**Criterion VII: Institutional Values & Best Practices**

# 7.1 Institutional Values and Social Responsibilities

## Session-2023-2024

| Metric No. | | Content / File Description | Document Link |
|---|---|---|---|
| 7.1.6 | | Quality audits on environment and energy regularly undertaken by the institution<br>1. Green Audit<br>2. Energy Audit<br>3. Environment Audit | |

SATPUDA EDUCATION SOCIETY, JALGAON JAMOD'S

# Arts & Commerce College

Warwat Bakal Tq. Sangrampur Dist - Buldhana (M.S.)

NAAC Reaccredited with 'B' Grade

College Code : 327

- Principal -
Dr. Shriram Yerankar
M.A., M.Phil, Ph.D.
9423722316

- President -
Shri. Krushnarao Ingle
(Ex. M.L.A.)
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## CERTIFICATE

This is to certify that the documents attached as supporting documents for Criterion VII: Institutional Values and Best Practices are verified from the college record and found to be correct to the best of my knowledge.

Principal
Arts & Commerce College
Warvat Bakal Dist.Buldana

# ARTS & COMMERCE COLLEGE,
## WARWAT BAKAL DIST- BULDANA

# Clean and Green Campus Policy Document

## About College

The Satpuda Education Society, Jalgaon (Jamod), founded the Arts & Commerce College in 1994. In Maharashtra's Buldana district, the college is located at the base of the Satpuda mountains, which are dispersed to the north. The majority of the population in this area is employed in agriculture. In Sangrampur Tahsil, there was no senior college prior to the establishment of this college. This region's students were denied access to higher education. Satpuda Education Society founded this college with a broad objective and a clear goal in mind: to meet the higher education needs of this area.

The administration built a separate structure for the college in under five years. The society established a junior college in the faculty of science in 2003 and a senior science and commerce college in 2009 in response to the need for science education. Undergraduate students studying in the streams of arts, commerce, and science are educated by the college. The college successfully completed the first cycle of NAAC accreditation in 2016 and received a "B" grade. The coordination between teaching and non-teaching staff is excellent at our college. Our team works hard and ensures that the college's goals and objectives are met. Our young and tenacious teachers instruct and mentor the pupils who travel from the remote highland area.

## The Clean and Green Campus Policy

The college's Green Campus Policy is to create a clean and green campus where ecologically responsible behaviour is encouraged through education and other means both on campus and off campus. By fostering environmental ethics among the faculty and staff, it also gives the institution a chance to take the lead in reinventing its environmental culture.

## Mission

To instill environmental awareness in society and actively engage in efforts to defend the planet earth against nefarious human incursions in order to ensure a sustainable, pollution-free, and healthy future.

## Objectives

• To increase awareness of the value of frequently using environmentally friendly goods and services. to inculcate the value of cleanliness in maintaining a healthy lifestyle.
• To raise public awareness of environmental issues through the organisation of events, rallies, clean-up drives, seminars, workshops, presentations, tree planting drives, wildlife photography competitions, rangoli competitions, essay competitions, bird watching programmes, excursions, study tours, guest lectures, and talks, among other activities.
• To raise awareness among students and faculty about speaking out against harmful practises that harm the environment and to encourage such practises throughout society.

## Initiatives Taken to Implement the Clean and Green Campus Policy

The Institution is committed to managing its campus in accordance with its Clean and Green Campus Policy by establishing the following infrastructure and carrying out the following activities:

- **Landscaping with Trees and Plants**
- **Ban on Single-Use Plastic**
- **14 KV. Solar Plant in the College**
- **Use of LED Bulbs/Tubes and Power Efficient Equipments**
- **Rainwater Harvesting**
- **Paperless Office and Communication**
- **Solid Waste Management**
- **Water Management**
- **Display Boards to Promote Environmental Sensibility on College Campus**
- **Observance of Days to protect and Nurture Environment**
- **The Green, Environmental and Energy Audit**

## Landscaping with Trees and Plants

According to the Arts & Commerce College's Warwat Bakal's Clean and Green Policy, the college works to grow several plant kinds of trees, as well as ornamental and medicinal varieties, both inside and outside the campus. The campus is kept clean, litter-free, and green by volunteers from NSS and Class 4 staff. The Department of Botany is responsible for caring for and maintaining the College Botanical Garden and the Vermicompost Unit. The college's NSS and NCC Units often organise tree-planting campaigns, which usually take place in the month of July.

## Ban on Single-Use Plastic

Single-use plastics are completely prohibited in classrooms, laboratories, the canteen, and all other areas of the Arts & Commerce College, Warwat Bakal campus. In order to progressively reduce the use of plastics on campus, the college provides environmentally friendly alternatives including stainless steel, washable, and reusable tumblers at all water units and requires the canteen to serve exclusively in stainless steel or paper plates, glasses, and cups.

## 14 kV Solar Plant in the College

In April 2023, the institution installed a 14 kV solar energy plant on one of its buildings. Since the commissioning of these solar plants, the MSEDCL's electricity bills have significantly decreased. The MSEDCL's power grid is connected to the solar panels' energy output, and the MSEDCL has subsidised the college's electricity needs by supplying the system with the power generated by the solar panels.

## Rainwater Harvesting

The college ensures rainfall conservation by collecting rainwater. More than five acres make up our facility. Rainfall in the area ranges from 90 to 110 cm on average. All the rainwater will be wasted in the neighbouring village. The institute and the governing body decided to store and gather this rainwater on campus as a result. We therefore constructed a water absorption hole that is 30 feet deep and 14 feet in diameter in the southeast corner of the campus. South East-sloping slopes are present naturally. All of the rainwater consequently streams into the pit to be collected. The extra water from the hole is emptied into the nearby river.

## Paperless Office and Communication

The college has a policy to use e-communication for the majority of official and academic communications in order to reduce the consumption of paper. Digitization significantly reduces the use of paper. To save paper waste, blank papers with one side are used. What's App groups have been formed based on classes, departments, and committees, which has decreased the need for paper in announcements and circulars. Additionally, by implementing Google Classrooms, where references, notes, syllabi, question banks, and study material are shared on the e-platform, the college has eliminated the heavy use of paper. E-assignments are now being

accepted by some departments as well.

## Solid waste Management

Solid waste needs to be disposed of to prevent unneeded accumulation. Waste material is sorted out for secure disposal. Waste is composted via vermicomposting and bio composting. The decomposition of dead plant matter and other trash occurs during vermicomposting. Waste that is complex is reduced to a simpler form. Composting is a sustainable practise. It transforms a vast array of wastes into beneficial agricultural nutrients. A great source of humus and plant nutrients, compost enhances the biophysical characteristics of the soil and the level of organic matter. We have taken action to manage the waste that has been gathered on college property.

Our institute employs a skilled approach to solid waste management. Garbage containers hold all of the solid garbage produced on campus. Waste from the departmental rooms and the canteen is also composted.

The college has adopted the practise of printing on both sides of the page to save paper usage; however, we mostly use electronic resources since we support paperless communication. Dustbins are available in every department, lab, and classroom for the disposal of dry waste. In key areas across the college, designated dustbins are used to segregate waste into dry and wet categories.

**Vermicompost Unit**

Vermicompost Unit is established in the Botanical Garden of the Department of Botany. The students of the department actively involve themselves to run this unit. The organic waste material is collected from the college campus by the students to deposit it in the special vermicompost pit. Using cow dung, Earthworms the soil mixture is made with appropriate proportions. With the help of students this mixture is installed in the tank and watered properly for 4-8 weeks.

## Water Management

A different set of distribution pipes provides water for all other uses. There is plenty of water in the college's well. Pumps are used to transfer groundwater from the wells into elevated service reservoirs and storage tanks spread throughout the campus. A network of well-built pipes is used to disperse the water.

The college administration closely monitors the whole distribution system to prevent water leaks and wastage at water taps, pipelines, and other points of use. The college's administrative staff controls how frequently the water tanks are cleaned. Every college stakeholder is knowledgeable about how to use water wisely and effectively.

Apart from carrying out Cleanliness Drives, Awareness Campaigns, the College NSS volunteers also render the services for ground water recharge in the adopted villages during the NSS Special Camps.

## Display Boards to Promote Environmental Sensibility on College Campus

Various boards including Quotes that promote environmental awareness and ethics including air-pollution control, plastic-free campus, conservation of energy, recycling of resources, tree plantation, Nature conservation, etc. are displayed for all the stakeholders of the college.

## Observance of Days to Protect and Nurture Environment

The organization of various events like Rallies, Awareness Campaigns, Cleanliness Drives, Tree Plantation Drives, Wildlife Week, Rangoli Competitions, Essay Competitions, Excursions, Study Tours, Guest Lectures, Talks, etc. on the occasion of various days like- 'International Day for the Preservation of the Ozone Layer' (16 September), 'World Environment Day' (05 June), 'Wildlife Week' (02 to 08 October), ‘World Wetland Day’ (02 February), ‘World Sparrow Day’ (20 March), Mahatma Gandhi Jayanti (02 October), 'Army Day' (15 January) ‘Bird Week’ in first week of November, etc. ensures to create awareness among young students and public about various environment related problems and conservation of Nature and natural resources in the surrounding area and educating on how to live a Eco- friendly life.

## The Green, Environmental and Energy Audit

The Green, Environmental and Energy Audit of the college is done by Nutan Urja Solutions, Pune.

# Report

# On

# Green Audit

# At

# Arts & Commerce College warwat Bakal, Buldana.

# (Year 2023-24)

Prepared by

**Nutan Urja Solutions**

A 703, Balaji Witefield, Near Sunni's World,

Sus Road, Sus, Pune 411 021

Phone: 83568 18381. Email: nutanurja.solutions@gmail.com

# Contents

## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Arts & Commerce College warwat Bakal, Buldana for awarding us the assignment of Green Audit of their college premises.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures and green practices. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

## Executive Summary

Green Audit of Arts & Commerce College warwat Bakal, Buldana is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Arts & Commerce College warwat Bakal, Buldana uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

**Table no 1: Details of energy consumption**

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|---|---|---|---|
| 1 | Maximum | 0 | 0 |
| 2 | Minimum | 0 | 0 |
| 3 | Average | 0 | 0 |
| 4 | Total | 0 | 0 |

### 2. Various Measures Adopted for Energy Conservation

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.
4. The college is zero energy building

### 3. Usage of Renewable Energy

The collage has installed **12 kW** Solar PV Power Plant.

### 4. Rain Water Harvesting

The College has installed the Rainwater harvesting project, to reduce dependency on municipal corporation water supply.

### 5. Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

## 6. Notes and Assumptions

1. Daily working hours-10 Nos
2. Annual working Days-250 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

## Abbreviations

| | | |
|---|---|---|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

# 1. Introduction

The mission undertaken by Arts & Commerce College warwat Bakal, Buldana is to strive and provide Education to those poor, downtrodden and exploited communities of the area. It will accelerate the development of this region and establish confidence among the youth.

## 1.1 Objectives

1. To study present level of Energy Consumption
2. To Study the present $CO_2$ emissions
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To measure various Electrical parameters
5. To study Scope for usage of Renewable Energy
6. To study various measures to reduce the Energy Consumption

## 1.2 Audit methodology

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

## 2. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

**Table no 2.1: Summary of electricity bills**

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|---|---|---|---|
| 1 | Jun-24 | 0 | 512 |
| 2 | May-24 | 0 | 512 |
| 3 | Apr-24 | 0 | 512 |
| 4 | Mar-24 | 0 | 512 |
| 5 | Feb-24 | 0 | 512 |
| 6 | Jan-24 | 0 | 512 |
| 7 | Dec-23 | 0 | 512 |
| 8 | Nov-23 | 0 | 512 |
| 9 | Oct-23 | 0 | 512 |
| 10 | Sep-23 | 0 | 440 |
| 11 | Aug-23 | 0 | 440 |
| 12 | Jul-23 | 0 | 440 |
| | **Total** | **0** | **5,928** |

Variation in energy consumption is as follows,

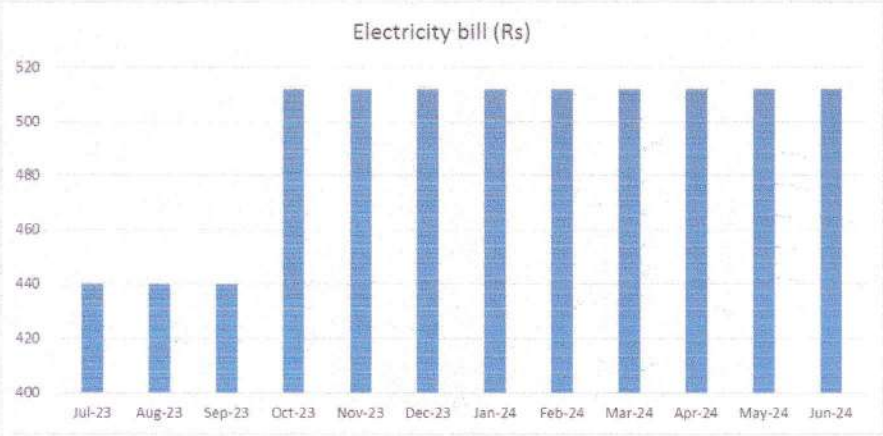



**Figure 2.1: Month wise electricity bill**

Key observations of electricity bill are as follows,

**Table no 2.2: Key observations**

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|---|---|---|---|
| 1 | Maximum | 0 | 0 |
| 2 | Minimum | 0 | 0 |
| 3 | Average | 0 | 0 |
| 4 | Total | 0 | 0 |

## 3. Carbon Foot printing

**1. A Carbon Foot print** is defined as the Total Greenhouse Gas emissions ($CO_2$ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

**2. Basis for computation of $CO_2$ Emissions:**

The basis of Calculation for $CO_2$ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of $CO_2$** into atmosphere.

Based on the above Data we compute the $CO_2$ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

**Table 3.1: Month wise Consumption of Electrical Energy & CO2 Emissions**

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|---|---|---|---|
| 1 | Jun-24 | 0 | 0 |
| 2 | May-24 | 0 | 0 |
| 3 | Apr-24 | 0 | 0 |
| 4 | Mar-24 | 0 | 0 |
| 5 | Feb-24 | 0 | 0 |
| 6 | Jan-24 | 0 | 0 |
| 7 | Dec-23 | 0 | 0 |
| 8 | Nov-23 | 0 | 0 |
| 9 | Oct-23 | 0 | 0 |
| 10 | Sep-23 | 0 | 0 |
| 11 | Aug-23 | 0 | 0 |
| 12 | Jul-23 | 0 | 0 |
| | **Total** | **0** | **0** |

It can be seen from above figures and tables that, the total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

**Zero Energy Building**

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy

## 4. Study of Usage of Alternate Energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is **10 kWp**.

**Table 4.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement**

| No | Particulars | Value | Unit |
|---|---|---|---|
| 1 | Annual Energy Purchased from MSEDCL | 0 | kWh/Annum |
| 2 | Energy Generated by Roof Top Solar PV System | 18,000 | kWh/Annum |
| 3 | Total Energy Requirement of College | 18,000 | kWh/Annum |
| 4 | % of Usage of Alternate Energy to Annual Energy Requirement | 100 | % |

**Photograph of Solar PV plant**

It can be seen from above figures and tables that, the total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

**Zero Energy Building**

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy

## 5. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

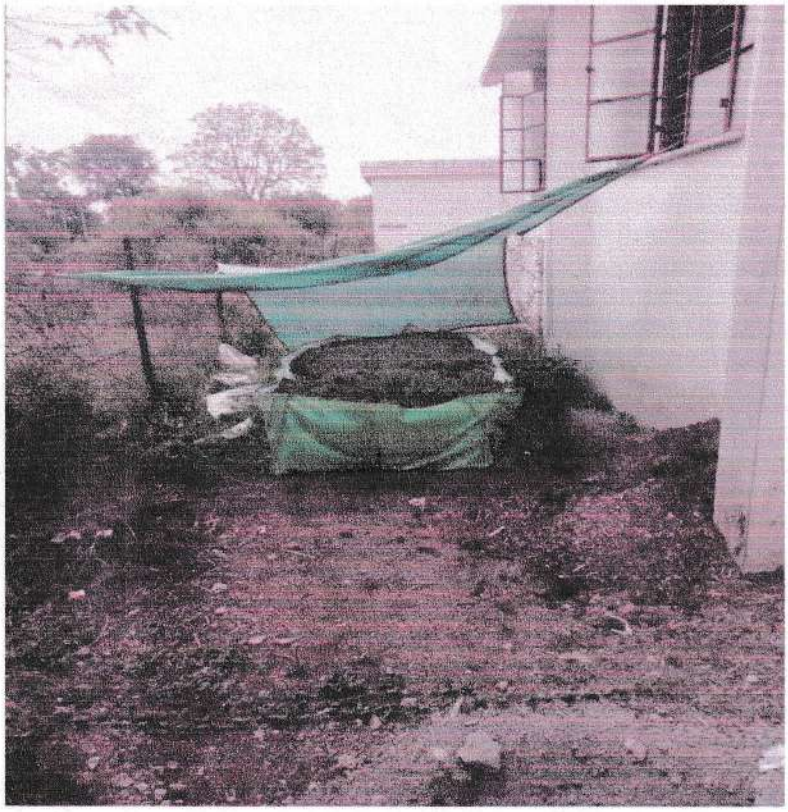
**Photograph of Rain Water Harvesting**

# 6. Study of Waste Management

## 6.1 Solid Waste Management

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

**Photographs of Bio Composting Storage Tanks:**



## 6.2 e-Waste Management

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

## 7. Study of Green Practices

### 7.1 No of students who don't use own Vehicle for coming to Institute

Out of total students coming to Institute, about 60% students use own Automobile.

### 7.2 Usage of Public Transport

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles.

### 7.3 Pedestrian Friendly Roads

The Institute has well defined pedestrian foot paths as to facilitate the easy movement of the students within the campus.

**Photograph of Road within campus**

### 7.4 Plastic Free Campus

The Institute is an active participant in the Government of India's most prestigious project of SWATCHH BHART ABHIYAN. The Institute has displayed boards in the Campus, to make the campus plastic free. Various measures adopted for this purpose are as follows

- Installation of Separate waste bins for Dry waste & wet waste
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

### 7.5 Paperless Office

The internal communication of the Institute is through the Internet. There are hardly any day to day operations, where printing is required.

### 7.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.

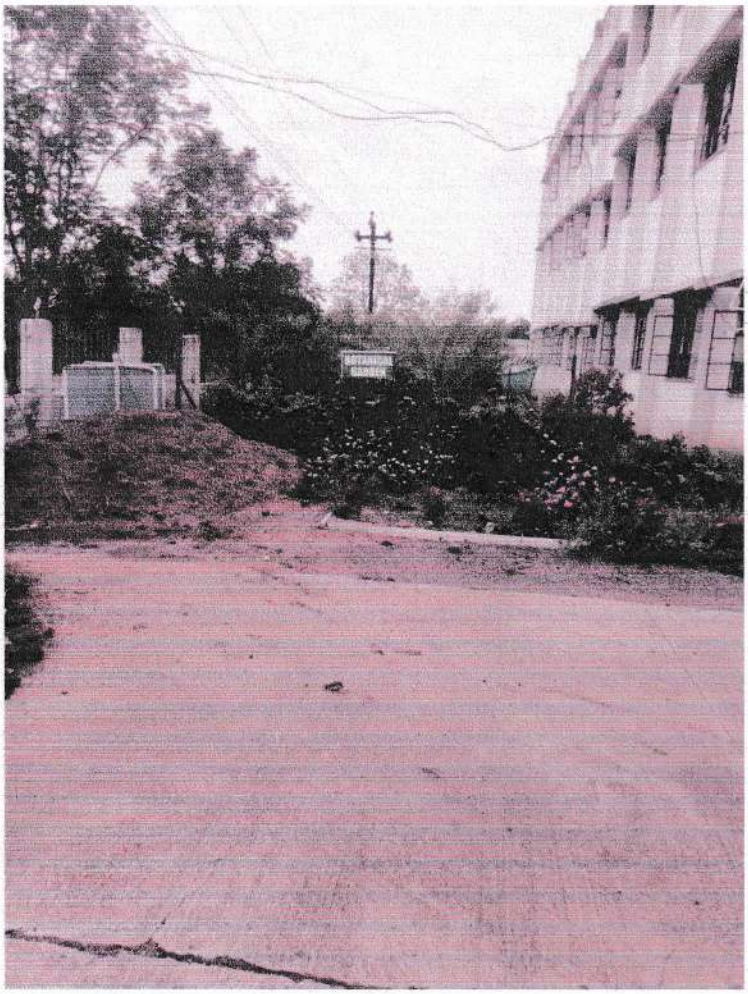


**Figure 7.1: Beautiful maintained Garden of college**

# Report

# On

# Energy Audit

# At

# Arts & Commerce College warwat Bakal, Buldana.

# (Year 2023-24)

Prepared by

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We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We hope that the recommendations stated in this report will be useful and worthy of discussions to take things forward to help implementation of energy conservation measures through energy savings. While we have made every attempt to adhere to high quality standards, in both data collection and analysis through the report, we would welcome your suggestions so as to improve upon this report further.

## Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the $CO_2$ emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

**1. Present Energy Consumption**

In the following Table, we present the details of Energy Consumption.

**Table no 2.1: Details of energy consumption**

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|---|---|---|---|
| 1 | Maximum | 0 | 0 |
| 2 | Minimum | 0 | 0 |
| 3 | Average | 0 | 0 |
| 4 | Total | 0 | 0 |

**2. Energy Conservation Projects already installed**

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.
3. Usage of STAR rated fans at new installations

**3. Key Observations**

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.

**5. Percentage of Usage of LED Lighting**

The College has various Types of Light fittings, namely: LED & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 94 %.

**6. Percentage of Usage of Alternate Energy**

The College has installed a Roof Top Solar PV Plant. The percentage of usage of Alternate Energy to Annual Energy Requirement is 100 %.

**7. Recommendations**

The total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building. There are not much energy saving recommendations for colleges.

**8 Notes & Assumptions**

1. Daily working hours-10 Nos
2. Annual working Days-300 Nos
3. Average Rate of Electrical Energy : **Rs 11/- per kWh**

## Abbreviations

| | | |
|---|---|---|
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| V | : | Voltage |
| I | : | Current |
| kW | : | Kilo- Watt |
| kWh | : | kilo-Watt Hour |
| kVA | : | Active Power |

# 1. Introduction

The mission undertaken by Arts & Commerce College warwat Bakal, Buldana is to strive and provide Education to those poor, downtrodden and exploited communities of the area. It will accelerate the development of this region and establish confidence among the youth.

## 1.1 Objectives

1. To study present level of Energy Consumption
2. To Study Electrical Consumption
3. To assess the various equipment/facilities from Energy efficiency aspect
4. To study various measures to reduce the Energy Consumption

## 1.2 Audit Methodology:

1. Study of connected load
2. Study of various Electrical parameters
3. To prepare the Report with various Encon measures with payback analysis

## 1.3 General Details of College

**Table No-1.1: Details of college**

| No | Head | Particulars |
|---|---|---|
| 1 | Name of Institution | Arts & Commerce College warwat Bakal, Buldana |
| 2 | Address | Arts & Commerce College warwat Bakal, Buldana ,Maharashtra 444202 |
| 3 | Affiliation | Sant Gadge Baba Amravati University, Amravati. |

## 2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load.

**Table No-2.1: Location wise study of Electrical fittings in various buildings**

| No | Location | LED tube (20W) | CFL | Fans | Computers (65W) |
|---|---|---|---|---|---|
| 1 | IQAC | 3 | | 3 | 2 |
| 2 | Exam room | | 1 | 1 | |
| 3 | Seminar Hall | 4 | | 7 | |
| 4 | Staff Room | 2 | | 3 | |
| 5 | G1 | 1 | | 1 | |
| 6 | G2 | 1 | | 1 | |
| 7 | G3 | 1 | | 1 | |
| 8 | G4 (Principal room) | 1 | 1 | 1 | |
| 9 | G5 (Office) | 3 | | 3 | 4 |
| 10 | G6 | 2 | | 1 | 1 |
| 11 | F1 | 1 | | | 1 |
| 12 | F2 | 1 | | | 1 |
| 13 | F3 | 1 | | | 1 |
| 14 | F4 | 1 | | | 1 |
| 15 | F5 | 2 | | | 1 |
| 16 | S1 | 1 | | | 1 |
| 17 | S4 | 1 | | | 1 |
| 18 | S5 | 3 | | | 1 |
| 19 | Reading room | 1 | | | 1 |
| 20 | Library | 10 | | 7 | 1 |
| 21 | Chemistry lab | 2 | | | 1 |
| 22 | Chemistry Dept | 1 | | | 1 |
| 23 | Zoology lab | 2 | | | 1 |
| 24 | Zoology Dept. | 2 | | | 1 |
| 25 | Physics lab | 2 | | | 1 |
| 26 | Botany Dept. | 2 | | | 1 |
| 27 | Computer lab | 2 | | | 6 |
| 28 | Meeting hall | 3 | | | 2 |
| 29 | Rest House | 1 | | | 2 |

| | | | | | |
|---|---|---|---|---|---|
| 30 | NCC | 1 | | | 1 |
| 31 | Sports | 1 | | | 1 |
| 32 | NSS | 1 | | | 1 |
| 33 | Hall | 5 | | | 5 |
| | **Total** | **65** | **2** | **29** | **41** |

Apart from above load, the school has pump. Individual fitting wise load is as under.

**Table No 2.2: Equipment wise Connected Load**

| No | Equipment | Qty | Load, W/Unit | Load, kW |
|---|---|---|---|---|
| 1 | Ceiling Fan | 29 | 65 | 1.9 |
| 2 | LED-20W | 65 | 20 | 1.3 |
| 3 | CFL | 2 | 24 | 0.0 |
| 4 | Computers | 41 | 65 | 2.7 |
| 5 | Pump (2HP) | | | 1.5 |
| | **Total** | | | **7.1** |

Data can be represented in terms of PIE chart as under,

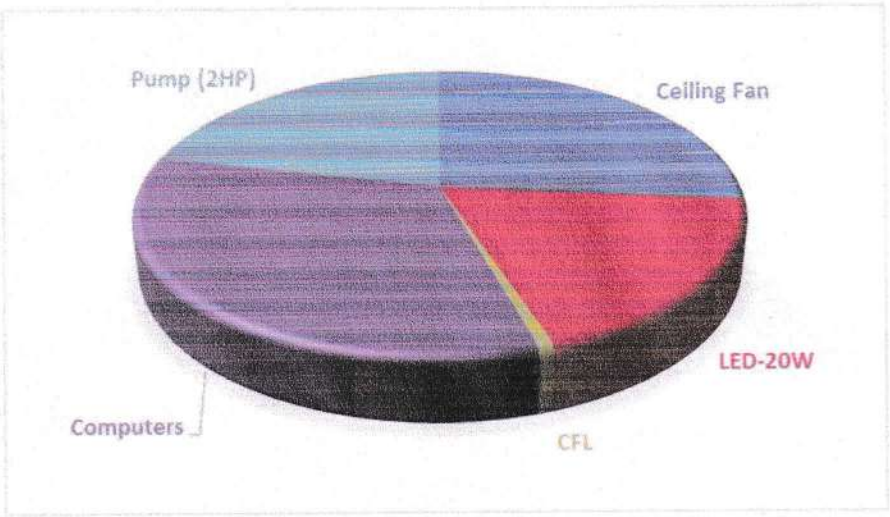


**Figure 2.1: Distribution of connected load.**

## 3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

**Table no 3.1: Summary of electricity bills**

| No | Month | Energy (kWh) | Bill Amount (Rs) |
|---|---|---|---|
| 1 | Jun-24 | - | 512 |
| 2 | May-24 | - | 512 |
| 3 | Apr-24 | - | 512 |
| 4 | Mar-24 | - | 512 |
| 5 | Feb-24 | - | 512 |
| 6 | Jan-24 | - | 512 |
| 7 | Dec-23 | - | 512 |
| 8 | Nov-23 | - | 512 |
| 9 | Oct-23 | - | 512 |
| 10 | Sep-23 | - | 440 |
| 11 | Aug-23 | - | 440 |
| 12 | Jul-23 | - | 440 |
| | **Total** | **-** | **5,928** |

Variation in energy consumption is as follows,

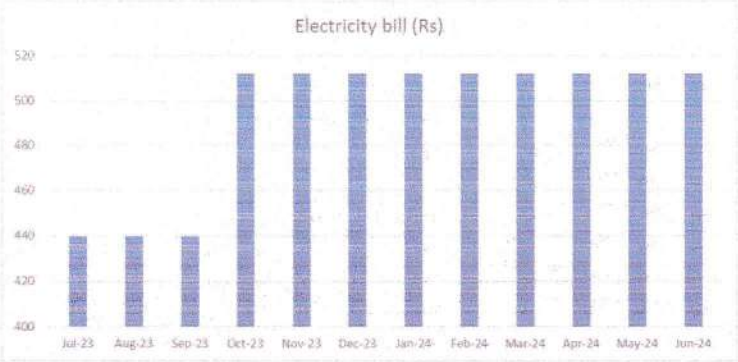


**Figure 3.2: Month wise electricity bill**

Key observations of electricity bill are as follows,

**Table no 3.2: Key observations**

| Sr no | Parameter | Energy consumed, (Units) | CO2 Emission (MT) |
|---|---|---|---|
| 1 | Maximum | 0 | 0 |
| 2 | Minimum | 0 | 0 |
| 3 | Average | 0 | 0 |
| 4 | Total | 0 | 0 |

It can be seen from above figures and tables that, the total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

**Zero Energy Building**

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

## 4. Carbon Foot printing

**1. A Carbon Foot print** is defined as the Total Greenhouse Gas emissions ($CO_2$ emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

**2. Basis for computation of $CO_2$ Emissions:**

The basis of Calculation for $CO_2$ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of $CO_2$** into atmosphere.

Based on the above Data we compute the $CO_2$ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

We herewith furnish the details of various forms of Energy consumption as under

**Table 4.1: Month wise Consumption of Electrical Energy & CO2 Emissions**

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|---|---|---|---|
| 1 | Jun-24 | 0 | 0 |
| 2 | May-24 | 0 | 0 |
| 3 | Apr-24 | 0 | 0 |
| 4 | Mar-24 | 0 | 0 |
| 5 | Feb-24 | 0 | 0 |
| 6 | Jan-24 | 0 | 0 |
| 7 | Dec-23 | 0 | 0 |
| 8 | Nov-23 | 0 | 0 |
| 9 | Oct-23 | 0 | 0 |
| 10 | Sep-23 | 0 | 0 |
| 11 | Aug-23 | 0 | 0 |
| 12 | Jul-23 | 0 | 0 |
| | **Total** | **0** | **0** |

The total energy imported by college from MSEB is zero. The college buildings is zero energy building. $CO_2$ emissions due to Electrical Energy is zero.

# 5. Study of utilities

## 5.1 Study of Lighting

There are 2 CFLs and 65 LEDs in indoor lightings.

## 5.2 Ceiling Fans

At building facility, there are about 29 Nos Old Ceiling Fans, which consumed about 65 W of Electrical Energy. It is recommended to replace these old Fans with BEE STAR Rated Ceiling Fans.

## 5.3 Water Pumps

There is 1 Water pump with 2HP capacity.

## 6. Study of usage of LED lighting

In this chapter we study the lighting system of college and compute the percentage of total load catered by LED lighting.

**Table 7.1: Total lighting load**

| No | Particulars | Qty | Load, W/Unit | Load, kW |
|---|---|---|---|---|
| 1 | CFL | 2 | 24 | 0.048 |
| | | | | |
| | **LED lighting load** | | | |
| 1 | LED tube | 65 | 20 | 1.3 |
| | **Total LED lighting load** | | | **1.3** |
| | **Total Lighting load** | | | **1.348** |

It can be seen that out of total lighting load 96% load is LED lighting load.

## 7. Study of usage of alternate energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is **12 kWp**.

**Table 7.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement**

| No | Particulars | Value | Unit |
|---|---|---|---|
| 1 | Annual Energy Purchased from MSEDCL | 0 | kWh/Annum |
| 2 | Energy Generated by Roof Top Solar PV System | 18,000 | kWh/Annum |
| 3 | Total Energy Requirement of College | 18,000 | kWh/Annum |
| 4 | % of Usage of Alternate Energy to Annual Energy Requirement | 100 | % |

**Photograph of Solar PV plant**

The total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

**Zero Energy Building**

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

# Report

# On

# Environmental Audit

# At

# Arts & Commerce College warwat Bakal, Buldana

# (Year 2023-24)

Prepared by

**Nutan Urja Solutions**

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## Table of Contents

## Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Arts & Commerce College Warwat Bakal, Buldana for assigning the work of Environmental Audit of college campus.

We appreciate the co-operation and support extended to our team members during the entire tenure of field study.

We are also thankful to various Head of Departments & other Staff members for helping us during the field measurements.

We are also thankful to all other staff members who helped us during the Measurements at the field and for giving us the necessary inputs to carry out this vital exercise.

## Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the dependency on Natural resources & reduce the pollution.

Arts & Commerce College Warwat Bakal, Buldana consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

**1. Various Pollution due to College Activities:**

- Air pollution: Mainly $CO_2$ on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

**2. Present Level of $CO_2$ Emissions:**

| No | Parameter /Value | Energy, kWh | $CO_2$ Emissions, MT |
|---|---|---|---|
| 1 | Maximum | 0 | 0 |
| 2 | Minimum | 0 | 0 |
| 3 | Average | 0 | 0 |
| 4 | Total | 0 | 0 |

Since, the college is zero energy building, $CO_2$ Emissions are zero

**3. The various projects already implemented for Environmental Conservation:**

- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting

**4. Recommendations:**

1. Installation of Bio Gas Generator Plant instead of Bio composting Plant.
2. Installation of Sewage treatment Plant to make campus a Zero Discharge campus

**5. Notes & Assumptions:**

1. **1 kWh** of Electrical Energy releases **0.8 Kg of $CO_2$** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

## Abbreviations

| | | |
|---|---|---|
| AC | : | Air conditioner |
| PES | : | Progressive Education Society |
| CFL | : | Compact Fluorescent Lamp |
| FTL | : | Fluorescent Tube Light |
| LED | : | Light Emitting Diode |
| kWh | : | kilo-Watt Hour |
| Qty | : | Quantity |
| W | : | Watt |
| kW | : | Kilo Watt |
| PF | : | Power Factor |
| M D | : | Maximum Demand |
| PC | : | Personal Computer |
| MSEDCL | : | Maharashtra State Electricity Distribution Company Ltd |

# 1. Introduction

## 1.1 Important Definitions:

### 1.1.1 Environment: Definition as per environment Protection Act: 1986

Environment includes water, air and land and the inter-relationship which exists among and between Water, Air, Land and Human beings, other living creatures, plants microorganism and property

### 1.1.2. Environmental Audit: Definition:

An audit which aims at verification and validation to ensure that various environmental laws are compiled with and adequate care has been taken towards environmental protection and preservation

*According to UNEP, 1990, "Environmental audit can be defined as a management tool comprising systematic, documented and periodic evaluation of how well environmental organization management and equipment are performing with an aim of helping to regularize the environment*

**1.1.3. Environmental Pollutant:** means any solid, liquid and gaseous substance present in the concentration as may be, or tend to be, injurious to Environment.

### 1.1.4. Relevant Environmental Laws in India: Table No-1:

| | |
|---|---|
| 1927 | The Indian Forest Act |
| 1972 | The Wildlife Protection Act |
| 1974 | The Water (Prevention and Control of Pollution) Act |
| 1977 | The Water (Prevention & Control of Pollution) Cess Act |
| 1980 | The Forest (Conservation) Act |
| 1981 | The Air (Prevention and Control of Pollution) Act |
| 1986 | The Environment Protection Act |
| 1991 | The Public Liability Insurance Act |
| 2002 | The Biological Diversity Act |
| 2010 | The National Green Tribunal Act |

### 1.1.5. Some Important Environmental Rules in India: Table No-2:

| | |
|---|---|
| 1989 | Hazardous Waste (Management and Handling) Rules |
| 1989 | Manufacture, Storage and Import of Hazardous Chemical Rules |
| 2000 | Municipal Solid Waste (Management and Handling) Rules |
| 1998 | The Biomedical Waste (Management and Handling) Rules |
| 1999 | The Environment (Siting for Industrial Projects) Rules |
| 2000 | Noise Pollution (Regulation and Control) Rules |
| 2000 | Ozone Depleting Substances (Regulation and Control) Rules |

| | |
|---|---|
| 2011 | E-waste (Management and Handling) Rules |
| 2011 | National Green Tribunal (Practices and Procedure) Rules |
| 2011 | Plastic Waste (Management and Handling) Rules |

### 1.1.6 National Environmental Plans & Policy Documents: Table No-3:

| | |
|---|---|
| 1. | National Forest Policy, 1988 |
| 2. | National Water Policy, 2002 |
| 3. | National Environment Policy or NEP (2006) |
| 4. | National Conservation Strategy and Policy Statement on Environment and Development, 1992 |
| 5. | Policy Statement for Abatement of Pollution (1992) |
| 6. | National Action Plan on Climate Change |
| 7. | Vision Statement on Environment and Human Health |
| 8. | Technology Vision 2030 (The Energy Research Institute) |
| 9. | Addressing Energy Security and Climate Change (MoEF and Bureau of Energy Efficiency |
| 10 | The Road to Copenhagen; India's Position on Climate Change Issues (MoEF) |

## 1.2 Objectives

1. To study present usage of Natural resources the College is consuming
2. To Study the present pollution sources
3. To study various measures to make the campus Self sustainable in respect of Natural resources
4. To suggest the various measures to reduce the pollution: Air, Water, Noise

## 1.3 Audit Methodology:

1. Study of College as System
2. Study of Electrical Energy Consumption
3. Study of CO2 emissions
4. Suggestions on usage of Renewable Energy

## 1.4 General Details of College

| No | Head | Particulars |
|---|---|---|
| 1 | Name of Institution | Arts & Commerce College warwat Bakal, Buldana |
| 2 | Address | Arts & Commerce College warwat Bakal, Buldana ,Maharashtra 444202 |
| 3 | Affiliation | Sant Gadge Baba Amravati University, Amravati. |

## 2. Study of Consumption of Various Resources

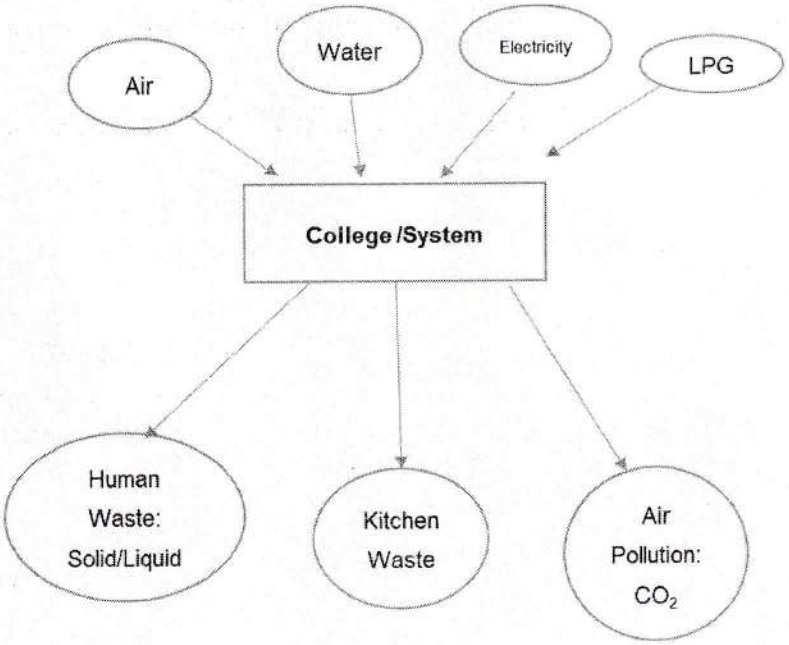
The Institute consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy
4. Liquefied Petroleum Gas

Also, college emits following pollutants to environment

1. Human Waste: Solid/ Liquid
2. Kitchen waste
3. Air pollution

We try to draw a schematic diagram for the College System & Environment as under.




Now we compute the Generation of CO2 on account of consumption of Electrical Energy & LPG as under.

The calculation of electrical energy consumption by college can be given as,

**Table 2.1: Electrical Energy Consumption**

| No | Month | Energy (kWh) |
|---|---|---|
| 1 | Jun-24 | 0 |
| 2 | May-24 | 0 |
| 3 | Apr-24 | 0 |
| 4 | Mar-24 | 0 |
| 5 | Feb-24 | 0 |
| 6 | Jan-24 | 0 |
| 7 | Dec-23 | 0 |
| 8 | Nov-23 | 0 |
| 9 | Oct-23 | 0 |
| 10 | Sep-23 | 0 |
| 11 | Aug-23 | 0 |
| 12 | Jul-23 | 0 |
| | **Total** | **0** |
| | Maximum | 0 |
| | Minimum | 0 |
| | Average | 0 |

**Key Inference drawn**

From the above analysis, we present following important parameters:

**Table 2.2: Variation in Important Parameters**

| No | Parameter/ Value | Energy Consumed, kWh |
|---|---|---|
| 1 | **Maximum** | 0 |
| 2 | **Minimum** | 0 |
| 3 | **Average** | 0 |
| 4 | **Total** | 0 |

It can be seen from above figures and tables that, the total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

**Zero Energy Building**

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

## 3. Study of Environmental Pollution

In this Chapter, we present the various types of Pollution as under:

### 3.1 Air Pollution

The College is using two forms of Energies, namely: Thermal in the form of LPG and Electrical Energy used for day to day operations of the College. The major pollutant on account of above Energy forms is the Carbon Di Oxide.

- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of $CO_2$ in the atmosphere
- 1 Kg of LPG emits 3 Kg of $CO_2$ in the atmosphere

In the following Table, we present the $CO_2$ emissions.

**Table 3.1: Month wise Consumption of Electrical Energy & $CO_2$ Emissions:**

| No | Month | Energy Consumed, kWh | CO2 Emissions, MT |
|---|---|---|---|
| 1 | Jun-24 | 0 | 0 |
| 2 | May-24 | 0 | 0 |
| 3 | Apr-24 | 0 | 0 |
| 4 | Mar-24 | 0 | 0 |
| 5 | Feb-24 | 0 | 0 |
| 6 | Jan-24 | 0 | 0 |
| 7 | Dec-23 | 0 | 0 |
| 8 | Nov-23 | 0 | 0 |
| 9 | Oct-23 | 0 | 0 |
| 10 | Sep-23 | 0 | 0 |
| 11 | Aug-23 | 0 | 0 |
| 12 | Jul-23 | 0 | 0 |
| | **Total** | **0** | **0** |
| | **Maximum** | 0 | 0 |
| | **Minimum** | 0 | 0 |
| | **Average** | 0 | 0 |

## 3.2 Study of Solid Waste Generation

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

### 3.2.1 Photograph of Bio Composting Processing Tanks

## 3.3 Study of Liquid Waste Generation

At present the Liquid Waste generated due to day to day operations is drained off to the municipal Corporation through a pipe.

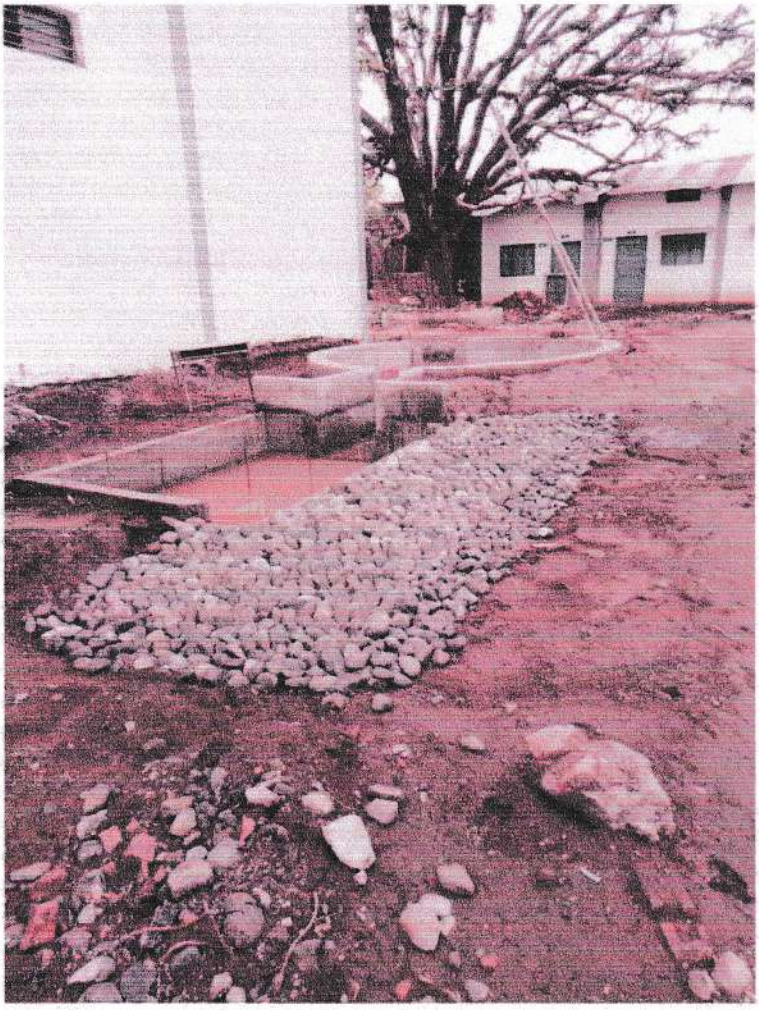
## 3.4 Study of e-Waste Management:

The internal communication is through emails and hence there is hardly any generation of e-Waste in the premises.

## 4. Study of Rain Water Harvesting

The College has already installed Rain Water Harvesting project, wherein the rain water falling on the terrace is collected and through pipes it is fed to underground Water Storage tank. This stored water is then reused for domestic purpose.

**Photograph of Rain Water Harvesting:**



## 5. Recommendations

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Bio Gas Generator Plant instead of Bio composting Plant.
- Installation of Sewage treatment Plant to make campus a Zero Discharge campus