Environmental Quality Audit

Safe air, land, and water are fundamental to a healthy community environment that in turn, necessary for all the teaching learning activities in a College. Quality of air and water in St. Thomas College campus are checked based on set parameters. Noise level in the campus is also analyzed.

6. Health Audit

Healthy people in a healthy environment are the ideal condition for all the campus activities. The College regularly conducts various programmes to ensure the wellbeing of the students, faculty and staff of this institution.

7. Audit of the Appliances, Equipments, Tools and Practices

Many appliances, equipments and tools are used in classrooms, laboratories, libraries and office of an institution like St. Thomas College. Their efficiency, energy consumption, emission etc. have great environmental impact. A thorough auditing of all these are conducted, which found that some of the items are old, consuming large amount of electricity, emit GHGs and other pollutants and have low working efficiency. Many of them require quick replacement with environmental friendly rating. The several air conditioners, fridges and other electrical appliances need to be replaced with those with five star rating.

8. Paper Usage

While paper materials are an essential part of classrooms and office in higher education, its usage should be minimized as far as possible. New initiatives have started to reduce the use of paper in communication purposes. Online examination system may be encouraged as well. Making office administration 100 percent paperless is an urgent need. Awareness among the stakeholders is to be made to reduce the paper usage to the maximum. It is also required to propagate the habit of collecting waste papers and recycle as far as possible.



SUGGESTIONS AND RECOMMENDATIONS BASED ON THE AUDIT FINDINGS

The green auditing exercise has been able to determine the impacts on the environment St. Thomas College is causing. The College already has implemented practical ways to reduce many of the negative impact on the environment. However, more remains to be done which are summarised as below.

- The College should adopt an environmentally responsible purchasing policy; should purchase items, including computers, fridges, air conditioners, laboratory equipments etc., with highest energy star rating.
- Preparation of action plan based on the environmental policy of the College. The green auditing report will be a base line for the action plan to be evolved.
- Environmental education: the college may conduct training and awareness programmes for all the stakeholders in the College (including kitchen/canteen staff for example). Training programmes in solid waste management, liquid waste management, water management, energy management, plant conservation, landscape management, pollution monitoring methods, etc. should be dealt with.
- Display of environmental awareness boards such as – Save water, save electricity, No wastage of food/water, no smoking, switch off light and fan after use, plastic free campus, various slogans to protect the environment etc., should be enhanced.
- Activate the environmental clubs to take more responsibility in creating and maintaining an environmental friendly campus.
- The rainwater harvesting system should be made more efficient.
- Construct a water treatment plant. Use the treated water for watering the gardens, lawns and vegetables grown in the campus.
- Installation of a biogas plant to treat biodegradable solid waste.
- Install more solar panels to meet the complete electricity needs of the institution.
- Install methods for the disposal of hazardous wastes and chemicals generated in the laboratories.
- Adopt an appropriate method for the eco-friendly disposal of e-wastes.
- Replace 100 percent incandescent and CFL lamps with LED lights.
- Replace computers with LED monitors.
- Make office administration paperless as far as possible.



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REFERENCES

1. Sunil Patil, BhushanLangi, MinakshiGurav. Green audit in Academins Institutes. International Journal of multidisciplinary educational research, August 2019.
2. Jean H. McCreary, Nixon, Hargrave, Devans& Doyle LLP; C. Smith, Jr., Elizabeth A Potts, Raymond W. Kane. The Evolution of Environmental Auditing. www.disweb.mit.edu/au/envi1178.
3. Mahwar RS, Verma NK, Chakrabarti SP, Biswas DK (1997). Environmental auditing programme in India. Sci Total Environ. 1997 Sep 19;204(1):11-26.
4. en.wikipedia.org.
5. Mary Lissy P N. Carbon Footprint of an Educational Institution as a Technique for Sustainable Development. The International Journal of Engineering and Science (IJES). Volume 1, Issue 2, Pages 196-200, 2012.

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