GREEN AUDIT REPORT

2023 - 2024

Emmanuel College

(Affiliated to the University of Kerala)

Vazhichal, Kudappanamoodu PO,

Thiruvanathapuram – 695 505, Kerala

Submitted by

Energy Management Cell

St. Xavier's Catholic College of Engineering

CONTENTS

CHAPTER NO.	CHAPTER TITLE	PAGE NO.
1	INTRODUCTION	1
2	CARBON AUDIT TOOLS AND ANALYSIS	6
3	ENERGY SAVING MEASURES AND CARBON FOOTPRINT REDUCTION	12
4	SOLAR PLANT	16
5	TRANSPORT SYSTEM AND CARBON EMISSION	17
6	WATER AUDIT	18
7	SUGGESTIONS AND RECOMMENDATIONS	19

CHAPTER 1

INTRODUCTION

The green audit team is delighted to submit the Green Audit report for Emmanuel College, Vazhichal for the period 2023 – 2024. This report focuses on the Carbon Foot Print reduction measures being implemented by the College Management in close coordination and assistance by the Eco Club of the institution. The Green audit was conducted in the campus on 24th November 2023.

The concept, structure of the audit, its objectives, methodology, tools of analysis, time frame of the Audit, the themes and cross cutting themes are detailed below.

THE CONCEPT

The term environmental audit or green audit means different things to different people. Terms like assessment, survey and review are also used to describe the same type of activities. Furthermore, some organizations believe that an "environmental audit" addresses only environmental matters, whereas others use the term to mean an audit of health, safety and environmental related matters. Although there is no universal definition, green auditing, as practiced by many leading companies/institutions, follows the same basic philosophy and approach summarized by the broad definition adopted by the International Chambers of Commerce (ICC) in its publication Environmental Auditing (1989).

The ICC defines Environmental Auditing as: "A management tool comprising a systematic, documented periodic and objective evaluation of how well environmental organization, management and equipment are performing with the aim of safeguarding the environment and natural resources in its operations/projects".

The European Commission in its proposed regulation on environmental auditing also adopts the ICC definition of environmental audit. However, the outcome of Green Audit should establish with concrete evidence that the measures undertaken and facilities in the institution under green auditing reduces carbon foot print in the atmosphere.

Carbon Foot print is historically defined as the total set of greenhouse gas emissions caused by an individual, event or organization, and expressed as carbon dioxide equivalent.

EMMANUEL COLLEGE, VAZHICHAL – A BRIEF PROFILE

Emmanuel College, Vazhichal was founded by a group of daring young priests who had lofty dreams on behalf of the common people of this region. They took a great leap into the unknown hoping to obtain for their brothers and sisters, the knowledge of the most advanced developments in modern science and technology, which was once considered beyond their reach. They aimed at rapid and qualitative growth of human resources of this part of the State and so to enable an ever-increasing number of young people of rural and urban Kerala to excel themselves in the most highly advanced and ultra-modern high-tech fields of education. The college is managed by Catholic Educational and Charitable Society (Reg. No. 409/82)

The College is affiliated to the University of Kerala and recognised by the Government and empowered to conduct Graduate and Post Graduate Degree programmes.

The College has a huge and beautiful building with sufficient infrastructure. All the class rooms are well furnished with separate table and chair for individual students. The college has a well-equipped library.

The college provides well-furnished lab facility with all sophisticated most modern instruments. Auditorium is furnished with sufficient facilities. There is an outdoor stadium, Canteen, stationery and other necessary arrangements provided within the campus itself.

The following courses are offered by the institution. The courses are;

UG Courses

- B.Sc. - Computer Science
- B.Sc - Electronics
- B.Sc -Biochemistry
- B.Sc - Botany and Biotechnology
- B.Sc - Physics & Computer Application
- B.Sc - Geography
- B.Com - with Computer Application
- B.Com - Commerce & Tourism and Travel Management
- B.Com - Finance
- B.A - English Language & Literature

- B.A - English & Communicative English
- B.Com - Co-Operation

PG Courses

- M.Sc - Biochemistry
- M.Sc - Geography
- M.Sc - Physics
- M.Com - Finance

OBJECTIVES OF GREEN AUDITING

The objectives are needed to define quantitative and qualitative level of achievement of Emmanuel College, Vazhichal – herein after referred to as institution - in terms of Carbon Foot Print reduction.

The objectives of green audit at Emmanuel College

- To assess whether the measures implemented by Emmanuel College, Vazhichal have helped to reduce the carbon foot print in the atmosphere.
- To assess whether the investments made in electricity power management, biodiversity and environment consciousness among the students have helped the institution to achieve the required carbon dioxide absorption and emission in the campus of the institution
- To assess whether the non-academic activities of the institution support the collection, recovery, reuse, recycling of the solid waste that harms the environment.
- To identify the gaps and suggest recommendations to improve the green campus status of the institution.

METHODOLOGY ADOPTED

The methodology adopted to conduct Green Audit in the Institution has the following components;

On site visit

The energy management cell of St.Xavier's Catholic College of Engineering, Nagercoil visited the institution on 24-11-2023 to assess the greenhouse gas emissions from the institution, carbon foot print reduction measures and energy efficient devises. The key focus was to assess the green cover and the flora status of the institution.

Focused Group Discussion

The focused group includes members of Eco Club and selected staff and students of Emmanuel College, Vazhichal. The discussion focused on identifying the attitudes and awareness towards environmental issues at the institution level, district level, national level and global level was done. The discussion revolved around three key questions; Do they consider themselves eco-conscious? Do they consider the organization to be eco-friendly? What do they think are the top priorities that should be tackled?

The Office/ Building Survey

Collecting information on the office-based environmental impacts, like square footage, utility bills, energy saving devises, and IT equipment. This information is added to the carbon footprint data, giving an accurate picture of the organization's annual greenhouse gas emissions and reduction measures.

The Carbon Footprint

- The data collected from the following sources are taken into consideration to calculate Carbon Foot Print emissions and reductions; the flora status of the campus like total number of plants, trees, shrubs – alternate green energy production and consumption to reduce fossil fuel-based energy. The number of fluorescent lamps, CFL and LED tube lights to improve energy efficiency in the campus/ building through our carbon footprint calculator is also taken in to account.

- The carbon foot print calculator will enable the institution to measure annual tons of carbon emissions by the institution. Besides, it will enable the institution to break it down by key "carbon drivers" so that the institution knows how much of carbon

footprint comes from which type of behaviour (e.g. high power consuming incandescent bulbs vs. LED lights, LPG cylinder vs. Bio Gas etc.).

Green Audit Assessment Team

Sl.no	Name	Designation
1.	Dr. M Marsaline Beno	BEE Certified Energy Manager, Professor & Dean for Research, Head - Energy Management Cell /SXCCE
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CHAPTER 2

CARBON AUDIT TOOLS AND ANALYSIS

A **carbon footprint** is defined as "the total set of greenhouse gas emissions caused by an individual, event, organization or product expressed as **carbon** dioxide equivalent."

FLORA STATUS OF THE INSTITUTION

The projected area of the institution is given below,

Total area of the campus = 12 acres

Built – up area = 2.765 acres

Projected area = 9.234 acres.

The area taken into consideration for data collection of flora is only the projected area.

Calculation calendar of Trees

560 to 700 fully grown trees shall be raised in one acre of land. This depends on the type of soil, the species/ family type of the tree and spacing. However, with the normal spacing of 6x10 feet, the total number of trees shall be taken up as 600/acre.

However, this calculation is not applicable in the slopes of the hill that also constitutes one part of the projected area. Nature raises trees, bush plants and shrubs without manmade spacing and hence they are thickly populated and defies head count. However, the Eco Club members of Emmanuel college has made an approximate survey of the number of flora in the projected area.

Sl.no	Status of trees/plants/ bush trees	Number/area
1	Total number of fully grown trees in the non-hilly area	42
2	Total number of fully grown trees in the hilly slopes	35
3	Total number of semi grown trees in non-hilly area	55
4	Total number of semi grown trees in the hilly slopes	34
5	Total number of shrub plants in the campus	111
6	Total number of bushes plants in the campus	360
7	Buffalo Variated Grass	750 sq.ft

8	Mexican Grass	450 sq.ft

The fifth and sixth calculations are based on the empirical evidence found out in controlled plots elsewhere in the country. As per this evidence, 9,000 to 10,000 bush trees shall be raised in one acre of land and 3,600 shrub plants shall be raised in one acre of land.

CARBON ABSORPTION BY FLORA IN THE INSTITUTION

Assumptions to measure carbon absorption

1. Number of mature trees in one acre = 700 trees
2. Carbon absorption capacity of 700 trees is equivalent to carbon emitted by a speeding car for 26,000 miles
3. Conversion of 26,000 miles into Kilometre is = 41,843 KM
4. Average Kilometre covered by a car per litre of petrol is 20 KM
5. Total quantity of petrol consumed by the car (41,843/20) = 2092 litres

The carbon emission by one litre of petrol is 2.3 Kg of CO_2. At this rate the total quantity of carbon emitted by 2092 litres of petrol is (2092 x 2.3 kg) = 4812 kg CO_2 or 4.8 tons of CO_2. Therefore, the carbon absorption of one fully grown tree is 4812/700 = 6.8 Kg of CO_2

The foot print calculation is based on the standard unit of one litre petrol = 2.3 Kg. CO_2.

Calculation of Carbon Absorption by flora

Carbon absorption of one fully grown tree = 6.8 Kg of CO_2.

1. Therefore, the carbon absorption of 77 fully grown trees in hilly slopes and plain lands of the institution is (77× 6.8 Kg. CO_2) = **523.6 Kg. CO_2 or 0.523 tons of CO_2**
2. At this rate the carbon absorption of 89 semi grown trees is half or 50% of the carbon absorption capacity of fully grown trees**.** Hence the carbon absorption is **(89 × 3.4 Kg. CO_2) = 302.6 Kg. CO_2 or 0.302 tons**

3. There are approximately 471 plant bushes and shrubs estimated to be raised by nature that belong to the projected area. This is based on the random counting of bush and shrub plants in the projected area.

   Carbon absorption of plants, bushes and shrubs vary widely according to the species, Genus and Family. Certain bush plants absorb as high as 49,000 grams CO_2 per plant where as some other bush plants absorb as low as 150-gram CO_2 per plant. In the absence of a detailed scientific study and botanical survey of the species of bush and thorny plants along the hilly slopes, it is fixed that per plant carbon absorption at 200 gram per plant in consultation with environment scientists.

   Based on this the total carbon absorption of 471 (360+ 111) plants is calculated at 471 x 200 grams = 94,200 grams or 94.2 Kilograms. If it is converted into tons, it is **0.0942 tons of CO_2.**

4. The institution maintains two grass fields. They are Buffalo Variated Grass with 750 sq.ft and Mexican Grass with 450 sq.ft. Thus, the total area of grass fields is 1,200 sq.ft. The carbon absorption capacity of 10 sq.ft area of grass is 1 gram CO_2. At this rate 1,200 sq.ft area of grass absorbs **120 gram or 0.12 Kg CO_2 per day.**

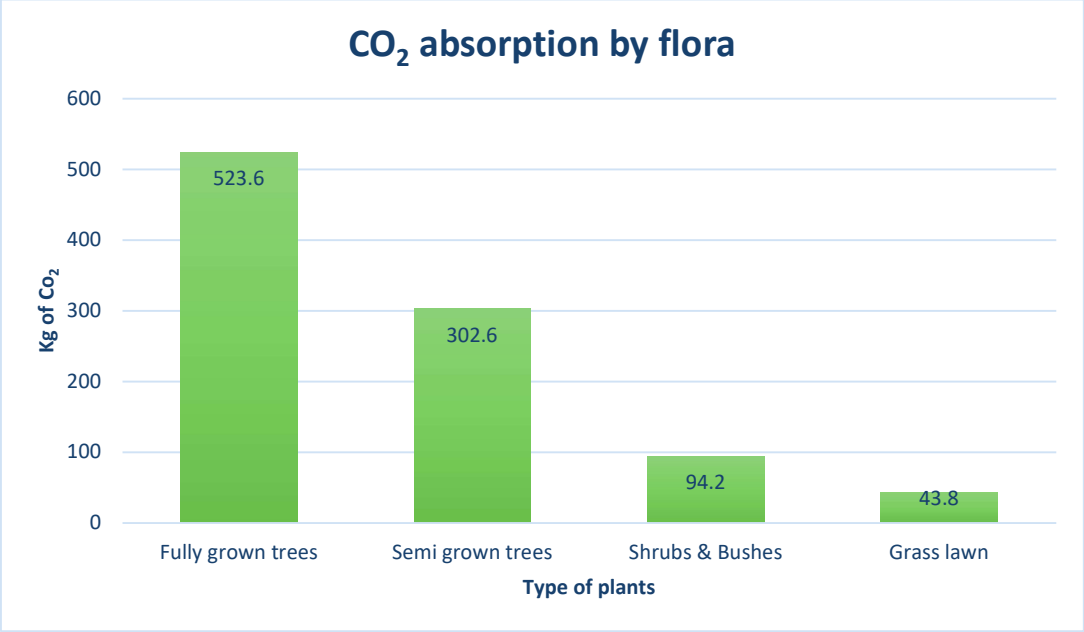
   At this rate, total carbon absorption per year is 0.12 Kg x 365 = **43.8 Kg or 0.0438 ton per year**

   The grant total of carbon absorption of the flora in the campus of Emmanuel College, Vazhichal is (1+2+3+4) = **964.2 Kg per year**

This is the sink effect of the Flora in the campus and the proactive Carbon Foot Print reduction measures.

Table 1: CO_2 absorption by Flora in the institution

Sl.no	Type of trees/ bushes	Number of trees/ bushes/ areas of grass	CO_2 absorption by flora (Kg)
1	Fully grown trees	77	523.6
2.	Semi grown trees	89	302.6
3	Bush plants	471	94.2
4	Grass lawn (sq. feet)	1200	43.8
		Total	**964.2**



OXYGEN EMISSION BY FLORA AT EMMANUEL COLLEGE

According to the Arbor Day Foundation, "A mature leafy tree produces as much oxygen in a season as 10 people inhale in a year." A person breathes 7 or 8 litres of air per minute. Air consists of about 20% oxygen. But when you exhale, your breath is about 15% oxygen, so you consumed about 5%. Therefore, a person uses about 550 litres of pure oxygen each day.

Calculation of oxygen emission by flora

The number of litres in 1 kilogram depends on the density of the substance being measured. The litre is a unit of volume, and the kilogram a unit of mass. Litre and kilogram are approximately equivalent when the substance measured has a density close to 1 kilogram per litre.

"On an average, one fully grown tree produces nearly 260 pounds or 117.6 kg of oxygen each year. Two mature trees can provide enough oxygen for a family of four persons."

Kilogram is considered for calculation.

1. Total Kg. of oxygen emitted by 77 fully grown trees per year is

(117.6 x 77) = **9,055.2 Kg. of Oxygen or 9.055 tons of oxygen**

2. Total oxygen emitted by semi grown trees (89×58.8) = **5,233.2 kg oxygen** or 5.233 tons of oxygen **(**oxygen emission is half or 50% of the fully grown-up tree)

3. Total oxygen emitted by 471 (111 + 360) plants is calculated based on the following oxygen inhaling requirement per person/day. One normal human being requires 550 litres of oxygen per day to avoid airlock. 400 bush plants produce enough oxygen per day to enable a person to breathe adequate quantity of oxygen of 550 litres. Total quantum of oxygen produced by 400 plants per day is 550 litres of oxygen.

If we take 400 plants as one unit, then the number of units of bush plants in the campus is (471/400) = 1.1775

Total quantity of oxygen produced by 1.1775 units is (1.1775 x 550 litres) = 647.625 litres of oxygen per day.

The annual production of oxygen at this rate is (647.625 x 365) = 2,36,383.125 litres or Kg. of oxygen. If this is converted into tons, it is approximately **236.383 tons**

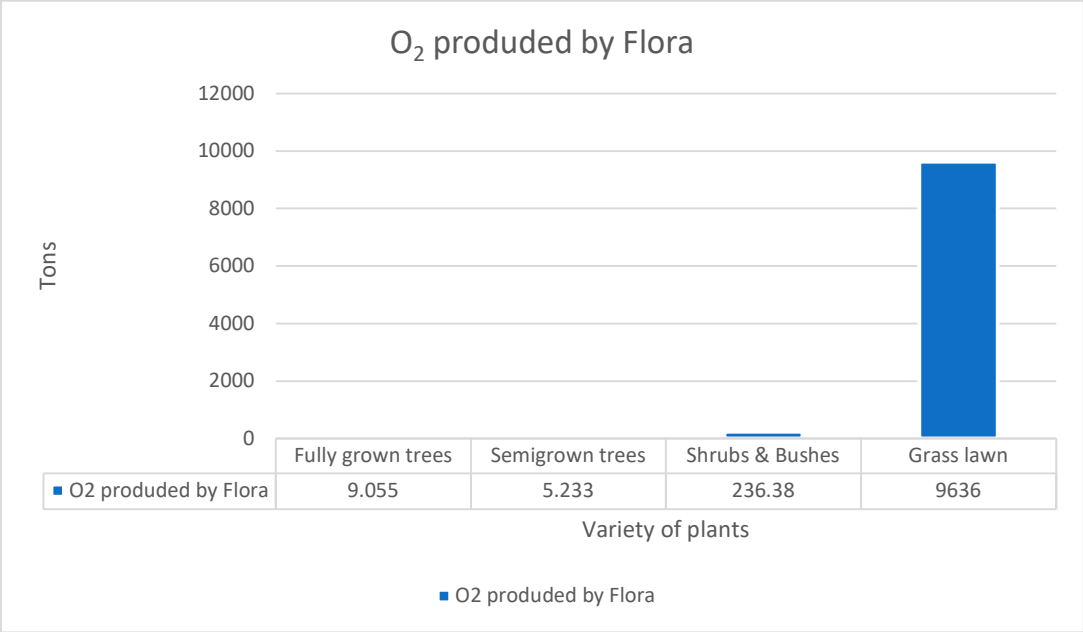
4. Grass lawns are incredible oxygen making machines. A 25 square foot area will supply enough oxygen to support one person for a day. In other words, quantitatively speaking, 25 square foot area of grass produces 550 liters of oxygen per day.

   Hence, we take 25 square foot area as one unit which is equivalent to 550 litres of oxygen.

Total area of grass land is 12,000 sq.ft. If we calculate units, it is 1,200/25 = 48 units which produces (48 x 550 litres of oxygen) = 26,400 litres of oxygen per day

Total quantity of oxygen produced by the 750 sq.ft Buffalo variety and 450 sq.ft. Mexican Grass is (26,400 litres/day x 365 days) = 9,636,000 **litres of oxygen or approximately 9,636 tons of oxygen.**

Sl.no	Type of trees/plants	Number of trees/plants/ area of grass	Oxygen produced by flora in tons
1	Fully grown trees	77	9.055
2	Semi grown trees	89	5.233
3	Shrubs and Bushes	471	236.383
4	Grass lawns (sq.ft)	1200	9,636
		Total	**9,886.671**



CHAPTER 3

ENERGY SAVING MEASURES AND CARBON FOOT PRINT REDUCTION

The Energy Audit Report of the College during the period 2023 – 2024 reveals that the total consumption of electricity is majorly due to fans, tube lights and air conditioners.

ENERGY CONSUMPTION WITH INCANDECENT BULBS FOR LIGHTING

Energy consumption of incandescent bulbs is taken as reference source to calculate the reduction of CO_2 emission through the installation of LED and CFL bulbs or tubes. Also, bulbs and tubes with power rating below 60 watts has been taken to calculate carbon emission reduction. The following table illustrates the total Incandecent lamps used (as reference only for calculation) and the energy consumed by them,

Sl. No.	Contents	Value
1	Total no. of incandescent lamps used as reference	417
2	Average power consumption by an incandescent lamp.	60 W
3	Energy consumed by 417 lamps for 5 hrs/day.	125.1 units
4	Energy consumption of 417 lamps for 200 days/ year. (417 x 60 watts x 5 hrs x 200 days)	25,020 units

CO_2 REDUCTION THROUGH ENERGY EFFICIENT MEASURES

Emmanuel College is conscious of the damages to the atmosphere due to carbon emission and has been implementing various programs/ activities to reduce energy consumption on one hand and increasing green energy sources on the other hand. They are;

1. Replacing high energy consuming lighting system with energy efficient lighting systems
2. Replacing No star rated air conditioners with star rated AC.
3. Installed capacity of 50 KW solar PV power system to produce 9,125 units of electricity per year.

CARBON FOOT PRINT REDUCTION ANALYSIS

First, it is appropriate to analyse the carbon emission of 25,020 units of electricity consumed by 417 incandescent lamps per year. The standard tool of analysis employed in this green Audit is coal equivalent of electricity.

0.538 Kg. of coal is required to produce one unit of electricity.

Total units of electricity consumed by 417 incandescent lamps = 25,020 units

Coal equivalent of 25,020 units (25,020 x 0.538 Kg. coal) = 13,460.76 **kg or 13.46 tons of coal.**

One Kg of coal emits 2.86 Kg of CO_2 into the atmosphere.

At this rate, 13,460.76 Kg of coal emits (**13,460.76 x 2.86) = 38,497.77 Kg CO_2 into the atmosphere or 38.497 tons of CO_2**

The following are the CO_2 reduction measures adopted in the institution.

The institution has installed 40 CFL bulbs in the college with a rating of 18 Watts each.

18 watts CFL lamps

One 18 watts lamp consumes (18 watts x 5 hours) 90-Watt hours of electricity per day. At this rate one lamp consumes (200 x 90-watt hours) 18,000-watt hours per year. If it is converted into units, it is 18,000/1,000 = 18 units. 40 lamps consume (18 units x 40) = 720 units. 720 units require (720 x 0.538) = 387.36 Kg of coal. This quantity of coal emits (387.36 x 2.86) **= 1,107.85 Kg of CO_2**

The carbon emission of 40 incandescent lamps with 60 watts capacity is (60 watts x 40 x 5 hours x 200/ 1,000 x 0.538 x 2.86) **= 3,692.832 Kg of CO_2**.

If we deduct 3,692.832 from the above amount, we get the carbon reduction as (3,692.832 – 1,107.85) = 2,584 Kg of CO_2 or **2.58 tons of CO_2**

9 watts LED lamps

The institution has installed 36 LED lamps with 9 watts capacity. The carbon emission during the reporting period is 9 watts x 36 lamps x 5 hours x 200 days / 1,000 x 0.538 x 2.86 = 498.53 Kg. CO_2 or **0.498 tons CO_2**

The carbon emission of 36 incandescent lamps with 60 watts capacity is (60 watts x 36 lamps x five hours x 200 days / 1,000 x 0.538 x 2.86) = 3,323.54 Kg CO_2 or **3.323 tons CO_2**

The carbon emission reduction is (3.323 tons – 0.498 tons) = **2.825 tons of CO_2**

18 watts LED lamps

The institution has installed 79 LED lamps with 18 watts capacity. The carbon emission during the reporting period is 18 watts x 79 lamps x five hours x 200 days / 1,000 x 0.538 x 2.86 = 2,188 Kg. CO_2 or **2.18 tons of CO_2**

The carbon emission of 79 incandescent lamps with 60 watts capacity is (60 watts x 79 lamps x 5 hours x 200 days / 1,000 x 0.538 x 2.86) = 7,293.34 Kg CO_2 or **7.29 tons of CO_2**

The carbon emission reduction is (7.29 tons – 2.18 tons) = **5.11 tons of CO_2**

40 watts Tube lights (Fluorescent lamp)

The institution installed 262 tube lights with 40 watts capacity. The carbon emission during the reporting period is 40 watts x 262 lamps x 5 hours x 200 days / 1,000 x 0.538 x 2.86 =

16,125.36 Kg. CO_2 or **16.125 tons CO_2**

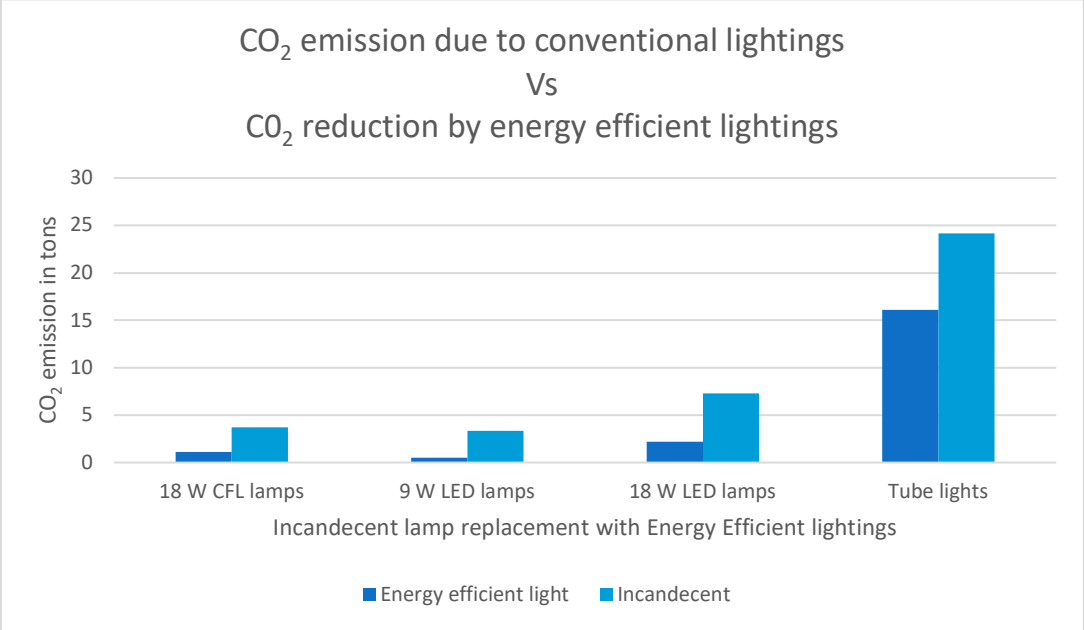
The carbon emission of 262 incandescent lamps with 60 watts capacity is (60 watts x 262 lamps x 5 hours x 200 days / 1,000 x 0.538 x 2.86) = 24,188.04 Kg CO_2 or **24.188 tons CO_2**

The carbon emission reduction is (24.188 tons – 16.125 tons) = **8.063 tons of CO_2**

The following table illustrate the total carbon emission reduction through installation of energy efficient lamps in the institution

Sl.no	Particulars of lamp	Watts	Quantity	CO_2 emission in tons	CO_2 reduction in tons
1	CFL lamps	18	40	**1.107 tons**	**2.58 tons**
2	LED lamps	9	36	**0.498 tons**	**2.825 tons**
3	LED lamps	18	79	**2.18 tons**	**5.11 tons**
4	Tube lights	40	262	**16.125**	**8.063 tons**
		Total	**417**	**19.91 tons**	**18.578 tons**

The net carbon reduction by installing energy efficient LED and CFL lamps and tubes is 18.578 tons of CO_2.



CHAPTER 4

SOLAR PLANT

SOLAR ENERGY

Solar Energy is the most feasible and viable green energy available around the globe. The viability and feasibility are very high in the tropical countries like India. Emmanuel college is located in an ideal place to trap solar energy to the maximum. As it is located on the foot hills of the western Ghat mountain, the thermal radiation is very high and hence the potential to trap solar energy is high.

A 50-kW solar PV power system is connected to the college grid which produces an average of 25 units of energy per day accounting to about 9,125 units of energy per year. Compared to the vast potential, this power generation is very moderate.

Even if we assume that 9,125 kWhr of energy is generated per year from this solar panel, the Coal equivalent is (9,125 x 0.538) = 4,909.25 Kg of coal. This is equivalent to 14,040.455 kg (4,909.25 x 2.86) of CO_2 or **14.040-ton of CO_2 is reduced from the Carbon Foot Print every year.**

CHAPTER 5

TRANSPORT SYSTEM AND CARBON EMISSION

India ranks third in the world – after China and United States - in terms of CO_2 emissions from transport system. It is estimated that 9% of the total carbon emissions from India emanates from the transport system. Hence it is appropriate, in this context, to analyse the carbon dioxide emissions from the fleet of four wheelers owned by the institution. The calculation does not take into account the number of two wheelers and four wheelers owned by the faculty and students.

The following data gives us the quantity of diesel consumed by the vehicles during the last year. There are 18 buses owned by the institution to provide transport service to the students hailing from distant places. Each bus has a seating capacity of 45.

CONSUMPTION OF DIESEL BY VEHICLES

The fuel consumption by vehicles is determined by the type of vehicle, year of manufacturing, maintenance status, traffic system of the particular area etc. Considering these factors in view it is estimated that the average distance covered by one bus per litre of diesel is taken as 5 km as standard unit for calculation. The buses are operated for a distance of 7,200 km/week. Based on this, the total quantity of diesel consumed by the 18 buses for 200 working days is **48,000 litres.**

Transport conversion table to calculate carbon emission per litre is very complicated and confusing in view of the local variables to be taken for calculation. Instead, we have taken up a simple but universally acceptable calculation calendar for various types of fuels and their CO_2 conversion rate.

As per this calculation calendar, per litre of diesel emits 2.68 kg. of CO_2

At this rate, the total quantity of CO_2 emitted by 48,000 litres of diesel is (48,000 x 2.68) = **1,28,640 kg of CO_2 or 128.64 tons of CO_2.**

CHAPTER 6

WATER AUDIT

The institution is located on the foot of Western Ghats range and hence run off water from the hilly slopes are sources of fresh water that shall be harvested and used for service water. At present the rain water collected on the roof top of girls hostel is channelized through drainage system to a reservoir tank with a storage capacity 10,000 litres. This is used to water the potted plants in the gardens and 1,200 sq.ft Mexican and Buffalo Variated Grass lawns.

Aerator taps fixed to reduce wastage of water during consumption. Another important measure to reduce water consumption is conversion of few 10 litres per flush into dual flush water closets which reduces 6 litres water for liquid waste and 2 litres water for solid waste. However, adequate water quality testing is not followed to ensure 100% protection from water borne diseases to the students, particularly those residing in the hostel.

CHAPTER 7

SUGGESTIONS AND RECOMMENDATIONS

Environment has become a most popular area since the last three decades. Some of the problems faced by humankind directly or indirectly are ozone depletion, greenhouse effect, acid rain, global warming, air-water pollution, and fossil fuel combustion. Noticing the bad effects of chemistry and traditional energy sources on environment and human life, the institution has been trying to find solutions for a better life. For this, teaching about environment issues and the preservation of the environment and eco system has become increasingly important in the life skill education in the college.

The rationale behind the environmental education is based on three factors; that (a) if people are aware of the need for and the ways of protecting the environment, they will act to preserve it, (b) student community should assume responsibility for educating about environmental protection and (c) environmental education can be effective as a part of a college curriculum. Hence the institution stresses increased concern about the environment education.

The energy management cell conducted two types of assessment of environment awareness among the Eco Club members (focused group) in the institution.

METHODOLOGY

52 questions related to green environment had been given to the focused group members to assess their understanding level of the environment related issues.

The questions focused on three concerns which are;

1. Whether they consider themselves eco-conscious?

2. Do they consider the institution to be eco-friendly?

3. What do they think are the top priorities that should be tackled to improve the green campus status of the institution?

Out of the 78 respondents, 80% of them are eco conscious as they are well aware of the effects of green gas emissions into the atmosphere and the negative impact of global warming on the mother earth and the life forms in the earth. But they pretend ignorance on the quantum of carbon emission at the national, state or at campus level. 20% of them are not

well informed of the simple carbon emission mitigation measures to be carried out in their homes.

All the respondents considered that their institution is eco-friendly. They are very conscious of the proactive role of the flora in their campus towards carbon absorption. They feel very much honoured that their campus contributes, though very marginally, to the reduction of global warming. Eco club members are proud about their garden and 1,200 sq.ft, spread lawn in the campus.

Another important achievement of the institution in creating environment consciousness among the students is that many are able to identify few species, Genus and Families of the Flora in the campus.

IMPRESSIONS

The overall impression one gets while green auditing the campus is that it qualifies to be labelled as Green Campus. The geographical terrain and the vast area at the disposal of the institution is a contributing factor to green the campus. The mountain slopes accommodate thousands of bush plants and trees planted by nature.

The college management and the faculty of Emmanuel college deserve appreciation to reduce carbon foot print through installing various energy efficient measures. One example is replacing incandescent and fluorescent bulbs with less energy consuming LED bulbs.

It is a commendable intervention to reduce thermal radiation on the top of the floors of the building through well planned method of insulation by a weathering course layer, which is a mixture of broken bricks in lime mortar, followed by earthen tiles covering. This insulation reduces the cooling loads of the air conditioning system.

SUGGESTIONS AND RECOMMENDATIONS

There exists vast scope to improve the green campus status of the College through biodiversity promotion measures and tapping green energy sources.

1. More than 3 acres of land area is available to raise horticulture gardens, fruit bearing trees and shade giving trees. About 500 such trees and 10,000 plants shall be raised in the campus in the next three years. This will improve the oxygen supply better.
2. Another 3000 sq.ft area of grass lawns shall be raised through the involvement of Eco Club members to enhance the oxygen emission.

3. Compostable solid waste shall be collected and deposited in solid waste collection tanks through wheel burrows. These wastes shall be profitably converted into compost manure and applied in the gardens and trees to reduce the application of chemical-based fertilizers and pesticides.
4. Capacity of solar panels installed on the concrete top of the buildings shall be improved to produce electricity annually, in such a way that the campus becomes self-reliant energy campus. To enhance the solar power productivity, aluminium foil-based reflectors shall be installed on the eastern and western side of the solar panel.
5. Energy efficient measures such as replacement of all bulbs with LED lamps, replacing all old electrical regulators of the fans with energy efficient electronic regulators, replacement of all air conditioning units with all 5-star rated system.
6. Electronic body temperature sensors may be fixed in the rooms that have air conditioners so that power is shut down for air conditioners automatically when nobody is in the room. This shall reduce wastage of electricity caused by human negligence.
7. Students and faculty from B.Sc. Computer science and B.Sc Electronics departments shall be trained as e- waste managers to manage the e- waste system. These e-managers shall be in constant touch with schools, orphanages and parish houses through social media and inform them of the outdated computer systems that shall be used by these less intense – research institutions. They also shall dispose of the less efficient, damaged and non-functioning e- wastes to the venders.
8. All the transport vehicles (18 buses) shall be fitted with carbon filters or Catalytic Converters. In the case of diesel exhaust, the catalyst oxidizes CO, HCs, and the liquid hydrocarbons adsorbed on carbon particles. In the field of mobile source emission control, liquid hydrocarbons adsorbed on the carbon particles in engine exhaust are referred to as the soluble organic fraction (SOF) -- the soluble part of the particulate matter in the exhaust. Diesel oxidation catalysts are efficient at converting the soluble organic fraction of diesel particulate matter into carbon dioxide and water.
9. Water quality testing lab shall be installed in one part of the chemistry laboratory to test the potability of the drinking water to ensure the students are free from water borne diseases.
10. All the water taps shall be fitted with high efficiency aerator taps to reduce wastage of water consumption. 100% of the toilets shall be fitted with dual flush water closets to reduce water consumption by 40%

11. Environment education shall be disseminated to all the college students through one hour Life skill study class once in a week. This will create wider level environment consciousness among the student community. They will be sensitized to encourage pillion riding with their peers or using public transport system instead of using two wheelers. Moreover, they will also motivate their parents to replace all the incandescent or fluorescent bulbs/tubes with energy efficient LED bulbs.