Green Auditing

SACRED HEART COLLEGE, THEVARA

CMJ Eco Associates

Forum for Ecological Analyses

2015-2016

Green Audit – Executive Summary

Educational institutions now a days are becoming more sensitive to environmental factors and more concepts are being introduced to make them eco-friendly. As environmental sustainability is becoming an increasingly important issue for the nation, the role of higher educational institutions in relation to environmental sustainability is more prevalent. The activities pursued by colleges can create a variety of adverse environmental impacts. The environmental assessment should be conducted in such a way that it provides, as specifically as possible, a baseline reference for future sustainability programming. **Green audit** is **defined** as an official examination of the effects a college has on the environment.

Green audit can be a useful tool for a college to determine how and where they are using the most energy or water or resources; the college can then consider how to implement changes and make savings. It can also be used to determine the type and volume of waste, which can be used for a recycling project or to improve waste minimization plan. Green auditing and the implementation of mitigation measures is a win-win situation for all the college, the learners and the planet. It can also create health consciousness and promote environmental awareness, values and ethics. It provides staff and students better understanding of Green impact on campus. Green auditing promote financial savings through reduction of resource use. It gives an opportunity for the development of ownership, personal and social responsibility for the students and teachers. If self enquiry is a natural and necessary outgrowth of a quality education, it could also be stated that institutional self enquiry is a natural and necessary outgrowth of a quality educational institution. Thus it is imperative that the college evaluate its own contributions toward a sustainable future.

In Sacred Heart College, Thevara the audit process involved initial interviews with management to clarify policies, activities, records and the co-operation of staff and students in the implementation of mitigation measures. This was followed by staff and student interviews, collection of data through the questionnaire, review of records, observation of practices and observable outcomes. In addition, the approach ensured that the management and staff are active participants in the green auditing process in the college.

The baseline data prepared for the Sacred Heart College, Thevara will be a useful tool for campus greening, resource management, planning of future projects, and a document for implementation of sustainable development of the college. Existing data will allow the college to compare its programmes and operations with those of peer institutions, identify areas in need of improvement, and prioritize the implementation of future projects. We expect that the management will be committed to implement the green audit recommendations.

We are happy to submit this green audit report to the Sacred Heart College, Authorities.

Dr. C.M. Joy,
Honorary Secretary
CMJ Eco Associates,
Forum for Ecological Analyses,
Arafa Nagar, CUSAT P.O., Kochi-22.
9447391905 jcheenikkal@gmail.com

25th April, 2016

CONTENTS

Chapter 1

Introduction

The Sacred Heart college established in 1944 by the CMI missionary fathers – reputed educational pioneers managing over 500 educational institutions across India and abroad - on the enchanting shores of Vembanadu backwaters on Thevara Island in Kochi, surrounded by lush greenery and located away from urban bustle, the 3-storeyed majestic structure on the eleven acre campus, spacious in dimensions, simple and elegant in design, is an aesthetic treat. Ever since its origin, the college - fondly called 'Thevara College'- has followed its core philosophy: holistic vision, i.e., harmony of the intellectual, physical and spiritual endeavors enshrined nits motto, *correctuminquirit scientiam* (a righteous heart seeks after wisdom). The college, fondly nurtured and ably steered by visionary leadership, having evolved into a premier centre of higher education through its 72 year-old fruitful academic journey, is now poised at a momentous threshold of its growth.

A multi-faculty, autonomous, coed College affiliated to MG University, Kottayam, Kerala, it offers a variety of conventional and vocational programs

for diverse mix of students from urban, semi urban and rural milieux. Accolades, awards and honours have bolstered its morale in its triumphant march from the modest origin with 29 students in 1944 to the present strength of 2399 (69% girls), spread across 16 UG and 16 PG departments and 6 research centres. The College was chosen as **College with Potential for Excellence** in 2004 by the UGC; the status was extended in 2010 and is still continuing. The college was granted Autonomous Status by the UGC and the State government in 2014.

The college was awarded the highest rating of **FIVE STAR** in the NAAC accreditation in 2000, and in the 2007 re-accreditation, the feat was replicated with **A+ (91.7)**. In 2013, the college was awarded **A Grade** (CGPA 3.30). Academically the college's record has been consistent and commendable, with top ranks and cent percent results almost a routine in many branches such as English, Commerce, Economics, Physics and Zoology. On the sporting arena, the college's credentials have been unrivalled maintaining I or II position in the MG University in games for the past many years, with many of our sportspersons representing the University, the State and the Country.

In the national surveys, for the **Best Fifty Colleges**, undertaken by prestigious media agencies such as *The Week*, and *India Today*, Sacred Heart College was ranked one among the best 30 colleges for science, 40 for arts and 30 for Commerce in the country, while notching up the commendable **I rank** consistently since 2006, among colleges in Kerala.

The number of permanent teachers with PhD now stands at 45, i.e., 50% of the total strength of 91. Teachers with M.Phil as the highest qualification are 18. Forty seven teachers serve in the self-financing stream offering 14

programs both at the PG and UG levels. The faculty has produced 155 international, national and regional publications during the last 3 years. The college also produced 34 PhDs in the given period under the guidance of 28 research guides in various departments. The publication of 2 research journals - Humanities and Sciences - with ISSN, 27 books, and contributions in anthologies also provide ample evidence for the creative vigour of the faculty. Some of the faculty, especially in Sciences are researchers of renown, presenting papers in seminars in world fora held in Switzerland, USA, Germany, Spain, Taiwan and Poland. The achievements in the field of Arachnology are indeed a praiseworthy instance. The faculty have secured 22 minor research projects and 6 major research projects with a total outlay of Rs 18123000/ from various agencies during the last three years.

The college has a well equipped library with 85,752 books, 25 periodicals and 75 journals. It is modernized with computerization, Network, DELNET,EBSCO and INFLIBNET facility. The significant digital makeover of the campus with wi-fi, video conferencing facility, interactive boards, digital library and film studio with state-of-the-art Final Cut Pro - have effected a sea change in the academic environment with laudable benefits for the stakeholders.

The availability of expertise and infrastructure has enabled the college to play a pivotal role vis-à-vis linkage with Government of India and global Universities. A laudable initiative of the College in domain of knowledge extension is the hosting of the **INSPIRE**, a programme of the DST since 2010, to draw Plus 1 students from across the nation to the study of basic sciences. The college has academic collaborations with Auckland University of Technology, New Zealand, Australian Catholic University, Australia, Nihon Fukushi University, Japan, Frazer Valley University, Canada and Juniata College, USA.

SH is a green campus. Proactive measures for environmental protection are organized and executed passionately by the college. An abiding concern for environment in tune with the global concern, underscores the college's present ethos and culture. A part of its energy needs are met by nonconventional sources such as solar and wind power. Visible in every SH act, this concern further reinforces its holistic approach.

1.1 Vision and Mission

Vision

Fashioning of an enlightened society founded on a relentless pursuit of excellence, a secular outlook on life, a thirst for moral values as well as an unflinching faith in God.

Mission

To provide an environment that facilitates

- the holistic development of the individual
- enables the students to play a vital role in the nation building process and contributes to the progress of humanity.
- disseminates knowledge even beyond the academia
- instills in the students a feel for frontier disciplines and cultivates a concern for the environment by setting lofty standards in the ever-evolving teacher learner interface.

1.2 Total Campus Area & College Building Spread Area

Campus area	15.3 Acres
Built up area	18830 Sq. Mts

List of places from where students commute

Cherthala, Aroor ,Kumbalam, Kumbalangi,Netoor,Maradu,Chottanikkara, Arayankavu, Vaikom, Kanjiramattom,Poothotta,Udayamperoor,Puthiyakavu,

Thripunithura, Thoppumpadi,Wellington Island,Fort Kochi,Mattamchery,Palluruthi,Edakochi,Koratty,Angamali, Aluva, Athani, Aluva,Kalamassery,Edappally,Palarivattom, Kaloor, Thevara,MG Road,Ravipuram,Vyttila, North Paravoor, Kodungalloor,Vypin,Cherayi,Varapuzha, Njarakkal, Kakkanadu, Thrikkakkara, Muvattupuzha, Kolachery, Thiruvankulam

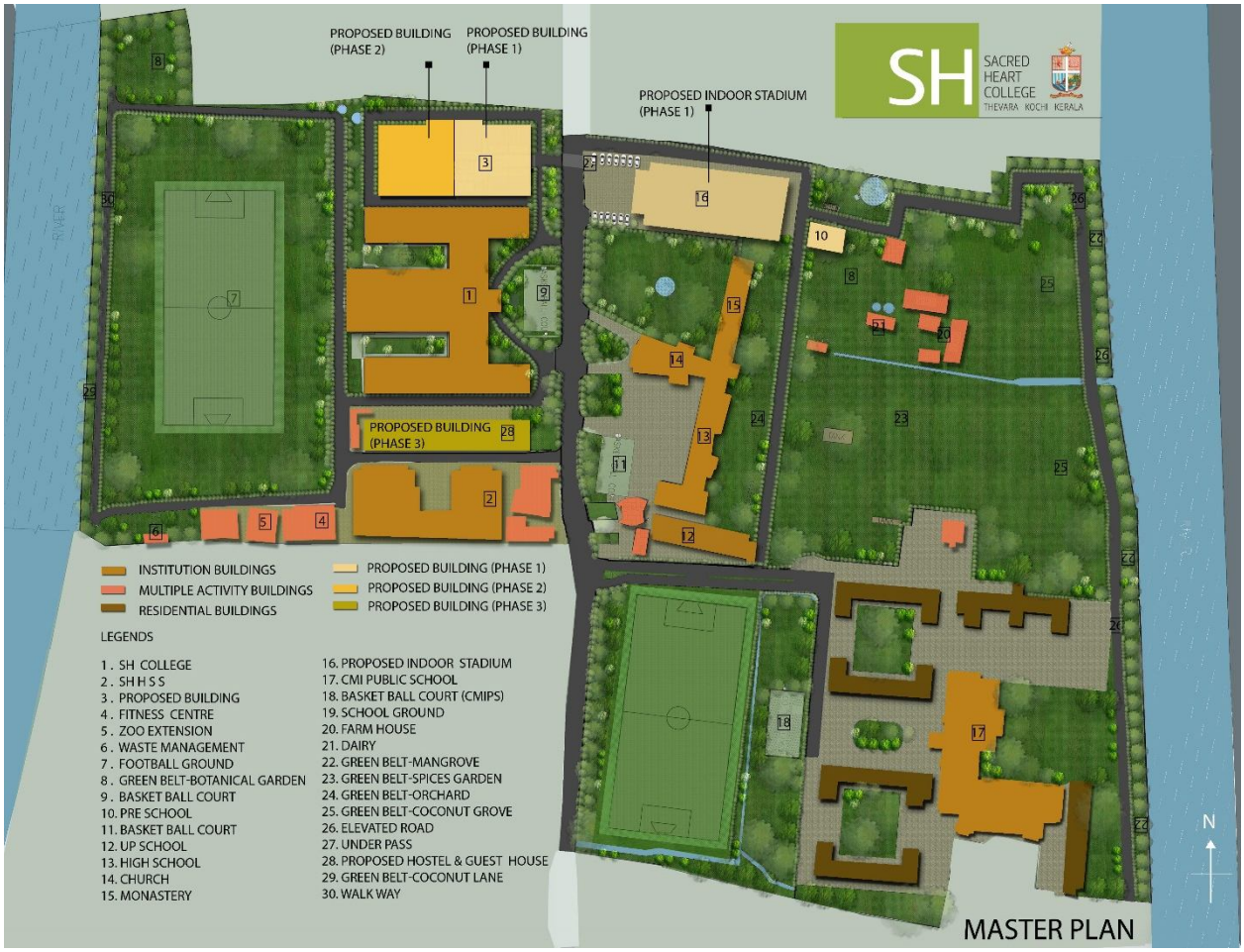
1.3 Previous NAAC grading

Cycle 1: April 17, 2000 Accreditation - **Five Star**

Cycle 2: March 31, 2007 Accreditation – **A+**, Institutional Score – 91.7

Cycle 3: March 23, 2013 Present NAAC grade – **A** Grade – 3.30 CGPA

1.4 Campus Infrastructure



List of Facilities in the College Campus

Water Pollution Testing Facilities
Civil Service Examination Training
Butterfly Garden – Zoology
Energy – Hybrid Energy Unit Source
Bio-gas Plant
Yachting
On Line Entry for internal Marks – Software Developed and Installed
Equal Opportunity Centre
College Bus Facility for Students and Staff
Waste Management Unit at Lakeview Ground
Green House and Medicinal Plant Garden
Student Centre
Smart Class Room for All PG Departments
DELNET, INFILBNET (2010), E-Journal, YMCANET
National History Museum
Sanitary Napkin Vending Machine and Incinerator
Ladies Hostel
Surveillance cameras
Facilities for Remitting Fees at Bank
Health Centre
Recreation and Board Room Facility for Staff
Reprographic Centre in the College Building
Browsing Centre for Students
Internet Access in the PG Class Rooms
Digital Library with the Assistance of MP Fund
E Learning Facility for Staff
Eco Friendly and Green Campus Developed -
Bee Keeping
Paddy Cultivation
Walkers' Lane-600mts – Around the Lake View Ground
Video Conferencing
International Programme in Environment Sciences
Turbine fans

Chapter 2

Pre-Audit Stage

A pre-audit meeting is an important prerequisite for the green audit because it is the first opportunity to meet the auditee and deal with any concerns. This was held at Sacred Heart College, Thevara on October 18th 2015. It was an opportunity to gather documentation that the audit team can study before arriving on the site. The audit protocol and audit plan was handed over at this meeting and discussed in advance of the audit itself. The meeting provided an opportunity to reinforce the scope and objectives of the audit and discussions were held on the practicalities associated with the audit.

2.1 Commitment of the College Management

The Management of the college had shown the commitment towards the green auditing during the pre-audit meeting. They were ready to encourage all green activities. It was decided to promote all activities that were environment friendly such as awareness programs on the environment, campus farming, planting more trees on the campus etc., after the green auditing. The

management of the college will formulate policies based on green auditing report.

2.2 Scope and Goals of Green Auditing

A clean and healthy environment aids effective learning and provides a conducive learning environment. There are various efforts around the world to address environmental education issues. Green auditing is one among them for the educational institutions. A very simple indigenized system has been devised to monitor the environmental performance of Sacred Heart College, Thevara. It comes with a series of questions to be answered on a regular basis. This innovative scheme is user-friendly and totally voluntary. The aim of this is to help the institution to set environmental examples for the community, and to educate the young learners.

2 .3 Benefits of Green Auditing

- ✓ More efficient resource management
- ✓ To create a green campus
- ✓ To enable waste management through reduction of waste generation, solid-waste and water recycling
- ✓ To create plastic free campus and evolve health consciousness among the stakeholders
- ✓ To provide basis for improved sustainability
- ✓ Impart environmental education through systematic environmental management approach and Improving environmental standards
- ✓ Benchmarking for environmental protection initiatives
- ✓ Financial savings through a reduction in resource use

- ✓ Curriculum enrichment through practical experience
- ✓ Development of ownership, personal and social responsibility for the College and its environment
- ✓ Enhancement of college profile
- ✓ Developing an environmental ethic and value systems in young people

Eco-campus concept mainly focuses on the efficient uses of energy and water; minimize waste generation or pollution and also economic efficiency. All these indicators are assessed in process of "Green Auditing of educational institute". Eco-campus focuses on the reduction of the educational institute contribution for emissions of green policy, procure a cost effective and secure supply of energy, encourages and enhance staff and student energy issues, also promotes personal action, reduce the institute energy and water consumption, reduce wastes to landfill and integrate environmental considerations into all contracts and services considered to have significant environmental impacts.

2.4 Target Areas of Green Auditing

- **Auditing for Water Management**

Water is a natural resource; all living matter depends on water. While freely available in many natural environments, in human settlements potable water is less readily available. We need to use water wisely to ensure that drinkable water is available for all, now and in the future. A small drip from a leaky tap can waste more than 180 liters of water to a day; that is a lot of water to waste - enough to flush the toilet eight times!

This indicator addresses water consumption, water sources, irrigation, storm water, appliances and fixtures. Aquifer depletion and water contamination are taking place at unprecedented rates It is therefore essential that any environmentally responsible institution should examine its water use practices.

- **Auditing for Energy Management**

This indicator addresses energy consumption, energy sources, energy monitoring, lighting, appliances, and vehicles. An old incandescent light bulb uses approximately 60W to 100W while an energy efficient light emitting diode (LED) uses only less than 10W. Energy use is clearly an important aspect of campus sustainability and thus requires no explanation for its inclusion in the assessment.

- **Auditing for Waste Management**

This indicator addresses waste production and disposal, plastic waste, paper waste, food waste, and recycling. Municipal solid waste has a number of adverse environmental impacts, most of which are well known and not in need of elaboration. Solid waste can be divided into two categories: general waste and hazardous waste. General waste includes what is usually thrown away in homes and schools such as tins and glass bottles. Hazardous waste is waste that is likely to be a threat to your health or the environment like cleaning chemicals and petrol.

When waste is piled up and left untreated, it causes pollution, which can be harmful to the environment and to your health. In a landfill, as the waste begins to decompose or breakdown, it releases a liquid called leach which can poison the soil and ground water.

Unscientific landfills may contain harmful contaminants that leach into soil and water supplies, and produce greenhouse gases contributing to global climate change. Furthermore, solid waste often includes wasted material resources that could otherwise be channeled into better service through recycling, repair, and reuse. Thus the minimization of solid waste is essential to a sustainable college.

❖ Hazardous Materials

This indicator addresses hazardous wastes of laboratories, medical waste, art supplies, and chemicals used in campus maintenance. Hazardous materials represent significant risks to human health and ecological integrity. They often persist in the environment leaving a legacy of land and water contamination for generations. Many accumulate in the tissues of organisms and become concentrated within food chains, leading to cancer, endocrine disruption, birth defects, and other tragedies. The minimization, safe handling, and ultimate elimination of these materials are essential to the long-term health of the planet.

➢ Auditing for Green Campus Management

Maintaining a biologically diverse environment is the foundation for a healthy planet and human well-being. By examining the habitats, species and areas of your environment, you can determine how biologically diverse your environment is, but more importantly, 'how green your carbon footprint is'

All plant and animal species - including humans - are linked together in a complex web of life; we depend upon biodiversity for our survival. Biodiversity is the key to healthy ecosystems and ultimately a healthy planet. It keeps the

air and water clean, regulates our climate and provides us food, shelter, clothing, medicine and other useful products. Each part within this complex web diminishes a little when one part weakens or disappears. Trees send up water vapour into the atmosphere through their leaves. When this vapour meets the cool air above it turns into drops of water which then fall as rain.

They give us beauty, colour and greenery. They are the homes of many birds, animals and insects. Each of these is important in maintaining the balance of nature. They give us food and juice to drink (think how many fruits we eat). Ropes, medicines, wood, paper, and so many other things we use in our daily life, or which are necessary for our health, are made from trees.

- **Auditing for Carbon Footprint**

How we get around, and to and fro from college each day has an impact on the environment through the emission of greenhouse gases into the atmosphere by the burning of fossil fuels (such as petrol). The most common greenhouse gases are carbon dioxide, water vapour, methane, nitrous oxide and ozone. Of all the greenhouse gases, carbon dioxide is the most prominent greenhouse gas, comprising 402 ppm of the Earth's atmosphere. The release of carbon dioxide gas into the Earth's atmosphere through human activities is commonly known as carbon emissions.

An important aspect of doing an audit is to be able to measure your impact so that we can determine better ways to manage the impact. In addition to the water, waste, energy and biodiversity audits we can also determine what our carbon footprint is, based on the amount of carbon emissions created. One aspect is to consider the distance and method traveled between your home and college every day. The above target areas particular to the college was evaluated through questionnaire circulated to the students for data collection.

Five categories of questionnaires were distributed. The formats of these are given below.

2.5 Survey Forms

I

Green Auditing @ Sacred Heart College, Thevara

Auditing for Water Management

1. List uses of water in your college.
2. What are the sources of water in your college?
3. How many wells are there in your college?
4. No. of motors used for pumping water from each well?
5. What is the total horse power of each motor?
6. What is the depth of each well?
7. What is the present depth of water in each well?
8. How does your college store water?
9. Quantity of water stored in your overhead water tank? (in liters)
10. Quantity of water pumped every day? (in liters)
11. If there is water wastage, specify why.
12. How can the wastage be prevented / stopped?
13. Locate the point of entry of water and point of exit of waste water in your College.
14. Where does waste water come from?
15. Where does the waste water go?
16. What are the uses of waste water in your college?
17. What happens to the water used in your labs? Whether it is mixing with ground water?
18. Is there any treatment for the lab water?
19. Whether your labs are practicing green chemistry methods?
20. Write down four ways that could reduce the amount of water used in your college.
21. Record water use from the college water meter for six months.
22. Bimonthly water charges paid to water connections if any
23. No. of water coolers. Amount of water used per day? (in liters)
24. No. of water taps. Amount of water used per day?
25. No. of bath rooms in staff rooms, common, hostels.

Amount of water used per day?

26. No. of toilet, urinals. Amount of water used per day?
27. No. of water taps in the canteen. Amount of water used per day?
28. Amount of water used per day for garden use.
29. No. of water taps in laboratories. Amount of water used per day in each lab?
30. Total use of water in each hostel?
31. At the end of the period, compile a table to show how many litres of water have been used in the college for each purpose
32. Is there any water used for agricultural purposes?
33. Does your college harvest rain water? If yes, how many rain water harvesting units are there? (Approx. amount)
34. How many of the taps are leaky? Amount of water lost per day?
35. Are there signs reminding people to turn off the water? ___ Yes ___No
36. day?(Approx)
37. Is there any waterless toilets? _____
38. How many water fountains are there? _____
39. How many water fountains are leaky? _____
40. Is drip irrigation used to water plants outside?
41. How often is the garden watered?
42. Amount of water used to watering the ground?
43. Amount of water used for bus cleaning? (liters per day)
44. Amount of water for other uses? (items not mentioned above)
45. Area of the college land without tree/building canopy.
46. Is there any water management plan for the college?
47. Are there any water saving techniques followed in your college? What are they?
48. Please share Some IDEA for how your college could save more water.

II

Green auditing @ Sacred Heart College, Thevara

Auditing for Energy Management

1. List ways that you use energy in your college. (Electricity, electric stove, kettle, microwave, LPG, firewood, Petrol, diesel and others).
2. Electricity bill amount for last one year
3. Amount paid for LPG cylinders for last one year
4. Weight of firewood used per month and amount of money spent? Also mention the amount spent for petrol/diesel/ others for generators?

5. Are there any energy saving methods employed in your college? If yes, please specify. If no, suggest some.
6. How much money does your college spend on energy such as electricity, gas, firewood, etc. in a month.(Record monthly for the year 2016).
7. How many CFL bulbs has your college installed? Mention use (Hours used/day for how many days in a month)
8. Energy used by each bulb per month? (for example- 60 watt bulb x 4hours x number of bulbs = kWh).
9. How many LED bulbs has your college installed? Mention use (Hours used/day for how many days in a month)
10. Energy used by each bulb per month? (kwh).
11. How many incandescent (tungsten) bulbs has your college installed? Mentions use (Hours used/day for how many days in a month)
12. Energy used by each bulb per month? (kwh).
13. How many fan has your college installed? Mention use (Hours used/day for how many days in a month)
14. Energy used by each fan per month? (kwh)
15. How many air conditioner has your college installed? Mention use (Hours used/day for how many days in a month)
16. Energy used by each air conditioner per month? (kwh).
17. How many electrical equipment including weighting balance has your college installed? Mentions use (Hours used/day for how many days in a month)
18. Energy used by each electrical equipment per month? (kwh).
19. How many computer has your college installed? Mention use (Hours used/day for how many days in a month)
20. Energy used by each computer per month? (kwh)
21. How many photocopier has your college installed? Mention use (Hours used/day for how many days in a month).
22. How many cooling apparatus has your college installed? Mention use(Hours used/day for how many days in a month)
23. Energy used by each cooling apparatus per month? (kwh) Mention use (Hours used/day for how many days in a month)
24. Energy used by each photocopier per month? (kwh) Mention use (Hours used/day for how many days in a month)ow many inverters your college installed? Mentions use (Hours used/day for how many days in a month)
25. Energy used by each inverter per month? (kwh)

26. How many electrical equipment used in different labs of your college ? Mentions use (Hours used/day for how many days in a month)
27. Energy used by each equipment per month? (kwh)
28. How many heaters used in the canteen of your college ? Mention use (Hours used/day for how many days in a month)
29. Energy used by each heater per month? (kwh)
30. No of street lights in your college?
31. Energy used by each street light per month? (kwh)
32. No of TV in your college and hostels?
33. Energy used by each TV per month? (kwh)
34. Any other item that uses energy (Please write the energy used per month) Mentions use (Hours used/day for how many days in a month)
35. Are any alternative energy sources/nonconventional energy sources employed / installed in your college? (photovoltaic cells for solar energy, windmill, energy efficient stoves, etc.,) Specify.
36. Do you run "switch off" drills at college?
37. Are your computers and other equipment put on power-saving mode?
38. Does your machinery (TV, AC, Computer, weighing balance, printers, etc.) run on stand by modes most of the time? If yes, how many hours?
40. What are the energy conservation methods adapted by your college?
41. How many boards displayed for saving energy awareness?
42. How much ash collected after burning fire wood per day in the canteen?
43. Write a note on the methods/practices/adaptations by which you can reduce the energy use in your college campus in future.

Calculation of energy for electrical appliances

Appliance	Power used in (watt)	Usage per day (hours)	Number of appliances	Average kWh per day (Watt X hours X Number X 1000)	Average kWh per month (Watt X hours X Number X 1000 x 30)
Incandescent bulb	60 watt				
CFL	18 W				
Microwave	1000W				
Stove	3000W				
Kettle	2500W				

I I I

Green auditing @ Sacred Heart College, Thevara

Auditing for Waste Management

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

	No. of Students	No. of Teachers	No. Non teaching staff
Gents			
Ladies			
Total			

Which of the following are available in your College? Give area occupied and number

Garden area	Garbage dump (number)
Play ground area	Laboratory
Kitchen	Canteen
Toilets (number)	Car/scooter shed area
Number of class rooms	Office rooms
	Others (specify)

- Which of the following are found near your college?

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

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

WASTE

Does your college generate any waste?
If so, what are they? How much quantity? Number or weight
E-waste
Hazardous waste (toxic)
Solid waste
Dry leaves
Canteen waste
Liquid waste

Glass
Unused equipment
Medical waste if any
Napkins
Others (Specify)

- Is there any waste treatment system in the college?
- Is there any treatment for toilet/urinal/sanitary napkin waste?
- What is the approximate amount of waste generated per day? (in Kilograms) (approx.)

Office

Approx	Bio degradable	Non-Bio degradable	Hazardous	Others
< 1 kg.				
2 - 10 kg.				
> 10 kg.				

Laboratories

Approx	Bio degradable	Non-Bio degradable	Hazardous	Others
< 1 kg.				
2 - 10 kg.				
> 10 kg.				

Canteen / kitchen

Approx	Bio degradable	Non-Bio degradable	Hazardous	Others
< 1 kg.				
2 - 10 kg.				
> 10 kg.				

- Why waste is a problem?
- Whether waste is polluting ground/surface water? How?
- Whether waste is polluting the air of the college? How?
- How is the waste generated in the college managed? Methods
  1 Composting
  2 Recycling
  3 Reusing
  4 Others (specify)

- How many separate boxes do you think you would need to put into a classroom to start a waste segregation and recycling campaign? What would each be used for? (Develop a colour code with reasons)
- Do you use recycled paper in College?
- Is there any waste wealth programme practiced in the college?
- How would you spread the message of recycling to others in the community? Have you taken any initiatives? If yes, please specify.
- Can you achieve zero garbage in your college? (Reduce ,Recycle, Reuse, Refuse)If yes, how?

IV

Green auditing @ Sacred Heart College, Thevara

Auditing For Green Campus Management

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

20. Any threatened plant species planted/conserved.
21. Is there a nature club in your college? If yes what are their activities?
22. Is there any arboretum in your college? If yes details of the trees planted.
23. Is there any fruit yielding plants in your college? If yes details of the trees planted.
24. Is there any groves in your college? If yes details of the trees planted.
25. Is there any irrigation system in your college?
26. What is the type of vegetation in the surrounding area of the college?
27. What are the nature awareness programmes conducted in the campus? (2014-15)
28. What is the involvement of students in the green cover maintenance?
29. What is the total area of the campus under tree cover? Or under tree canopy?
30. Share your IDEAS for further improvement of green cover.

V

Green auditing @ Sacred Heart College, Thevara

Auditing for Carbon Footprint

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

No. of Students No. of Teachers No. of Non teaching staff

Gents

Ladies

Total

2. Total Number of vehicles used by the stakeholders of the college.(per day)
3. No. of cycles used
4. No. of two wheelers used (average distance travelled and quantity of fuel and amount used per day)
5. No. of cars used (average distance travelled and quantity of fuel and amount used per day)
6. No. persons using common (public) transportation (average distance travelled and quantity of fuel and amount used per day)
7. No. of persons using college conveyance by the students, nonteaching Staff and teachers (average distance travelled and quantity of fuel and amount used per day)
8. Number of parent-teacher meetings in an year? Parent turn out (approx.)

9. Number of visitors with vehicles per day?
10. Number of generators used every day (hours). Give the amount of fuel used per day.
11. Number of LPG cylinders used in the canteen (Give the amount of fuel used per day and amount spent).
12. Quantity of kerosene used in the canteen/labs (Give the amount of fuel used per day and amount spent).
13. Amount of taxi/auto charges paid and the amount of fuel used per Month for the transportation of vegetables and other materials to canteen.
14. Amount of taxi/auto charges paid per month for the transportation of Office goods to the college.
15. Average amount of taxi/auto charges paid per month by the stakeholders of the college.
16. Use of any other fossil fuels in the college (Give the amount of fuel used per day and amount spent).
17. Suggest the methods to reduce the amount of use of fuel by the stakeholders/students/teachers/non teaching staff of the college.

Chapter 3

Audit Stage

Green auditing was done by CMJ eco-associates involving different student groups , teaching and non-teaching staff. The green audit began with the teams walking through all the different facilities at the college, determining the different types of appliances and utilities (lights, taps, toilets, fridges, etc.) as well as measuring the usage per item (Watts indicated on the appliance or measuring water from a tap) and identifying the relevant consumption patterns (such as how often an appliance is used) and the impact that they have. The staff and learners were interviewed to get details around usage, frequency or general characteristics of certain appliances. Data collection were done in the sectors such as Energy, Waste, Greening, Carbon footprint and Water uses. College records and documents were verified several times to clarify the data received through survey and discussions. The whole process was completed within five months period, *ie.* 2015 November to March, 2016.

3.1 Student groups involved

List of students – Energy Audit

Jincymol Joseph, III BSc Physics

Amal V Sreedhar, III BSc Physics

Keerthana K, III BSc Physics

Nilah A R, III BSc Physics

Catherine Jose, III BSc Physics

Arshy Thankachan, III BSc Physics

K B Sreelakshmi, III BSc Physics

Mary Anila Xavier, III BSc Physics

Mary Nivitha Bivera, III BSc Physics

Gayathree M Vinod, III BSc Physics

Aleena James, III BSc Physics

Arpitha Ann James, III BSc Physics

Ajin Joy, III BSc Physics

Fathima V S, III BSc Physics

Akhila P Mony, III BSc Physics

Taniya Rodriguez, III BSc Physics

Livi George, III BSc Physics

Jobin Mathew Jose, III BSc Physics

Sahil P Jose, III BSc Physics

Namitha Mariya Emmanuel, III BSc Physics

Dinu T David, III BSc Physics

Jismary Devassy, III BSc Physics

Ayana Jose, III BSc Physics

Anjaly Jobai, III BSc Physics

Suvarna Ganesh, III BSc Physics

Mavadigothi Ruby, III BSc Physics

Alma Reji, III BSc Physics

Jayakrishnan K Ravindran, III BSc Physics

Water Auditing – Women's Cell

Ashly John,III BSc CA

Aiswarya Raju, III BSc CA

Kajal CP,III BSc CA

Sneha Pual, III BSc CA

Sreepriya R.,III BSc CA

Meera Manohar, III B Com CA

Rahila Sulaiman, III B Com CA

Sayeeda Mol D.M., III B Com CA

Fidha Faizal, III B Com CA

Athria Suresh, III BA Economics

Carbon Footprint – NCC Group

Anand Menon

Jjibin Joseph

Rose Veneetha Bivera

Maria Jeremy Shaji

Stebin Mathew

Waste Auditing – NSS

Riya Marium Joseph, II B Com Taxation

Saranyamol K.M., II B Com Taxation

Elna V Raji, II B Com Taxation

Jeena K Benny, II B Com Taxation

Anand Balakrishnan, II B Com Taxation

Abhimaneu T.A., II B Com Taxation

3.2 Student Clubs and Forums

Nature Club, Tourism Club, Bhoomithrasena, ENCON Club, NSS, NCC, and Department level associations

3.3 Comments on Site Tour

Site inspection was done along with students and staff. It was quite interesting and fascinating. It was an environmental awareness programme for the students who participated in the green auditing. The experience of green auditing was first of its kind for most of the students. They have shared their expectations about a green campus and gave suggestions for the audit recommendations.

3.4 Review of Documents and Records

Documents such as admission registers, registers of electricity and water charge remittance, furniture register, laboratory equipment registers, purchase register, audited statements, and office registers were examined and data were collected. College calendars, college magazines, annual report of the college and NAAC self-assessment reports, UGC report etc. were also verified as part of data collection.

3.5 Review of Policies

Discussions were made with the college management regarding their policies on environmental management. Future plans of the college were also discussed.

3.6 Interviews

In order to collect information for green auditing different audit groups interviewed office staff, Principal, Teaching and non-teaching staff, students, parents and other stakeholders of the college. Discussions were also made with the PTA office bearers to clarify doubts regarding certain points.

3.7 Site Inspection

College and its premises were visited and analyzed by the audit-teams several times to gather information. Campus trees were counted and identified, vegetable garden, play grounds, canteen, library, office rooms and parking grounds were also examined to collect data.

Chapter 4

Post Audit Stage

4.1 Key Findings and Observations

a) Water Management

- Water uses for different purpose
- No water treatment system in place.
- Number of urinals and toilets – 65
- No waterless urinals
- Number of bathrooms – 41
- Number of water taps – 168 (a few are leaky)
- Taps in canteen and cafeteria – 25
- Taps in labs - 151
- No of wells – 3 (Depth 4, 5, 6 meters respectively)
- No of Motors – 3 (5 HP each)
- Quantity of water pumped – 9000 liters/day
- Water charges paid – Rs.8620/Bimonthly

- Water used for garden use – 10000 liters/day (3 hours a day)
- Water use for bus cleaning – 200 liters/week
- No water coolers with drinking water filtration installed – 8 (4000 litres/day)
- Water use in hostels – 45000 liters/day
- Rainwater harvesting systems present – 2

Purpose	**Amount of water used per day**
Drinking (water purifiers)	4000 liters
Washing	30,000 liters
Gardening	10000 liters
Hostel use	45000 liters
Total	89000 liters/day

b) Energy Management

- Electricity charges Rs.142392.5/month
- Number of gas cylinders used – 75.5
- Cost of Gas cylinders used Rs. 520800/year (Rs.560/cylinders)
- Monthly amount paid for electricity and gas – Rs. 185792.5 (2016)
- Cost of generator fuel – Rs.1000/month
- Energy generated by the biogas plant equivalent to 1.5 LPG cylinders
- No. CFL bulbs – 613
- No LED bulbs - 102
- No. incandescent bulbs – 15
- Fan – 531
- Ac – 17
- Computer – 251

- Water pumps – 4
- Tubes – 837
- Photocopier – 2
- Printers – 45
- Water purifier – 8
- LCD projector – 34
- Television – 11
- No of inverters – 2
- No water heaters – 11
- CCTV systems and monitors - 3
- Fridge - 8
- Freezers - 8
- Grinders – 4
- Washing Machine – 1

Auditing for Energy Management

Appliance	Power (Watt)	Usage per day (hrs)	Number of appliance	Total Energy (Whr)	Units of current per month
Tubelight1	20	6	22	79200	79.2
Tubelight2	40	6.347	815	6207366	6207.366
Fan	75	7.246	531	8657158.5	8657.1585
CFL	15	7.398	613	2040738.3	2040.7383
Computer	350	5.898	251	15544179	15544.179
Printer	260	2.834	45	994734	994.734
Fridge	400	18.75	8	1800000	1800
Laptop	60	8.121	123	1797989.4	1797.9894
LED	5	3.812	102	58323.6	58.3236
TV	140	4.458	11	205959.6	205.9596

Grinder	350	2	4	84000	84
Washing machine	700	0.5	1	10500	10.5
Water purifier	20	20.667	8	99201.6	99.2016
Iron box	800	1	2	48000	48
Projector	300	2.209	34	675954	675.954
AC1	1000	14.412	15	6485400	6485.4
AC2	9750	1	2	585000	585
Photostat machine	1000	1	2	60000	60
Incandescent bulb	40	2	15	36000	36
CCTV system	1500	24	1	1080000	1080
CCTV monitor	69	24	2	99360	99.36
Sound system	3324	4	6	2393280	2393.28
Motor pump1	2625	1.5	1	118125	118.125
Motor pump2	1125	0.75	1	25312.5	25.3125
Motor pump3	750	2	2	90000	90
Scanner	3	2.008	4	722.88	0.72288
Tread mill	1800	6	2	648000	648
Offset press	5965.6	1.1	1	196864.8	196.8648
Mini Offset	745.7	1	2	44742	44.742
Stitching machine	372.85	1.33	1	14876.715	14.876715
Cutting machine	1491.4	0.16	1	7158.72	7.15872
Freezer	350	21.742	8	1826328	1826.328

Precision balance	55	1	20	33000	33
Induction cooker	90	0.68	5	9180	9.18
Electric kettle	1000	1	2	60000	60
Centrifuge	250	2.167	6	97515	97.515
Hot air oven	10000	1.12	5	1680000	1680
Auto clave distillation	60	0.9667	3	5220.18	5.22018
Inverter	200	10	4	240000	240
UV/Na/Hg lamp	100	10	2.704	81120	81.12
Evacuator vacuum	746	1	1	22380	22.38
Vacuum oven	250	0.5	5	18750	18.75
Vacuum pump	746	1	1	22380	22.38
Shaker	373	0.5	2	11190	11.19
Muffler furnace	10000	0.5	1	150000	150
Heating mantle	100	1	1	3000	3
Conductivity meter	20	1	1	600	0.6
Calorimeter	20	0.5	1	300	0.3
Laser class	10	2.125	4	2550	2.55
BOD incubator	186	0.5	1	2790	2.79
Rota vapour	60	7	1	12600	12.6
Distilled water unit	25	5	1	3750	3.75
CRO	90	2.75	17	126225	126.225

RF oscillator	10	1	2	600	0.6
Signal generator	25	3	10	22500	22.5
Four probe setup	25	3	1	2250	2.25
Bar magnet app	50	3	2	9000	9
Gauss meter	10	2	2	1200	1.2
Hall effect	500	2	2	60000	60
BG	12	0.5	1	180	0.18
Battery charger	250	5	1	37500	37.5
ID printer	20	3	1	1800	1.8
Server	850	8.5	1	216750	216.75
Water bath	1000	0.875	3	78750	78.75
Laminar air flow	250	2	2	30000	30
Magnetic stirrer	8.5	1	1	255	0.255
Spectrophotometer	170	0.6	3	9180	9.18
Cooling incubator	186	24	3	401760	401.76
Aerator1	3	24	2	4320	4.32
Aerator2	150	24	2	216000	216
Stabilizer	80	0.2	5	2400	2.4
Microwave oven	1000	1	1	30000	30
DVD player	30	4	5	18000	18
Vacuum coating	5000	0.1	1	15000	15
Total electricity consumption				**55754.47 Units**	

c) Waste Management

- **Total Stakeholders**

	Students	Teachers	Non-Teaching Staff
Gents	888	95	42
Ladies	1538	40	12
Total	2426	135	54

- Class rooms – 98
- Other rooms – 12
- E-wastes- computers, electrical and electronic parts – Disposal by selling
- Plastic waste- disposal by selling
- Solid wastes – Damaged furniture, paper waste, paper plates, food wastes – to Municipal waste collection centres
- Chemical and hazardous wastes – Battaries, Laboratory waste (dry pit)
- Waste water – washing, urinals, bathrooms
- Glass waste – Broken glass wares from the labs
- Waste treatments – biogas plant and compost system, chicken feed uses
- Napkin incinerator - 2
- Garbage heaps – 2
- Stagnant water areas – 3

Quantity of waste generated:-

Place of Generation (per day)	Biodegradable	Non-Biodegradable	Hazardous
Office and college campus	Papers, dry leaves, cartons and napkins 10 kg	Plastics 1 kg	Electrical and electronic wastes 1kg
Laboratories	Paper wastes 1 kg	Plastics, chemicals and glass 2 kg	½ kg
Canteen/Kitchen /Foodies corner	Food waste 66 kg/day	Plastics ½ kg	-

d) Green Campus Management

Total number of plant species identified – 222

Total campus area under tree cover – 1 Acre

LIST OF PLANTS in the college campus

1. *Abelmoschus esculentus*
2. *Acacia chundra*
3. *Acorus calamus*
4. *Aegle marmelos*
5. *Alangium salvifolium*
6. *Alpinia calcrata*
7. *Alstonia scholaris*
8. *Amaranthus dubius*

9. *Amaranthus spinosus*
10. *Amorphophallus Paeonifolius*
11. *Ananas comosus*
12. *Anisomalous asiatica*
13. *Annona squamosa*
14. *Anthurium sp*
15. *Antiaris toxicaria*
16. *Aporusa lindleyana*
17. *Ardisia littoralis*
18. *Areca catechu*
19. *Artocarpus altilis*
20. *Artocarpus hetrophyllus*
21. *Artocarpus hirsutus*
22. *Asparagus racemosus*
23. *Averrhoa Bilimbi*
24. *Averrhoa billimbi*
25. *Azadirachta indica*
26. *Bambusa vulgaris*
27. *Benincasa hispida*
28. *Biophytum sensitivum*
29. *Boerhavia diffusa*
30. *Butea monosperma*
31. *Calotropis gigantia*
32. *Cananga odorata*
33. *Capsicum fruitescens*
34. *Careya arborea*
35. *Carica papaya*
36. *Carissa carenda*
37. *Cassia occidentalis*

38. *Cassia tora*
39. *Centella asiatica*
40. *Chamaecostus cuspidatus*
41. *Chromolena odorata*
42. *Cinnamomum zeylanicum*
43. *Cissus quadrangularis*
44. *Citrus limon*
45. *Clerodendron paniculatum*
46. *Clerodendron sp*
47. *Clerodendron viscosum*
48. *Clusia sp*
49. *Cocos nucifera*
50. *Couropitia guianensis*
51. *Cucurbita pepo*
52. *Cuphaea sp*
53. *Curcuma aromatica*
54. *Curcuma longa*
55. *Cynodon dactylon*
56. *Cynometra travancorica*
57. *Dioscorea alata*
58. *Diospyros buxifolia*
59. *Diospyros ebony*
60. *Eclipta alba*
61. *Elaeocarpus tuberculatus*
62. *Elattaria cardamomum*
63. *Emelia sonchifolia*
64. *Epipremnum aureum*
65. *Euphorbia hirta*
66. *Ficus benghalensis*

67. *Ficus racemosa*
68. *Ficus religiosa*
69. *Flacourtia montana*
70. *Garcinia gummigutta*
71. *Garcinia xanthochymus*
72. *Gliricidia sepium*
73. *Glochidion ellipticum*
74. *Gossypium sp*
75. *Hibiscus rosa sinensis*
76. *Holoptelia integrifolia*
77. *Hopea*
78. *Hopea parviflora*
79. *Humboldtia bourdillonii*
80. *Hydnocarpus pentandra*
81. *Luffa acutangula*
82. *Mallotus philipinensis*
83. *Mangifera indica*
84. *Manihot esculenta*
85. *Manilkara zapota*
86. *Meiogyne ramarawii*
87. *Mentha sp*
88. *Mesua ferrea*
89. *Michelia champaca*
90. *Mimusops elengi*
91. *Moringa oleifera*
92. *Murraya koenijii*
93. *Musa sp*
94. *Myristica fragrans*
95. *Myxopyrum serratulum*

96. *Neolamarkia cadamba*
97. *Nerium oleander*
98. *Ocimum Basilicum*
99. *Oxalis corniculata*
100. *Pajanalia longifolia*
101. *Pandanus sp*
102. *Percea americana*
103. *Persea americana*
104. *Phyllanthus amarus*
105. *Phyllanthus emblica*
106. *Pimenta Dioica*
107. *Piper longum*
108. *Pisum sativum*
109. *Plectranthus amboinicus*
110. *Polyalthia longifolia*
111. *Pongamia pinnata*
112. *Pouteria lucuma*
113. *Premna glaberrima*
114. *Psidium guajava*
115. *Punica granatum*
116. *Quiscalis indica*
117. *Salacia fruiticosa*
118. *Samania saman*
119. *Saraca asoka*
120. *Smilax zeylanica*
121. *Solanu sp*
122. *Spondias pinnata*
123. *Strychnos nuxvomica*
124. *Swetinia macrophylla*

125. *Symplochos laurina*
126. *Syzygium cumini*
127. *Syzygium samarangense*
128. *Tabebua rosea*
129. *Tamarindus indicus*
130. *Tectona grandis*
131. *Terminalia arjuna*
132. *Tetrameles nudiflora*
133. *Tinospora cordifolia*
134. *Tragia involucrata*
135. *Tridax proccumbens*
136. *Vatica chinensis*
137. *Vatteria indica*
138. *Vernonia sineria*
139. *Writia tinctoria*
140. *Zingiber officinale*
141. *Vanilla sp*
142. *Bogainvillaea sp*

Medicinal Plants in the College Medicinal Plants Garden

Area for medicinal plant garden – 5 cents

1	*Acacia chundra*	1
2	*Acorus calamus*	4
3	*Aegle marmelos*	2
4	*Alangium salvifolium*	2
5	*Alpinia calcrata*	4
6	*Alstonia scholaris*	1
7	*Anisomalous asiatica*	6
8	*Antiaris toxicaria*	1

9	*Asparagus racemosus*	8
10	*Azadirachta indica*	1
11	*Biophytum sensitivum*	180
12	*Boerhavia diffusa*	28
13	*Butea monosperma*	1
14	*Calotropis gigantia*	11
15	*Careya arborea*	1
16	*Carissa carenda*	2
17	*Cassia occidentalis*	54
18	*Cassia tora*	32
19	*Centella asiatica*	86
20	*Chamaecostus cuspidatus*	1
21	*Chromolena odorata*	18
22	*Cissus quadrangularis*	28
23	*Clerodendron paniculatum*	16
24	*Clerodendron sp*	1
25	*Clerodendron viscosum*	27
26	*Curcuma aromatica*	12
27	*Curcuma longa*	9
28	*Cynodon dactylon*	800
29	*Eclipta alba*	76
30	*Elaeocarpus tuberculatus*	2
31	*Emelia sonchifolia*	230
32	*Euphorbia hirta*	600
33	*Ficus benghalensis*	1
34	*Ficus racemosa*	1
35	*Ficus religiosa*	4
36	*Garcinia gummigutta*	1
37	*Garcinia xanthochymus*	2

38	*Holoptelia integrifolia*	1
39	*Mallotus philipinensis*	1
40	*Mesua ferrea*	1
41	*Mimusops elengi*	3
42	*Myxopyrum serratulum*	2
43	*Neolamarkia cadamba*	1
44	*Ocimum basilicum*	12
45	*Oxalis corniculata*	87
46	*Pajanalia longifolia*	1
47	*Phyllanthus amarus*	214
48	*Phyllanthus emblica*	1
49	*Piper longum*	42
50	*Plectranthus amboinicus*	1
51	*Pongamia pinnata*	2
52	*Premna glaberrima*	1
53	*Salacia fruiticosa*	1
54	*Saraca asoka*	2
55	*Strychnos nuxvomica*	1
56	*Symplochos laurina*	1
57	*Syzygium cumini*	1
58	*Terminalia arjuna*	2
59	*Tinospora cordifolia*	29
60	*Tragia involucrata*	17
61	*Tridax proccumbens*	216
62	*Vernonia cineria*	459
63	*Writia tinctoria*	1
64	*Hygrophila schuli*	2
65	*Hygrophila auricuata*	8
66	*Ipomoea sepiaria*	4

67	*Curculigo orchioides*	2
68	*Cardiospermum helicacabum*	8
69	*Evolvulus alsinoides*	32
70	*Aloe vera*	2
71	*Catharanthus roseus*	18
72	*Plumbago roseus*	4
73	*Bacopa monieri*	16
74	*Andrographis panicullata*	4
75	*Cyperus rotundus*	273
76	*Cleome viscosa*	76
77	*Strobilanthes ciliatus*	3
78	*Chasalia curviflora*	2
79	*Argyria hirsuta*	1
80	*Leucas aspera*	24

Nakshatra Marangal (Star trees)

Planting saplings corresponding to the zodiac signs was a major initiative of the college. The campus boasts of two sets of Star Trees, and two butterfly gardens, under the guidance of college.

കാഞ്ഞിരം (Strychnos nux-vomica), നെല്ലി (Emblica officinalis), ആത്തി(Ficus racemosa),ഞാവല് (Syzygium cumini), കരിങ്ങാലി(Acacia catechu), കരിമരം (Diospyros ebenum), മുള(Bambusa bambos), അരയാല് (Ficus religiosa),നങ്ക് (Mesua ferrea), പരോല് (Ficus benghalensis), പ്ലാശ് (Butea monosperma), ഇത്തി (Ficus tinctoria), അമ്പഴം (Spondias pinnata), കൂവളം (Aegle marmelos), നീർ മരുത്(Terminalia arjuna), വയ്യം

കതെ (Flacourtia jangomas), ഇലഞ്ഞി (Mimusops elengi), വട്ടെി(Aporusa lindleyana), വള്ളെ പനൈ് (Vateria indica), വഞ്ചി(Salix tetrasperma), പ്ലാവ് (Artocarpus heterophyllus), എരിക്ക് (Calotropis gigantea), വന്നി (Prosopis juliflora), കടമ്പ് (Anthocephalus cadamba), മാവ് (Mangifera indica), കരിമ്പന (Borassus flabellifer), ഇലിപ്പ (Madhuca longifolia)

Special Trees on the campus

Calamus rotang Linn (chooral - cane)
Cynometra travancorica (Endemic and Endangered) *Fabaceae*- Koori
Cynometra beddomei (Endemic and Endangered) *Fabaceae* - Koori
Hopea racophloea (Endemic and Endangered) *Dipterocarpaceae* -
Vateria indica (Endemic and Endangered)- *Dipterocarpaceae* - Vellapine
Vatica chinensis (Endemic and Endangered)-*Dipterocarpaceae* - Adakkapine
Terminalia bellerica (Medicinal)- *Combretaceae* - Thanni
Hydnocarpus pentandra (Endemic & medicinal) - Marotti
Antiaris toxicaria (Moraceae) (Medicinal and Endemic) – Marvuri
Santalum album – Sandal wood – Chandanam

List of plants used for campus cultivation

Area for vegetable cultivation – 30 cents

µøæÈÜ
É Ï V
ÕÝáÄÈ
æÄ B

º àø

æÕ I

Ä A Þ{ß

µÞç Ì ¼

çµÞ{ßË ÕV

ÉÞÕ Ï A

ÎÇáø A ßÝ B

ç º O

ç º È

Fruit yielding plants in the campus

- Guava (*Psidium guajava)*
- Passion fruit (*Passiflora edulis*)
- *Syzygium jambolina*
- *Mangifera indica*
- *Artocarpus heterophyllus*
- *Averhoa bimbili*
- *Phyllanthus emblica*
- *Phyllanthus acidus*

Harvest details during the year 2015 (Season)

- Amaranthus -10kg
- Capsicum- Capsicum sp.2 Kg
- Brinjal- Solanum melongena-5kg
- Pea- Phaseolus sps-120 kg
- Lady's Finger-Abelmoschus esculentus-5 kg
- Tomato – Lycopersicon Esculentum-3Kg

- Cauliflower – Brassica Oleracea-25Kg
- Paddy – 2.5 tons
- *Cajanus cajan* (Thuvara payar) 2 kg

Harvested vegetables are sold out among staff and students

e) Carbon footprint

	Students	Teachers	Non-Teaching Staff
Gents	888	95	42
Ladies	1538	40	12
Total	2426	135	54

Use of fossil fuels

No. persons using cars – 71 (151.3 liters petrol/diesel/day)

No. persons uses two wheelers – 199 (77 liters petrol/day)

Persons using other transportations – 1100 (17400kms)

No. persons using cycles – 24

No. visitors per day - 15

Average distance travelled by stakeholders – 50 kms/day (on an average/year)

Money spent for transportation by per person per day – Rs.30/-

Number of buses to the college – 2 (100 students)

Number PTA meetings per year – 2 (400-500 persons for each meeting)

Generators used – 62 KV (15-20 liters of diesel/month)

Quantity of LPG used per month – 32 kg (Rs 2425)

Quantity of biogas used – 3 kg/day

Amount spent for transportation (office) – Rs 2000/- Month. Approx.)

Amount spent for transportation (canteen) – Rs 6000/- Month. Approx.)

Amount spent for transportation (Stakeholders) – Rs 25000/- Year. Approx.)

4.2 Evaluation of Findings

Water

Water Audit at Sacred Heart College, Thevara					
1	2	3	4	5	6
Activity	Average litres of water used per activity (litres)	Number of times activity done each day	Total water used by a person each day (litres)	Number of people in the College using water	Total household water consumption per day (Litres)
Wash hands and face	1	3 times a day	3 L	2500	7500
Bath (Hostel)	10-30 L	twice	30 L	200	6500
Toilet flush	6-20	once	10 L	2200	22000
Drinking (cup)	0.5	twice	2 L	2000	4000
Washing dishes	8-10	twice	5 L		25000
Leaking/dripping tap	10	continuous		A few taps	10 L
Garden	-	once			10000
Cooking (average)	3/person	once		2000	6000
Lab uses	2	5	3	1500	4500

Bus wash					30
Miscellaneous use					2470
Total water use	89000 L/day				

The college requires 89000 liters of water per day for different uses. The main source of water is ground water. Water from the public water supply is also utilized. 10 L of water per day is lost through the leaking of pipes. This can be prevented and other sources of water may be identified. If water treatment system is installed at canteen and chemical laboratories the amount of water lost can be prevented. A major preference to the recycling of water may be adopted in the college for an efficient water management. Awareness programs for the management of sustainable water use will be highly efficient in this college.

Energy

1	2
Appliances	**Average kWh per month**
Tube light	6286.566
CFL	2040.7383
Photocopier	60
Fan	8657.1585
AC	7070.4
Computers	15544.179
Water pump	233.4375

Printers	994.734
Water filter	99.2016
LCD Projector	675.954
Sound systems	2393.28
Laboratory uses	11698.8311
Total power consumption – 55754.47 kWh/month	

The total energy utilization of the college for different purposes is approximately 55754.47 kwh/month. A hybrid source of energy comprising solar and wind type of non-conventional category of energy will be a good energy management system for the college. Electricity charges per month is Rs.142392.5/month. Energy saving through the replacement of incandescent bulbs to LED light may be a good energy management system for the college. Awareness programs for the stakeholders to save energy may also increase sustainability in the utilization of various energy source. Present attempts towards exploiting solar and wind energy is appreciated.

Waste

Biodegradable waste = 77 kg/day

Non-biodegradable waste = 3 ½ kg/day

A composting pit is highly essential for the treatment of bio degradable waste generated from the canteen, office, vegetable garden and from the college campus cleaning operations. Different methods such as pit composting, vermi-composting, bacterial composting using bacterial consortium, may be used to treat the bio degradable waste. Hazardous waste generated from the college can be collected properly and may be handed over to the local self-

governments treatment yards. Bottles, plastics, cans, broken glass wares, tins etc., may be recycled or sold out.

Green Campus

There are many greening initiatives in the college.

Total area for cultivation:-

Area for vegetable cultivation - 40 cents

Campus under tree cover – 1 Acre

Cultivation of medicinal plants – 5 cents

Paddy fields - 3 ½ Acre

A model arboretum will be ideal for the college. At least 100 different types of trees can be planted in the campus.

Carbon Footprint

Petrol used by two wheelers/day 199 L (1 L for 20kmx2=40 km/day)

Petrol/diesel used by four wheelers 142 L (2 L for 20x2=40km)

For persons travelling by college bus (Diesel) = 16 L

(4 L x 50 persons x 2 times)

For persons travelling by common transportation = 12 L (1100 persons)

Total fossil fuel use is 370 L / day

Generators used – 62 KV (15-20 liters of diesel/month)

Quantity of LPG used per month – 32 kg (Rs 2425)

Amount spent for transportation (office) – Rs 2000/- Month. Approx.)

Amount spent for transportation (canteen) – Rs 6000/- Month. Approx.)

Amount spent for transportation (Stakeholders) – Rs 25000/- Year. Approx.)

Burning of fossil fuels is the main source and cause of carbon dioxide release to the atmosphere. Carbon dioxide release for the stakeholders to reach the college is very high. It is contributing to the global warming and increasing the pace of climate change. If a College bus is plying for the staff and students carbon dioxide released for the stakeholders can be reduced. More trees may

be planted in the campus to make a source of sink for the carbon dioxide and for other green house gases.

Suggestions from the College

Save Water Programs to be Implemented

- Increase employee, faculty, and student awareness of water conservation.
- Install signs in all rest rooms encouraging water conservation.
- When cleaning with water is necessary, use budgeted amounts.
- Determine the quantity and purpose of water being used.
- Install flow reducers and faucet aerators in all plumbing fixtures whenever possible.
- Reduce the water used in toilet flushing by adjusting the vacuum flush mechanism
- Shut off water supply to equipment rooms not in use.
- Instruct clean-up crew to use less water for mopping.
- Change window cleaning schedule from periodic to an on-call/as required basis.
- Use low flow showerheads and faucets
- Leak detection technology which allow us to detect and correct leaks
- Rather than watering manually during the daytime the college should implement smart irrigation system that water during the evening or early morning hours, saving evaporation as well as overspray.

Save Energy Programs to be Implemented

- Increase the number of solar panels.
- Car pooling and usage of cycles for transportation have to be promoted among students and faculties.
- Boards have to be displayed for save energy awareness.
- In order to save energy, old energy inefficient appliances should be replaced by efficient ones.

- More wind mills can be installed near the Lakeview ground and promote save energy awareness through boards and classes.

Waste Management Programs to be Implemented

- Implement proper waste disposal methods.
    - Composting to be strengthened
- Reduce the usage of hazardous items and plastics in the campus.
- Reusing of papers and recycling of waste products generated.
- Stop polluting water sources by throwing waste and chemicals.
- Prevent the flow of chemical wastes from laboratories into water sources.

Green Campus Programs to be Implemented

- Theme based garden such as Medicinal, Timber, Vegetable & Endemic shall be appropriate for the college
- Proper irrigation and maintenance by employing a Gardner would improve the garden
- More space for garden is inevitable as the space allotted is limited

Programs to be Implemented to Reduce Carbon Foot Print

- Car pooling – Even though some teachers make use of the car pooling system, the majority of the staff do not practice. If carpooling is practiced by more staff, the college can save more fuel.
- Pooling of auto/taxi – students can follow auto pooling so that they can save money and thus reduce the carbon foot print.
- Biogas plant – An additional biogas plant can be initiated
- Students may be encouraged to use public transport system

Existing Environment Policy of the College

Sacred Heart College is committed to protection and promotion of life on the planet. It believes in 'go-green and grow green'. As a matter of practice, it shall,

- Seek to spread and deepen awareness on environment issues and an environment friendly life-style among the academic community and neighbourhood community
- Pay special attention to minimizing waste, with 'zero waste' as the ideal, managing it properly with advance planning of this aspect of our activities/programs/celebrations, and avoiding/minimizing the use of disposables and flex banners
- Introduce recycling at the student level through entrepreneurship development cell, and at the college level, by establishing a paper recycling unit in due course
- Tap renewable energy resources and introduce water recycling by 2019.
- Protect and promote diversity, especially of indigenous and coastal flora and fauna and their documentation.
- promote organic vegetable and food production on and off-campus

4.3 Suggestions for Green Campus

- Allocate more space for planting trees.
- Create automatic drip irrigation system during summer holidays.
- Improve Botanical gardens and greenhouses
- Installation of composting facilities on campus
- Increasing local and organic food options in campus dining halls
- Collect rain water for watering purpose of gardens
- Not just celebrating environment day but making it a daily habit
- Beautifying the entire campus with indoor plants
- Providing funds to nature club for making campus more green

- Encouraging students not just through words, but through action for making the campus green
- Conducting competitions among departments for making students more interested in making the campus green.

4.4 Consolidation of Audit Findings

We hope that you will have developed a greater appreciation and under-standing of the impact of your actions on the environment. You have successfully been able to determine your impacts on the environment through the various auditing exercises. The green auditing exercise have brainstormed and implemented practical ways to reduce your negative impact on the environment. Participating in this green auditing procedure you have gained knowledge about the need of sustainability of the college campus. It will create awareness about the use of the Earth's resources in your home, college, local community and beyond.

4.5 Major Audit Observations

- There is an environmental policy statement indicating the commitment of the college towards its environmental performance.
- Gardens inside the college premises are found well maintained.
- Use of notice boards and signs are inadequate to reduce over exploitation of natural resources.

Water Audit

- There is no water consumption monitoring system in the college campus.

- The college does not have waste water treatment for waste water generated from laboratories, canteen, hostel kitchen, toilets, bathrooms and office rooms.
- The waste water from canteen and kitchens are not suitably controlled and are not used for gardening.
- The college has taken initiative for rain water harvesting. Rain water harvesting for separate buildings are lacking. Study on measurement of water quantity from the rain water harvesting should be measured.
- Automatic switching system is not installed for pump sets used for overhead tank filling.

Energy Audit

- The communication process for awareness in relation to energy conservation found inadequate.
- Assessment of electrical load calculation is yet to be done by the college.
- Objectives for reducing energy, water and fuel consumptions are meager.
- High energy consuming incandescent lights and fluorescent lights are found in use.
- There are fans of older generation and non energy efficient which can be phase out by replacing with new energy efficient fans.

Waste Audit

- Model solid waste management systems established are insufficient.
- E-waste and glass wastes generated from office, Computer science department and science laboratories are not handled through authorized service providers.
- The college has proper communication with the local body for regular collection of solid waste from the campus.

- Implementations of sustainable projects to attain set environmental goals are not in place.

Green Campus Audit

- Tree cover of the college with respect to the stakeholder strength is not enough.

Carbon Foot Print Audit

- College has not yet taken any initiative for carbon accounting.
- Common transportation facilities provided by the college are inadequate.

4.6 Preparation of Action Plan

Policies referring to your College's management and approach's towards the use of resources need to be considered. The environmental policy formulated by the management of the college should be implemented meticulously. Where there are policies they need to be listed as part of your analysis documentation. The college should have a policy on awareness raising or training programs (for ground staff or kitchen staff for example) and college also should have a procurement policy (the College's policy for purchasing materials). Based on the policies college should have an action plan. The green auditing report will be a base line data for the action plan to be evolved.

4.7 Follow Up Action and Plans

Green Audits are exercises which generate considerable quantities of valuable management information. The time and effort and cost involved in this

exercise is often considerable and in order to be able to justify this expenditure, it is important to ensure that the findings and recommendations of the audit are considered at the correct level within the organisation and that action plans and implementation programs result from the findings.

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

4.8 Environmental Education

The following environmental education programs may be implemented in the college before the next green auditing:-

- Training programs in solid waste management, liquid waste management, setting up of medicinal plant nursery, water management, vegetable cultivation, paddy cultivation, tree planting, energy management, landscape management, pollution monitoring methods, and water filtration methods.
- Increase the number of display boards on environmental awareness such as – Save water, save electricity, No wastage of food/water, no smoking, switch off light and fan after use, plastic free campus etc.,
- Activate the environmental clubs
- Set up model rainwater harvesting system, rainwater pits, vegetable garden, medicinal plant garden, paddy fields etc., for providing proper training to the students.
- Conduct exhibition of recyclable products
- Display various slogans to protect environment
- Implement chemical treatment system for waste water from the laboratories.

4.9 Conclusion and Full List of Recommendations

Green audits can “add value” to the management approaches being taken by the college and is a way of identifying, evaluating and managing environmental risks (known and unknown). The green audit reports assist in the process of attaining an eco friendly approach to the development of the college. Hope that the results presented in the green auditing report will serve as a guide for educating the college community on the existing environment related practices and resource usage at the college as well as spawn new activities and innovative practices.

List of recommendations

1. Increase the capacity of biogas plant and compost units
2. More Solar panels should be installed to generate electricity
3. Planting of 10 trees/year in the campus
4. Allot more area for vegetable and medicinal plant gardens
5. Purchase of college a few more buses
6. Increase the number of water taps and set up recycling of water system
7. Install waste water system for chemistry labs
8. Use green chemistry in all chemical labs
9. Set up an efficient water recycling system in the college canteen
10. Install more rain water harvesting systems
11. Organize more programmes on earn while learn eco-friendly projects
12. Arrange more training programmes on environmental management System and nature conservation
13. Tap more wind energy through wind mills
14. Declare the campus plastic free and arrange awareness programmes frequently to make the campus plastic free
15. Set up a common waste water treatment plant

16. Establish a e-waste collection centre
17. Participation of students and teachers in local environmental issues
18. Renovation of cooking system in the canteen to save gas
19. Establish a purchase policy for environmental friendly materials
20. Replace incandescent lamps with LED lights
21. Replace all computers with LED monitors
22. Conduct seminars and workshops on environmental education
23. Establish water, waste and energy management systems
24. Avoid plastic plates and plastic items in the college functions
25. Set up a nursery for plants to be distributed among the students
25. The College needs to develop a monitoring and measurement program for resources such as water, electricity, LPG and other fuel consumptions
26. The college may take initiative for community plantation program by involving students to reduce the carbon emissions.
27. An electric car/scooter can be purchased by the college and use solar energy to charge it. So the office expenses for local use can be reduced and carbon emission can also be reduced.
28. Promotion of cycling and walking among students and staff of the college
29. More solar panels may be installed and linked with the KSEB

Actions recommended from green audit are mainly minor adjustments in management practices (e.g. replace incandescent light bulbs with less energy demanding products). Some actions require purchases to replace inefficient items. Such action could be expected to be implemented between audits or at least considered and rejected, based on factors other than environmental protection grounds.

Chapter 5

Exit Meeting

The exit meeting was conducted by the lead auditor Dr. C.M. Joy and was the mechanism to feedback broad, preliminary findings to management and staff before the audit team completing the audited report. The exit meeting was held in the college on 10th April, 2016. Clarification on certain information gathered was sought by the audit team from the management and staff of the college.

Draft Audit Report

The information gathered by the audit team was consolidated and written up as a draft audit report. This draft report was then circulated to the audit team and those directly concerned with the audit. The purpose is to check the report for accuracy. The draft green audit report was also discussed in the exit meeting.

Final Audit Report

The final audit report is the corrected final document which contains the findings and recommendations of the audit. This was submitted on 25th April, 2016 to the Principal of the college.

Follow up and Action Plans

Green audits form a part of an on-going process. Innovative green initiatives have to be designed and implemented every year to make the college environmentally sustainable. We hope that you will have a greater appreciation and understanding of the impact of your actions on the environment. Hence you will create awareness around the use of the Earth's resources in your home, college, local community and beyond.

Next Audit

In order to promote continuous improvement it is recommended to conduct the next green auditing during the year 2018.

Acknowledgements:-

CMJ Eco Associates are thankful to the Management and the ***Principal of the Sacred Heart College, Thevara*** *for entrusting processes of Green auditing with us. We thank all the participants of the auditing team especially students, faculty and non-teaching staff who took pain along with us to gather data though survey. We also thank the office staff who helped us during the document verification.*

PHOTOGRAPHS

Cycle Expedition

Ground Water Recharging

Rain water Harvesting

Tree Planting

Drive against plastics

Paddy Cultivation

Fruitipeedika

Energy Auditing

Vegetable Cultivation

Forest Visit

Nature Study Trip

Medicinal Plants Exhibition

Exit Meeting