

# GREEN AUDIT REPORT

**MARATHWADA MITRA MANDAL'S,  
SHANKARRAO CHAVAN LAW COLLEGE,**  
202/A, MMCC Complex, Deccan Gymkhana, Pune 411 004



Year: 2023-24

Prepared by:

## **ENGRESS SERVICES**

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# ENGRESS SERVICES

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UDYAM Regn. No: UDYAM-MH-26-0135636,

MEDA Regn. No: ECN/2023-24/CR-43/1709

ISO: 9001-2015 Certified (Cert No: 23EQKC13),

ISO: 14001-2015 Certified (Cert No: 23EEKW20)



## GREEN AUDIT CERTIFICATE

Certificate No: ES/SCLC/23-24/02

Date: 18/7/2024

This is to certify that we have conducted Green Audit at Marathwada Mitra Mandal's Shankarrao Chavan Law College, 202/A, Deccan Gymkhana, Pune in the Academic Year: 2023-24.

The College has adopted following Green & Sustainable Practices:

- Usage of Energy Efficient LED Light Fitting
- Sensor Based Lighting Operation in the Corridor
- Installation of Solar Thermal Water Heating System at Hostel Block
- Provision of Separate bins for Dry & Wet Waste
- Installation of Bio Composting Unit for conversion of Organic Waste
- Provision of Sanitary Waste Incinerator
- Implementation of Rain Water Management Project.
- Maintenance of good Internal Road
- Tree Plantation in the campus
- Provision of Ramp, Wheel Chair & Lift for Divyangajan
- Provision of Braille language signage and dedicated foot ways for Divyangajan
- Creation of Awareness on Water Conservation by Display of Posters

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Green.

For Engress Services,

A Y Mehendale,

B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-8192

ASSOCHAM GEM Certified Professional: GEM: 22/788





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## **ACKNOWLEDGEMENT**

We Engress Services, Pune, express our sincere gratitude to the management of Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune, for awarding us the assignment of Green Audit of their Campus for the Academic Year: 2023-24.

We are thankful to all the staff members for helping us during the field study.

## EXECUTIVE SUMMARY

1. Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune 411 004 consumes Energy in the form of **Electrical Energy**; used for various gadgets, Office & other facilities.

### 2. Present Energy Consumption & CO<sub>2</sub> Emission:

No	Particulars	Value	Unit
1	Annual Energy Consumed	35359	kWh
2	Annual CO <sub>2</sub> Emissions	32.9	MT

### 3. Usage of Renewable Energy:

- Usage of Energy Efficient LED fittings
- Solar Thermal Water Heating System at Hostel Block

### 4. Waste Management:

No	Head	Particulars
1	Solid Waste Management	Segregation of waste at source.
2	Organic Waste	Arrangement of Bio Composting Bed.
3	Sanitary Waste	Provision of Sanitary Waste Incinerator, & also disposal through External Agency
4	E Waste Management	Disposed through authorized agency.

### 5. Rain Water Management:

The College has installed Rain Water Management Project and the rain water falling on the terrace is channelized to increase the underground water table.

### 6. Green & Sustainable Practices:

- Maintenance of good Internal Road
- Tree Plantation in the campus.
- Provision of Ramp & Wheel Chair for Divyangajan
- Creation of awareness on Water Conservation Display of Posters
- Braille Language Signage & Dedicated foot Ways for Divyangajan

### 7. Assumptions:

1. 1 kWh of Electrical Energy releases 0.93 Kg of CO<sub>2</sub> into atmosphere
2. Energy Consumption is computed based on Load Utilization Factor

### 8. Reference:

- For CO<sub>2</sub> Emissions: [www.ccd.gujarat.gov.in](http://www.ccd.gujarat.gov.in)

## **ABBREVIATIONS**

BEE	Bureau of Energy Efficiency
kWh.	Kilo Watt Hour
LPD	Liters Per Day
Kg	Kilo Gram
MT	Metric Ton
CO <sub>2</sub>	Carbon Di Oxide
Qty	Quantity

## CHAPTER-I INTRODUCTION

### 1.1 Introduction:

An Energy Audit is conducted at Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune.

### 1.2 Key Study Points:

No	Particulars
1	Study of Present Energy Consumption & CO <sub>2</sub> Emission
2	Study of Usage of Renewable Energy
3	Study of Waste Management Practices
4	Study of Rain Water Management
5	Study of Green & Sustainable Initiatives

### 1.3 College Location Image:



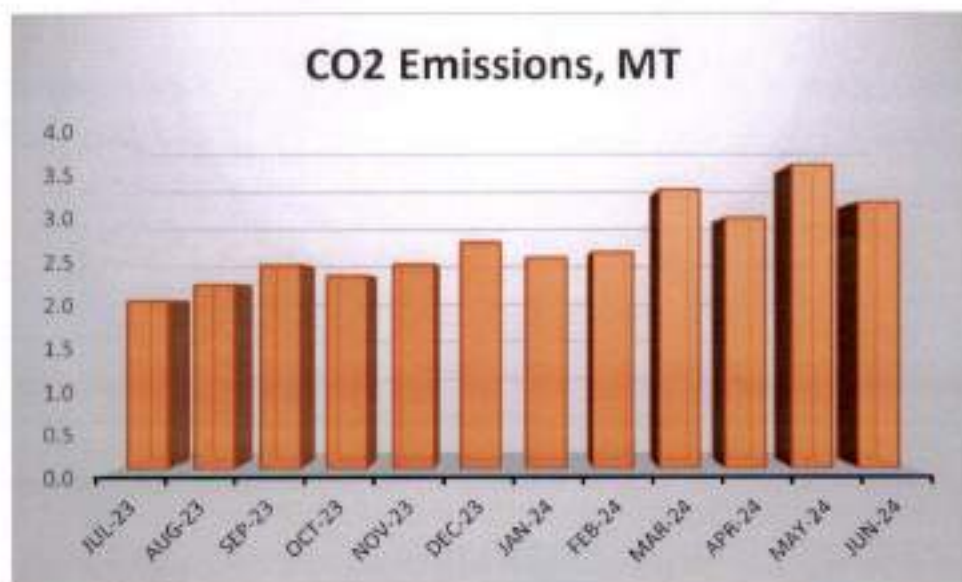
College  
Campus

**CHAPTER-II****STUDY OF ENERGY CONSUMPTION & CO<sub>2</sub> EMISSION**

A Carbon Foot print is defined as the Total Greenhouse Gas emissions, emitted due to various activities. **Basis for computation of CO<sub>2</sub> Emissions: 1 kWh of Electrical Energy releases 0.93 Kg of CO<sub>2</sub> into atmosphere**

**Table No 1: Month wise CO<sub>2</sub> Emissions:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jul-23	2200	2.0
2	Aug-23	2412	2.2
3	Sep-23	2665	2.5
4	Oct-23	2524	2.3
5	Nov-23	2672	2.5
6	Dec-23	2959	2.8
7	Jan-24	2765	2.6
8	Feb-24	2830	2.6
9	Mar-24	3636	3.4
10	Apr-24	3274	3.0
11	May-24	3954	3.7
12	Jun-24	3468	3.2
13	Total	35359	32.9
14	Maximum	3954	3.7
15	Minimum	2200	2.0
16	Average	2947	2.7

**Chart No 1: Month wise CO<sub>2</sub> Emissions:**

### **CHAPTER III**

## **STUDY OF USAGE OF RENEWABLE ENERGY**

The College has Solar Thermal Water Heating System of Capacity 1500 LPD.

The College has yet to install Roof Top Solar PV Plant




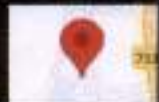
**Photograph of Solar Thermal Water Heating System:**





## CHAPTER IV STUDY OF WASTE MANAGEMENT

In this Chapter, we present the Waste Management Practices, followed by the College.

**Details of Waste Management Practices:**

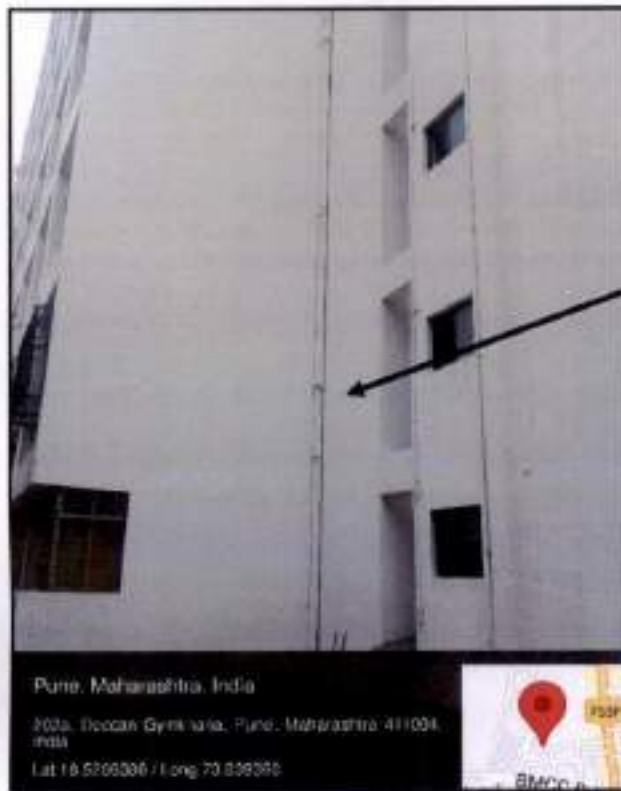
No	Head	Observation	Photograph
1	Solid Waste	Segregation of Waste at Source: Provision of Waste Collection Bins	<p style="text-align: center;"><b>Waste Collection Bin</b></p>  <p>Pune, Maharashtra, India                      512, Lala P. Naray. Hanthoriba Road, Pune,                      Dist: Pune, Maharashtra, India                      Lat: 18.529497 / Long: 73.855171</p> 
2	Organic Waste	Provision of a Bio Composting Bed for conversion of Organic Waste.	<p style="text-align: center;"><b>Vermi Composting Pit:</b></p>  <p>Pune, Maharashtra, India                      51004, Deccan Gymkhana, Pune, Maharashtra,                      India                      Lat: 18.529497 / Long: 73.855171</p> 

3	<b>Sanitary Waste</b>	Provision of Sanitary waste Incinerator & tie up with external Agency for disposal of Sanitary Waste	<p style="text-align: center;"><b>Sanitary Napkin Disposal Unit</b></p>  <p>Pune, Maharashtra, India 813, Lax P. Kerkar, Sachchidanand Kerkar Patil, Ganeshwadi, Dahanu, Shivajinagar, Pune, Maharashtra 411004, India Ln: 18.0022407 / Long: 73.6891111</p> 
4	<b>E Waste</b>	Disposed of through Authorized Agency.	

## CHAPTER-V STUDY OF RAIN WATER MANAGEMENT

The College has installed Rain Water Management Project and the rain water falling on the terrace is used to increase the underground water table.





**Photograph of Rain Water Management Pipe:**


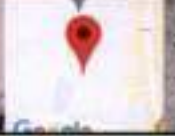




Rain Water  
Collecting Pipe

## CHAPTER-VI STUDY OF GREEN & SUSTAINABLE PRACTICES

In this Chapter, we present the Green & Sustainable Practices followed by the College.  
**Green & Sustainable Practices:**

No	Head	Observation	Photograph
1	Easy Movement of Stake Holders	Provision of Good Internal Road within the Campus	<p><b>Internal Road:</b></p>  <p>Pune, Maharashtra, India 301A, Doodh Chikhani, Pune, Maharashtra 411004, India Lat: 18.505422° / Long: 73.821605</p> 
2	Tree Plantation	Internal Tree Plantation in the Campus	<p><b>Internal Tree Plantation:</b></p>  <p>Pune, Maharashtra, India 301A, Doodh Chikhani, Pune, Maharashtra 411004, India Lat: 18.505422° / Long: 73.821605</p> 

<p>3</p>	<p><b>Facilities for Divyangajan</b></p>	<p>Provision of Ramp Structure &amp; Wheelchair for Divyangajan</p>	<p><b>Ramp for Divyangajan:</b></p>   <p>Pune, Maharashtra, India ORCO-FJM, Shivajinagar, Pune, Maharashtra 411004, India Lat 18.521075° Long 73.839059°</p>
<p>4</p>	<p><b>Creation of Awareness among Stake Holders</b></p>	<p>Display of Poster on Water Conservation</p>	<p><b>Poster on Water Conservation:</b></p>   <p>Pune, Maharashtra, India JDA, MMCC Campus, Deccan Gymkhana, Pune, Maharashtra 411002, India Lat 18.3204314 / Long 73.8387790</p>

5	<b>Braille Signage Board &amp; Dedicated Footway:</b>	The College has Braille language signage and dedicated foot ways for Divyangajan	<p><b>Braille Signage Board:</b></p> 
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**ANNEXURE-1:**

**LIST OF TREES & PLANTS:**

No	Common Name	Qty
1	Mango	6
2	Silver Oak	4
3	Pichkari	6
4	Coconut	17
5	Jamun	1
6	Ashok	56
7	Guava	6
8	Almond	4
9	Morpankhi	6
10	Lemon	2
11	Phycus	8
12	Areca Palm	101
13	Christmas Tree	9
14	Sonchampa	5
15	Chikoo	2
16	Rubber	1
17	Shevari	10
18	Kaduneem	1
19	Apta	1
20	<b>Total</b>	<b>246</b>

# ENVIRONMENTAL AUDIT REPORT

**MARATHWADA MITRA MANDAL'S,  
SHANKARRAO CHAVAN LAW COLLEGE,**  
202/A, MMCC Complex, Deccan Gymkhana, Pune 411 004



**Year: 2023-24**

Prepared by:

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## ENVIRONMENTAL AUDIT CERTIFICATE

Certificate No: ES/SCLC/23-24/03

Date: 18/7/2024

This is to certify that we have conducted Environmental Audit at Marathwada Mitra Mandal's Shankarrao Chavan Law College, 202/A, Deccan Gymkhana, Pune in the Academic Year: 2023-24.

The College has adopted following Eco- Friendly Practices:

- Usage of Energy Efficient LED Light Fitting
- Sensor Based Lighting Operation in the Corridor
- Installation of Solar Thermal Water Heating System at Hostel Block
- Provision of Separate bins for Dry & Wet Waste
- Installation of Bio Composting Unit for conversion of Organic Waste
- Provision of Sanitary Waste Incinerator
- Implementation of Rain Water Management Project.
- Tree Plantation in the campus
- Creation of Awareness on Water Conservation by Display of Posters

We appreciate the support of Management, involvement of faculty members and students in the process of Energy Conservation & making the campus Green & Eco Friendly.

For Engress Services,

**A Y Mehendale,**

B E- Mech, M Tech-Energy, Certified Energy Auditor, EA-8192

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We are thankful to all the staff members for helping us during the field study.

## EXECUTIVE SUMMARY

1. Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune 411 004 consumes Energy in the form of **Electrical Energy**; used for various gadgets, Office & other facilities.

### 2. Pollution due to College Activities:

- **Air pollution:** Mainly CO<sub>2</sub> on account of Electricity Consumption
- **Solid Waste:** Bio degradable Garden Waste
- **Liquid Waste:** Human liquid waste

### 3. Present Energy Consumption & CO<sub>2</sub> Emission:

No	Particulars	Value	Unit
1	Annual Energy Consumed	35359	kWh
2	Annual CO <sub>2</sub> Emissions	32.9	MT

### 4. Usage of Renewable Energy:

- Usage of Energy Efficient LED fittings
- Solar Thermal Water Heating System at Hostel Block
- The College has yet to install Roof Top Solar PV Plant

### 5. Indoor Air Quality Parameters:

No	Parameter/Value	AQI	PM-2.5	PM-10
1	Maximum	90	57	72
2	Minimum	80	48	56

### 6. Indoor Lux & Noise Level Parameters:

No	Parameter/Value	Lux Level	Noise Level, dB
1	Maximum	243	48
2	Minimum	219	43.2

### 7. Waste Management:

No	Head	Particulars
1	Solid Waste Management	Segregation of waste at source.
2	Organic Waste	Arrangement of Bio Composting Bed.

3	Sanitary Waste	Provision of Sanitary Waste Incinerator, & also disposal through External Agency
4	E Waste Management	Disposed through authorized agency.

#### 8. Rain Water Management:

The College has installed Rain Water Management Project and the rain water falling on the terrace is channelized to increase the underground water table.

#### 9. Environment Friendly Initiatives:

- Tree Plantation in the campus.
- Creation of awareness on Water Conservation Display of Posters

#### 10. Assumptions:

1. 1 kWh of Electrical Energy releases 0.93 Kg of CO<sub>2</sub> into atmosphere
2. Energy Consumption is computed based on Load Utilization Factor

#### 11. References:

- For CO<sub>2</sub> Emissions: [www.ccd.gujarat.gov.in](http://www.ccd.gujarat.gov.in)
- For Various Indoor Air Parameters: [www.ishrae.com](http://www.ishrae.com)
- For AQI Quality Standards: [www.cpcb.com](http://www.cpcb.com)

## **ABBREVIATIONS**

Kg	: Kilo Gram
MSEDCL	: Maharashtra State Distribution Company Limited
MT	: Metric Ton
kWh	: kilo-Watt Hour
LPD	: Liters per Day
LED	: Light Emitting Diode
AQI	: Air Quality Index
PM-2.5	: Particulate Matter of Size 2.5 Micron
PM-10	: Particulate Matter of Size 10 Micron
CPCB	: Central Pollution Control Board
ISHRAE	: The Indian Society of Heating & Refrigerating & Air Conditioning Engineers

## CHAPTER-I INTRODUCTION

### 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:

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

### 1.3 Key Study Points:

No	Particulars
1	Study of Present Resource Consumption & CO <sub>2</sub> Emission
2	Study of Usage of Renewable Energy
3	Study of Indoor Air Quality
4	Study of Indoor Lux & Noise Level
5	Study of Water Management
6	Study of Waste Management Practices
7	Study of Environment Friendly Practices

### 1.4 College Location Image:



College  
Campus

## CHAPTER-II

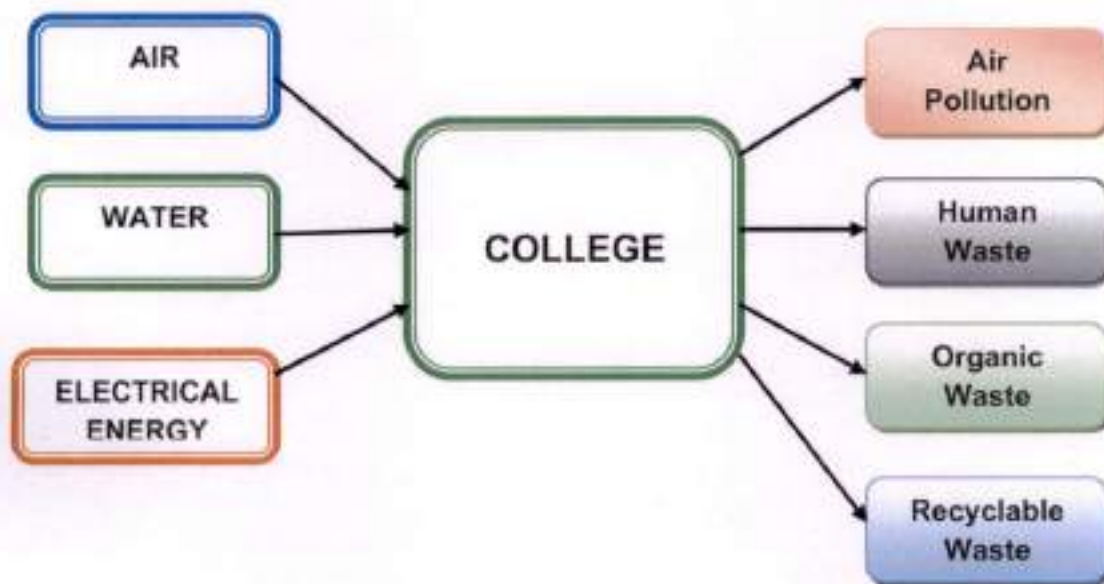
### STUDY OF RESOURCE CONSUMPTION & CO<sub>2</sub> EMISSION

The College consumes following basic/derived Resources:

1. Air
2. Water
3. Electrical Energy

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

**Chart No 1: Representation of Resource Requirement & Waste of a College:**



Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy. The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under.

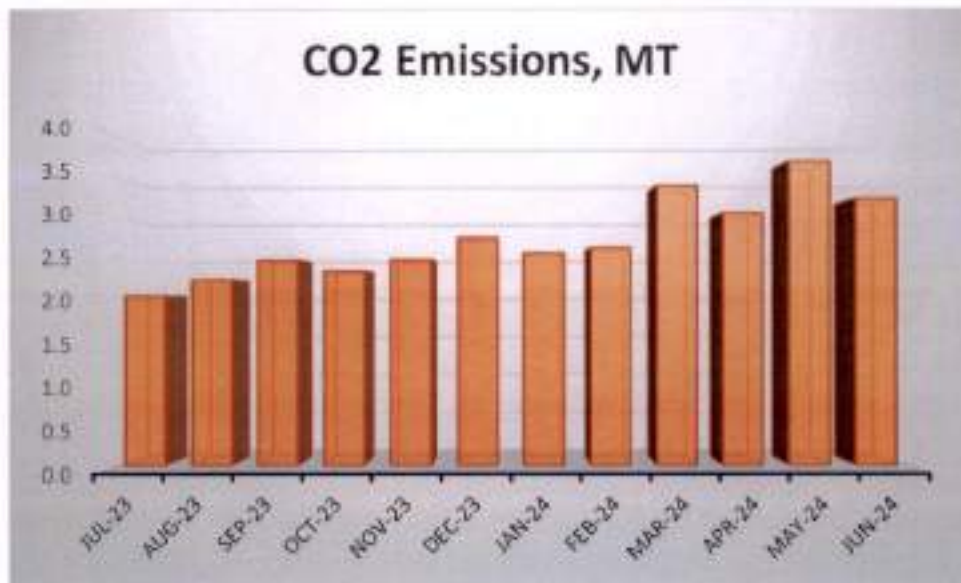
- **1 kWh** of Electrical Energy releases **0.93 Kg of CO<sub>2</sub>** into atmosphere

**Table No 1: Study of Purchase of Energy & CO<sub>2</sub> Emissions: 23-24:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jul-23	2200	2.0
2	Aug-23	2412	2.2
3	Sep-23	2665	2.5
4	Oct-23	2524	2.3
5	Nov-23	2672	2.5
6	Dec-23	2959	2.8

7	Jan-24	2765	2.6
8	Feb-24	2830	2.6
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12	Jun-24	3468	3.2
13	Total	35359	32.9
14	Maximum	3954	3.7
15	Minimum	2200	2.0
16	Average	2947	2.7

Chart No 2: Month wise CO<sub>2</sub> Emissions:



### **CHAPTER III**

## **STUDY OF USAGE OF RENEWABLE ENERGY**

The College has Solar Thermal Water Heating System at Hostel Block.

The College has yet to install Roof Top Solar PV Plant

**Photograph of Solar Thermal Water Heating System:**



## CHAPTER IV STUDY OF INDOOR AIR QUALITY

1. **Air:** The common name given to the atmospheric gases used in breathing and photosynthesis.

2. **Air quality** is a measure of the suitability of air for breathing by people, plants and animals.

3. **Air Quality Index: Air Quality Index (AQI)** is a number used by government agencies to measure the **Air Pollution** levels and communicate it to the population.

In this Chapter, we present three important Parameters: **AQI-** Air Quality Index, **PM-2.5-** Particulate Matter of Size 2.5 micron and **PM-10-** Particulate Matter of Size 10 micron

**Table No 2: Indoor Air Quality Parameters:**

No	Location	AQI	PM2.5	PM10
1	Office	80	48	57
2	Principal cabin	81	48	58
3	Computer lab	85	51	62
4	Classroom	83	49	56
5	Faculty Room	90	57	72
	Maximum	90	57	72
	Minimum	80	48	56

**Table No 3: Air Quality Index Values & Concentration of PM 2.5 & PM10: (By CPCB):**

No	Category	AQI Value	Concentration Range, PM 2.5	Concentration Range, PM 10
1	Good	0 to 50	0 to 30	0 to 50
2	Satisfactory	51 to 100	31 to 60	51 to 100
3	Moderately Polluted	101 to 200	61 to 90	101 to 250
4	Poor	201 to 300	91 to 120	251 to 350
5	Very Poor	301 to 400	121 to 250	351 to 430
6	Severe	401 to 500	250 +	430 +

### Conclusion:

From the above measured values, we conclude that the observed values of AQI, PM-2.5 & PM-10 are in the **Satisfactory Range**, as per the guidelines given by Central Pollution Control Board.

## CHAPTER V STUDY OF LUX & NOISE PARAMETERS

In this Chapter, we present the various Indoor Comfort Parameters measured during the Audit. The Parameters include: **Lux Level and Noise Level**.

**Table No 4: Study of Indoor Lux & Noise Parameters:**

No	Location	Lux Level	Noise Level, dB
1	Office	225	43.2
2	Principal cabin	219	45
3	Computer lab	243	47
4	Classroom	214	46.9
5	Faculty Room	229	48
	Maximum	<b>243</b>	<b>48</b>
	Minimum	<b>219</b>	<b>43.2</b>

**Recommended Lux & Noise Level: As per BEE & ISHRAE Guidelines:**

A) Noise Level Reference:		
No	Location	Noise Level Range, dB
1	Offices	45-50
2	Occupied Class Room	40-45
3	Libraries	35-40
B) Reference Lux Level, Lumens:		
1	For Class Rooms	<b>200 Plus</b>
2	For Reading Rooms	<b>200 Plus</b>

### Conclusion:

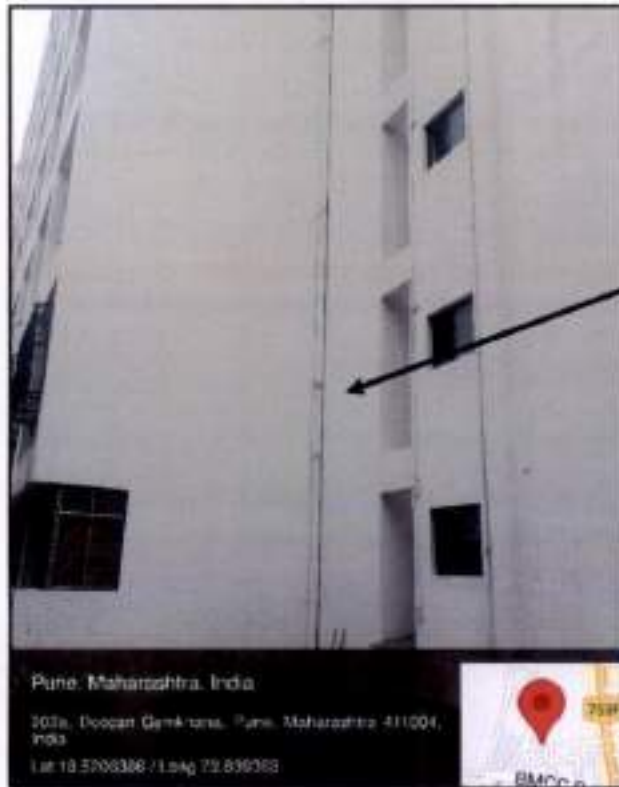
From the above measured values, we conclude that:

- The Noise Level is within the prescribed Limit
- The Lux Level at various locations is Okay

## CHAPTER VI STUDY OF RAIN WATER MANAGEMENT

The Rain Water falling on the terrace is used to increase the underground Water Table.

**Photograph of Rain Water Management Pipe:**









Rain Water  
Carrying Pipe

## CHAPTER-VII STUDY OF WASTE MANAGEMENT

In this Chapter, we present the Waste Management Practices, followed by the College.

**Details of Waste Management Practices:**



No	Head	Observation	Photograph
1	Solid Waste	Segregation of Waste at Source: Provision of Waste Collection Bins	<p style="text-align: center;"><b>Waste Collection Bin</b></p>  <p>Pune, Maharashtra, India 612, Late P. Anwar, Ramchandra Bhabar, Inna, Government, Dnyaneshwar, Pune, Maharashtra 411004, India Lat: 18.520287 / Long: 73.858471</p> 
2	Organic Waste	Provision of a Bio Composting Bed for conversion of Organic Waste.	<p style="text-align: center;"><b>Vermi Composting Pit:</b></p>  <p>Pune, Maharashtra, India 6100, P.M., Dnyaneshwar, Pune, Maharashtra 411004, India Lat: 18.520287 / Long: 73.858471</p> 

<p>3</p>	<p><b>Sanitary Waste</b></p>	<p>Provision of Sanitary waste Incinerator &amp; tie up with external Agency for disposal of Sanitary Waste</p>	<p style="text-align: center;"><b>Sanitary Napkin Disposal Unit</b></p>  <p>Pune, Maharashtra, India          6-15, Laxi H. Kherkar, Shankarrao Chavan Law Coll.,          Gandhinagar, Dadasaheb Phalke, Maharashtra          411004, India          Lat: 18.5222487 / Long: 73.8995173</p> 
<p>4</p>	<p><b>E Waste</b></p>	<p>Disposed of through Authorized Agency.</p>	

## CHAPTER-VIII STUDY OF ECO-FRIENDLY PRACTICES

In this Chapter, we present the Eco-Friendly Practices, followed by the College.

### Details of Eco-Friendly Practices:

No	Head	Observation	Photograph
1	Tree Plantation	Internal Tree Plantation in the Campus	<p>Internal Tree Plantation:</p>  <p>Pune, Maharashtra, India 302A, Deccan Gymkhana, Pune, Maharashtra 411004, India Lat: 18.529193 / Long: 73.828995</p>
2	Creation of Awareness among Stake Holders	Display of Poster on Water Conservation	<p>Poster on Water Conservation:</p>  <p>Pune, Maharashtra, India 302A, BMCC Campus, Deccan Gymkhana, Pune, Maharashtra 411004, India Lat: 18.529474 / Long: 73.828796</p>

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ISO: 9001-2015 Certified (Cert No: 23EQKC13),  
ISO: 14001-2015 Certified (Cert No: 23EEKW20)



## ENERGY AUDIT CERTIFICATE

Certificate No: ES/SCLC/23-24/01

Date: 18/7/2024

This is to certify that we have conducted Energy Audit at Marathwada Mitra Mandal's Shankarrao Chavan Law College, 202/A, Deccan Gymkhana, Pune in the Academic Year: 2023-24.

The College has adopted following Energy Efficient Practices:

- Usage of Energy Efficient LED Fittings
- Sensor Based Lighting Operation in the Corridor
- Installation of Solar Water Heating System at Hostel block.

We appreciate the support of Management, involvement of faculty members and students in the process of making the Campus Energy Efficient.

For Engress Services,

**A Y Mehendale,**  
B E-Mechanical, M Tech- Energy  
BEE Certified Energy Auditor, EA-8192





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## **ACKNOWLEDGEMENT**

We Engress Services, Pune, express our sincere gratitude to the management of Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune, for awarding us the assignment of Energy Audit of their Campus for the Academic Year: 2023-24.

We are thankful to all the staff members for helping us during the field study.

## EXECUTIVE SUMMARY

1. **Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune 411 004** consumes Energy in the form of **Electrical Energy**; used for various gadgets, Office & other facilities.

### 2. Present Connected Load & Energy Consumption:

No	Particulars	Value	Unit
1	Total Connected Load	43.69	kW
2	Annual Energy Consumed	35359	kWh

### 3. Per Capita Energy Consumption:

No	Particulars	Value	Unit
1	Annual Energy Consumed	35359	kWh
2	No of students studying in the College	1296	Nos
3	Per Capita Energy Consumption = (1) / (2)	27.28	kWh/Annum

### 4. Study of % Usage of LED Lighting:

No	Particulars	Value	Unit
1	% of Usage of LED Lighting to Total Lighting Load	96	%

### 5. Renewable Energy & Energy Efficiency Projects:

- Usage of Energy Efficient LED fittings
- Sensor Based Lighting in Corridor
- Installation of Solar Water Heating System at Hostel Block

### 6. Assumptions:

1. 1 kWh of Electrical Energy releases 0.93 Kg of CO<sub>2</sub> into atmosphere
2. Energy Consumption is computed based on Load Utilization Factor

### 7. References:

- Audit Methodology: [www.mahaurja.com](http://www.mahaurja.com)
- Energy Conservation Building Code: ECBC-2017: [www.beeindia.gov.in](http://www.beeindia.gov.in)
- For CO<sub>2</sub> Emissions: [www.ccd.gujarat.gov.in](http://www.ccd.gujarat.gov.in)

## **ABBREVIATIONS**

LED	: Light Emitting Diode
SVKM	: Shri Vile parle Kelavani Mandal
BEE	: Bureau of Energy Efficiency
FTL	: Fluorescent Tube Light
CFL	: Compact Fluorescent Light
PV	: Photo Voltaic
Kg	: Kilo Gram
kWh	: kilo-Watt Hour
CO <sub>2</sub>	: Carbon Di Oxide
MT	: Metric Ton.

## CHAPTER-I INTRODUCTION

### 1.1 Introduction:

An Energy Audit is conducted at Marathwada Mitra Mandal's Shankarrao Chavan Law College, Pune.

The guidelines followed for conducting the Energy Audit are:

- BEE India's Energy Conservation Building Code: ECBC-2017
- Maharashtra Energy Development Agency ([www.mahaurja.com](http://www.mahaurja.com))
- Tata Power: [www.tatapower.com](http://www.tatapower.com)

### 1.2 Key Study Points:

No	Particulars
1	Study of Present Connected Load
2	Study of Present Energy Consumption
3	Study of Per Capita Energy Consumption
4	Study of Lighting
5	Study of Energy Efficiency & Renewable Energy

### 1.3 College Location Image:



College  
Campus

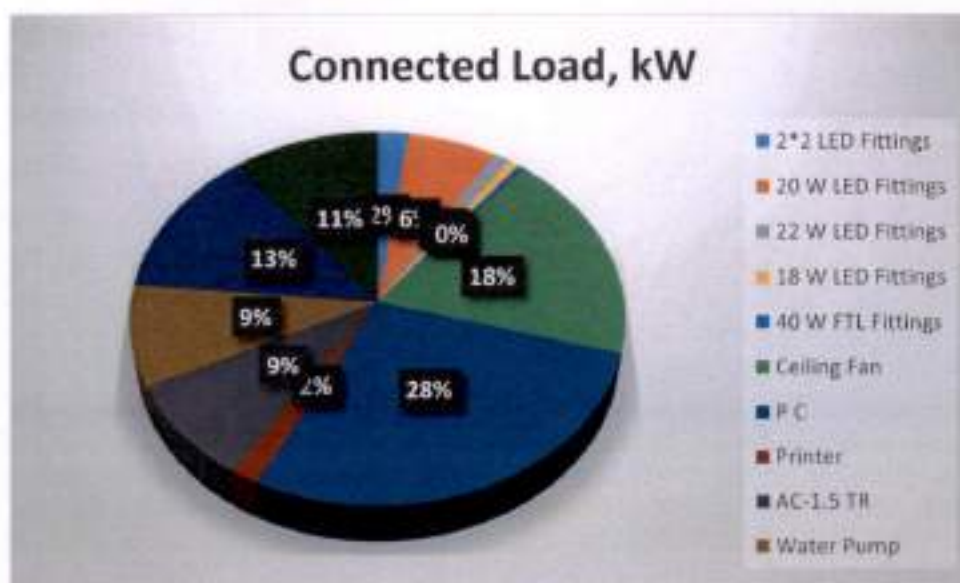
## CHAPTER-II STUDY OF CONNECTED LOAD

The major contributors to the connected load of the College include:

**Table No 1: Study of Equipment wise Connected Load:**

No	Equipment	Qty	Load, W/Unit	Load, kW
1	2*2 LED Fittings	24	40	0.96
2	20 W LED Fittings	137	20	2.74
3	22 W LED Fittings	24	22	0.528
4	18 W LED Fittings	18	18	0.324
5	40 W FTL Fittings	5	40	0.2
6	Ceiling Fan	121	65	7.865
7	P C	80	150	12
8	Printer	10	150	0.75
9	AC-1.5 TR	2	1875	3.75
10	Water Pump	1	3730	3.73
11	Lift	1	5595	5.595
12	Other Equipment	30	150	4.5
13	<b>Total</b>			<b>43.69</b>

**Chart No 1: Study of Connected Load:**



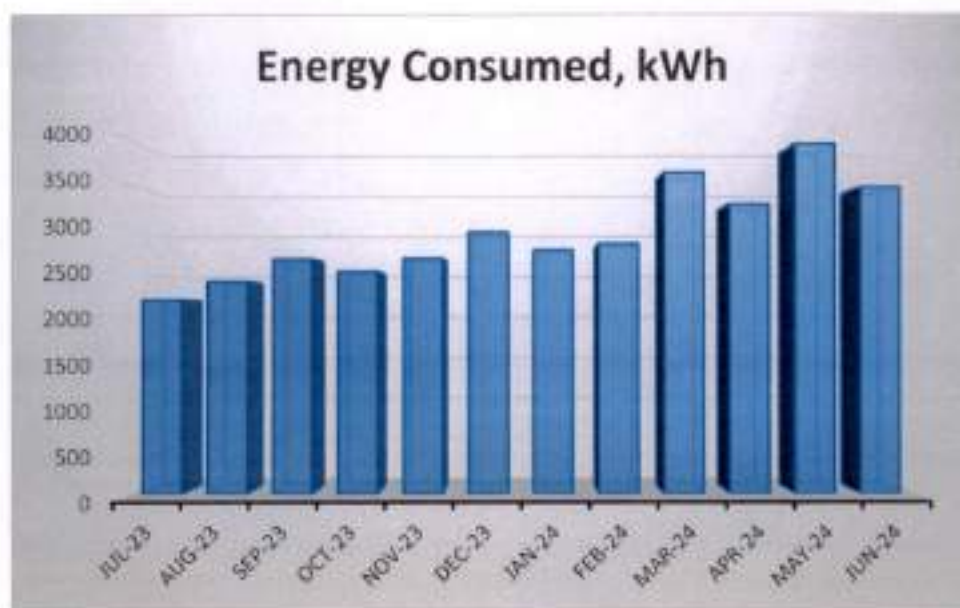
### CHAPTER-III STUDY OF PRESENT ENERGY CONSUMPTION

In this chapter, we present the analysis of Electrical Energy Consumption.

**Table No 2: Study of Electrical Energy Consumption Analysis: 2023-24:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jul-23	2200	2.0
2	Aug-23	2412	2.2
3	Sep-23	2665	2.5
4	Oct-23	2524	2.3
5	Nov-23	2672	2.5
6	Dec-23	2959	2.8
7	Jan-24	2765	2.6
8	Feb-24	2830	2.6
9	Mar-24	3636	3.4
10	Apr-24	3274	3.0
11	May-24	3954	3.7
12	Jun-24	3468	3.2
13	Total	35359	32.9
14	Maximum	3954	3.7
15	Minimum	2200	2.0
16	Average	2947	2.7

**Chart No 2: Variation in Monthly Energy Consumption:**



## **CHAPTER-IV**

### **STUDY OF PER CAPITA ENERGY CONSUMPTION**

**Per Capita Energy Consumption Index:** Per Capita Energy Consumption Index of an educational College/College is its Annual Energy Consumption in Kilo Watt Hours per student studying in the College/College.

It is determined by:

$$\text{Per Capita Energy Consumption Index} = \frac{\text{Annual Energy Consumption in kWh}}{\text{(Total No of students studying)}}$$

**Table No 3: Computation of Energy Performance Index:**

<b>No</b>	<b>Particulars</b>	<b>Value</b>	<b>Unit</b>
1	Annual Energy Consumed	35359	kWh
2	No of students studying in the College	1296	Nos
3	Per Capita Energy Consumption = (1) / (2)	<b>27.28</b>	kWh/Annum

## CHAPTER-V STUDY OF LIGHTING

### Terminology:

1. **Lumen** is a unit of light flow or luminous flux. The lumen rating of a lamp is a measure of the total light output of the lamp. The most common measurement of light output (or luminous flux) is the lumen. Light sources are labeled with an output rating in lumens.

2. **Lux** is the metric unit of measure for illuminance of a surface. One lux is equal to one lumen per square meter.

3. **Circuit Watts** is the total power drawn by lamps and ballasts in a lighting circuit under assessment.

4. **Installed Load Efficacy** is the average maintained illuminance provided on a horizontal working plane per circuit watt with general lighting of an interior. Unit: lux per watt per square metre ( $\text{lux}^2/\text{Wm}^2$ )

5. **Lamp Circuit Efficacy** is the amount of light (lumens) emitted by a lamp for each watt of power consumed by the lamp circuit, i.e. including control gear losses. This is a more meaningful measure for those lamps that require control gear. Unit: lumens per circuit watt ( $\text{lm/W}$ )

6. **Lighting Power Density:** It is defined as Total Lighting Load in a room divided by the Area of that Room in square meters.

In this Chapter we compute the Lighting Power density and the percentage usage of LED Lighting to total Lighting Load of the College.

**Table No 4: Percentage Usage of LED Lighting to Total Lighting Load:**

No	Particulars	Value	Unit
1	No of 40 W LED Fittings	24	Nos
2	Load per unit of 40 W LED Fitting	40	W
3	Total Load of 40 W LED Fittings	0.96	kW
4	No of 20 W LED Fittings	137	Nos
5	Load per unit of 20 W LED Fitting	20	W
6	Total Load of 20 W LED Fittings	2.74	kW
7	No of 22 W LED Fittings	24	Nos
8	Load per unit of 22 W LED Fitting	22	W

<b>9</b>	Total Load of 2 W LED Fittings	<b>0.528</b>	<b>kW</b>
10	No of 18 W LED Fittings	18	Nos
11	Load per unit of 18 W LED Fitting	18	W
<b>12</b>	<b>Total Load of 18 W LED Fittings</b>	<b>0.324</b>	<b>kW</b>
13	No of 40 W FTL Fittings	5	Nos
14	Load per unit of 40 W FTL Fitting	40	W
<b>15</b>	<b>Total Load of 40 W FTL Fittings</b>	<b>0.2</b>	<b>kW</b>
<b>16</b>	<b>Total LED Lighting Load= 3+6+9+12</b>	<b>4.552</b>	<b>kW</b>
<b>17</b>	<b>Total Lighting Load= 3+6+9+12+15</b>	<b>4.752</b>	<b>kW</b>
<b>18</b>	<b>% of LEDs to Total Lighting Load=16*100/17</b>	<b>96</b>	<b>%</b>

## CHAPTER-VI

### STUDY OF RENEWABLE ENERGY & ENERGY EFFICIENCY

#### 6.1 Usage of Renewable Energy:

- The College has Solar Thermal Water Heating System at Hostel Block
- The College has yet to install Roof Top Solar PV Plant

#### Photograph of Solar Thermal Water Heating System:



#### 6.2 Energy Efficiency Projects:

- Usage of Energy Efficient LED Lighting
- Sensor Based Lighting in the Corridor
- Usage of Energy Efficient BEE STAR Rated Equipment

#### Photographs of LED Lighting & Sensor Based Lighting:

