

**7.1.3: Quality audits on environment and energy regularly undertaken by the Institution. The institutional environment and energy initiatives are confirmed through the following**

- 1. Green audit / Environment audit**
- 2. Energy audit**
- 3. Clean and green campus initiatives**
- 4. Beyond the campus environmental promotion activities**

Documents attached

Green Audit report 2022-23

Environment audit report 2022-23

Green Audit report 2021-22

Environment audit report 2021-22

Green Audit report 2020-21

Environment audit report 2020-21

**Report**  
**On**  
**Green Audit**  
**At**  
**Paramhansa Ramkrishna Maunibaba Shikshan Santha's**  
**Anuradha Engineering College**  
**Chikhli**  
**(Year 2022-23)**



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## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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 Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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	7,090	5.67
2	Minimum	3,054	2.44
3	Average	4,138	3.31
4	Total	49,653	39.72

### 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.

### 3. Rain Water Harvesting

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

### 4. 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.

### 5. 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**



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 institution Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is situated in the Anuradha Nagar, Chikhli ; Dist:-Buldana in Maharashtra state. The campus is situated on sprawling 37 acre acres land 3km from Chikhli town on Sakegaon road. The institution has developed a beautiful campus with residential facility for the students and staff, sport facilities, Garden, Canteen, etc. The institution is a dream founder Chairman Shri Siddhavinayak Bondre realized by the blessings of Sant Paramhansa Ramkrishna Maunibaba. It was established in the year 1993 with two branches & now has grown to six branches and M.Tech.

### **1.1 Objectives**

1. To study present level of Energy Consumption
2. To Study the present CO<sub>2</sub> 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



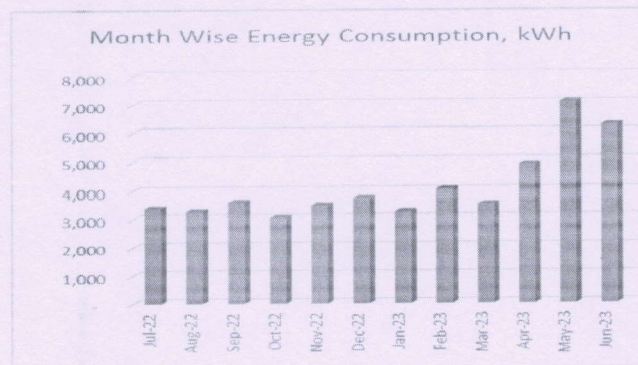
## 2. Study of Electrical Energy Consumption

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-23	6,279	84,470
2	May-23	7,090	99,194
3	Apr-23	4,882	70,428
4	Mar-23	3,520	99,194
5	Feb-23	4,061	56,475
6	Jan-23	3,253	46,997
7	Dec-22	3,753	53,643
8	Nov-22	3,497	50,302
9	Oct-22	3,054	44,713
10	Sep-22	3,610	52,022
11	Aug-22	3,275	48,117
12	Jul-22	3,379	49,188
	<b>Total</b>	<b>49,653</b>	<b>754,743</b>

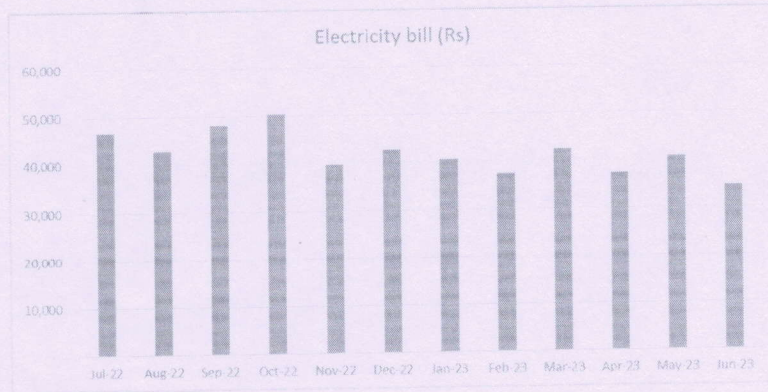
Variation in energy consumption is as follows,



**Figure 2.1: Month wise energy consumption**



Monthly variation in electricity bill is as follows,



**Figure 2.2: 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	7,090	5.67
2	Minimum	3,054	2.44
3	Average	4,138	3.31
4	Total	49,653	39.72

### 3. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

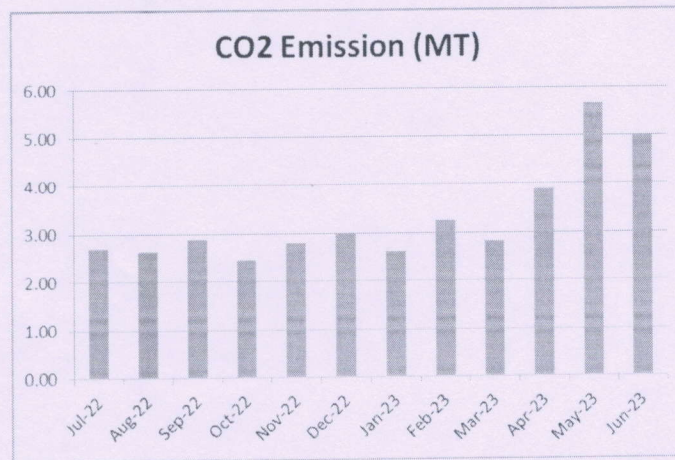
We herewith furnish the details of various forms of Energy consumption as under

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-23	6,279	5.02
2	May-23	7,090	5.67
3	Apr-23	4,882	3.91
4	Mar-23	3,520	2.82
5	Feb-23	4,061	3.25
6	Jan-23	3,253	2.60
7	Dec-22	3,753	3.00
8	Nov-22	3,497	2.80
9	Oct-22	3,054	2.44
10	Sep-22	3,610	2.89
11	Aug-22	3,275	2.62
12	Jul-22	3,379	2.70
	<b>Total</b>	<b>49,653</b>	<b>39.72</b>

In the following Chart we present the CO<sub>2</sub> emissions due to usage of Electrical Energy.





**Figure 3.1: Month wise CO2 Emission**

#### 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



## **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 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.

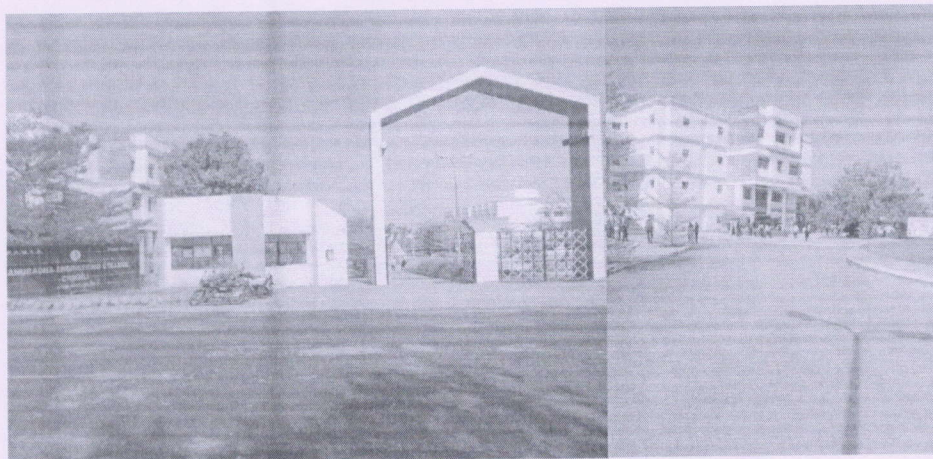
### 7.2 Usage of Public Transport

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. Institute encourages students to not to use automobiles.

### 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

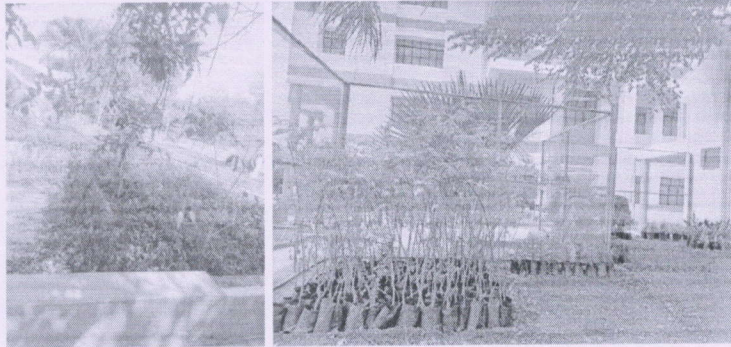
### 7.5 Paperless Office

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**

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**On**  
**Environmental Audit**  
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## **Acknowledgement**

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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.

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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<sub>2</sub> on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

### 2. Present Level of CO<sub>2</sub> Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO <sub>2</sub> Emission (MT)
1	Maximum	7,090	5.67
2	Minimum	3,054	2.44
3	Average	4,138	3.31
4	Total	49,653	39.72

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

- Usage of Energy Efficient BEE STAR Rated ACs
- 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<sub>2</sub> 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
MD	: 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	Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli.
2	Address	Anuradha Nagar, Sakegaon Road, Chikhli, Buldhana, Maharashtra. 443201.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

## 2. Study of Consumption of Various Resources

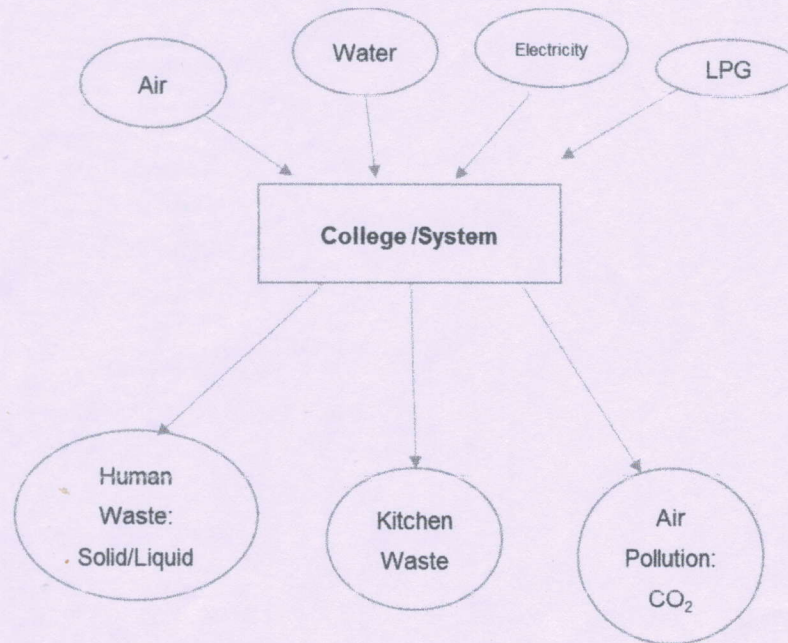
The Institute consumes following basic/derived Resources:

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.



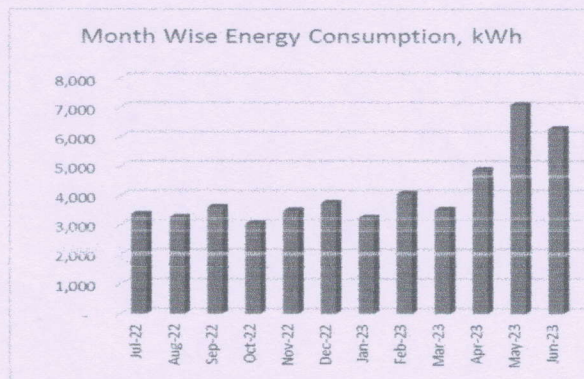
Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy & LPG as under.

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

**Table 2.1: Electrical Energy Consumption**

No	Month	Energy (kWh)
1	Jun-23	6,279
2	May-23	7,090
3	Apr-23	4,882
4	Mar-23	3,520
5	Feb-23	4,061
6	Jan-23	3,253
7	Dec-22	3,753
8	Nov-22	3,497
9	Oct-22	3,054
10	Sep-22	3,610
11	Aug-22	3,275
12	Jul-22	3,379
	<b>Total</b>	<b>49,653</b>
	<b>Maximum</b>	<b>7,090</b>
	<b>Minimum</b>	<b>3,054</b>
	<b>Average</b>	<b>4,138</b>

**2.1 Variation of Monthly Electrical Energy Consumption**



**Figure 2.1 : Monthly Electrical Energy Consumption**



## 2.2 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	7,090
2	Minimum	3,054
3	Average	4,138
4	Total	49,653

### 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<sub>2</sub> in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO<sub>2</sub> in the atmosphere

In the following Table, we present the CO<sub>2</sub> emissions.

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-23	6,279	5.02
2	May-23	7,090	5.67
3	Apr-23	4,882	3.91
4	Mar-23	3,520	2.82
5	Feb-23	4,061	3.25
6	Jan-23	3,253	2.60
7	Dec-22	3,753	3.00
8	Nov-22	3,497	2.80
9	Oct-22	3,054	2.44
10	Sep-22	3,610	2.89
11	Aug-22	3,275	2.62
12	Jul-22	3,379	2.70
	<b>Total</b>	<b>49,653</b>	<b>39.72</b>
	<b>Maximum</b>	7,090	5.67
	<b>Minimum</b>	3,054	2.44
	<b>Average</b>	4,138	3.31

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

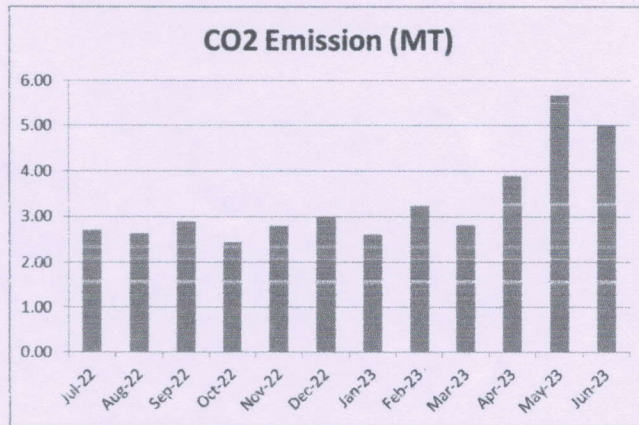


Figure 2.1: CO2 emission due to usage of electrical energy.

### 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 Pipe:**



## 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





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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<sub>2</sub> 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**

<b>Sr no</b>	<b>Parameter</b>	<b>Energy consumed, (Units)</b>	<b>CO<sub>2</sub> Emission (MT)</b>
1	Maximum	5,001	4.00
2	Minimum	2,674	2.14
3	Average	3,482	2.79
4	Total	41,789	33.43

### 2. Energy Conservation Projects already installed

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. 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.

#### 4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 23 %.

#### 5. Recommendations

**Table no 1: Recommendations for energy savings**

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 352 Nos T-8 fittings with 20W LED fittings	7,040	77,440	225,632	35
2	Replacement of 487 Nos Old Ceiling Fans with STAR rating fans	6,331	69,641	1,058,738	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1,000,000	36
	<b>Total</b>	<b>43,371</b>	<b>477,081</b>	<b>2,284,370</b>	<b>57</b>

#### 6. 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 institution Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is situated in the Anuradha Nagar, Chikhli ; Dist:-Buldana in Maharashtra state. The campus is situated on sprawling 37 acre acres land 3km from Chikhli town on Sakegaon road. The institution has developed a beautiful campus with residential facility for the students and staff, sport facilities, Garden, Canteen, etc. The institution is a dream founder Chairman Shri Siddhavinayak Bondre realized by the blessings of Sant Paramhansa Ramkrishna Maunibaba. It was established in the year 1993 with two branches & now has grown to six branches and M.Tech.

### 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	Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli.
2	Address	Anuradha Nagar, Sakegaon Road, Chikhli, Buldhana, Maharashtra. 443201.
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	FTL (40W)	LED tube (20W)	LED bulb (12W)	Computers (65W)	Fans	1.5TR Star rated AC
<b>Office Building</b>							
1	T & P Cell		4		2	2	
2	Dark Room Physics		1			1	
3	Engineering Physics Lab		4			2	
4	Industrial Waste Treatment Lab		4			4	
5	Mechanical Operations Lab		2			2	
6	A 007	2				3	
7	Chemical Reaction Engg. Lab	2					
8	Heat Transfer Lab		4			2	
9	Mass Transfer Lab	4	1			2	
10	Wash Room Staff		1				
11	Wash Room Boys		1				
12	Wash Room Girls		1			6	
13	Chemical Lab	2	1			2	
14	H.O.D.		1		1	1	
15	Tutorial		1			1	
16	Class Room		2			4	
17	Class Room		3			4	
18	Server Room		2			3	1
19	Computer Centre		4		50	14	
20	Class Room PG		2			3	
21	Staff Room		1			1	
22	Class Room		4			3	
23	Wash Room Staff		1				
24	Wash Room Boys		1				
25	Wash Room Girls		1				
26	Transfer Fenomena Lab		2		1	3	



27	H.O.D.	1			2	1	
28	Tutorial Room	1	1			2	
29	Advanced Software Lab		2			2	
30	Open Source Lab		4		19	4	
31	Programming Lab		4		18	4	
32	Web Technologies Lab		2		20	4	
33	Class Room		5			4	
34	Class Room		3		1	5	
35	Advanced Programming Lab		2		18	4	
36	Class Room		3			4	
37	Wash Room Staff		1				
38	Wash Room Boys		1				
39	Wash Room Girls		1				
40	Girls common room		2			3	
41	H.O.D.		2			2	
42	Tutorial Room		1		2	2	
43	AI & MI Lab		2			4	
44	Open Source Lab		2		16	4	
45	Programming Lab		2			4	
46	Web Technologies Lab		3	1		2	
47	Class Room		4			4	
48	A 308		4			4	
49	Advanced Programming Lab		2		17	9	
50	Class room		4			4	
51	Wash Room Staff		1				
52	Wash Room Boys		1				
53	Wash Room Girls		1				
54	Staff Room		2			2	
55	Chairman's Cabin		3		1	2	1
56	Secretary's Cabin		1	11		2	
57	Engg. Chemistry Lab		4			2	
58	Former Chairman Photo Gallery			22		4	
59	Meeting Hall		14			4	1
60	Trustee's Cabin		4		1	2	1
61	IQAC Cell		3		3	2	
62	Administrative Office	4	5		12	8	
63	Former Chairman Cabin		1			1	

64	Principal Cabin			12	1	2	1
65	Wash Room Ladies Staff		1				
66	Tea / Refreshment Room		1				
67	Wash Room Gents Staff		1				
68	H.O.D.		1		1	1	
69	Tutorial Room		1			2	
70	Seminar Hall		6			6	
71	Additional W/S	9				5	
72	Toilet Staff	1					
73	Toilet Staff	1					
74	Civil Laboratory 5	4				5	
75	Boys Common Room	5				4	
76	Girls Common Room	4				4	
77	Toilet Ladies	1					
78	Toilet Gents	2					
79	Passage	3					
80	Laboratory	5				4	2
81	Toilet	4					
82	Passage	10					
	<b>(First floor)</b>						
82	Civil Class Room1	3				4	
83	Civil Class Room 2	4				6	
84	Civil Class Room 3	4				6	
85	Civil PG Lab 1	7				6	
86	TR 1	5				6	
87	Civil Laboratory 4	5				6	
88	Drawing Hall	5				6	
89	Toilet Staff	1					
90	Toilet Staff	1					
91	Civil Laboratory 5	5				6	
92	Civil Class Room 4	5				6	
93	Civil Class Room 5	5				6	
94	Toilet Ladies	4					
95	Toilet Gents	4					
96	Civil Laboratory 09	2				4	
97	HOD Civil	5			4	6	
98	Toilet	4					
99	Passage	10					
	<b>(Second floor)</b>						

100	Electrical Class Room 1	5				6	
101	Electrical Class Room 2	4				6	
102	Laboratory	4				6	
103	Electrical Laboratory3	5				6	
104	Electrical Laboratory	5				6	
105	Electrical Laboratory	5				6	
106	Electrical Laboratory 4	5				6	
107	Toilet	2					
108	Toilet	2					
109	Laboratory for Electrical 5	5			2	6	
110	Laboratory for Electrical 6	5				6	
111	Laboratory	5				6	
112	Research lab	5			2	3	
113	MBA Comp Lab	3				4	
114	HOD Electrical	5			4	6	
115	Toilet	1					
116	Passage	7					
	<b>(Third floor)</b>						
117	Computer Class Room 1	5			10	6	
118	Computer Class Room 2	5			10	6	
119	Laboratory	5				6	
120	Computer Laboratory 1	3			10	5	
121	Staff Room	1				2	
122	Computer Laboratory 2	4			10	4	
123	Staff Room	1				2	
124	Computer Laboratory 3	8			15	6	
125	Computer Laboratory4	3			15	4	
126	Staff Room	1				2	
127	Toilet	1					
128	Toilet	1					
129	Computer Laboratory 5	5			10	4	
130	Computer Laboratory 6	4			10	4	
131	Staff Room	1				2	
132	E&TC PG Classroom 1	4				5	
133	E&TC PG Classroom 2	1				1	
134	Toilet Ladies	1					
135	Toilet Gents	1					

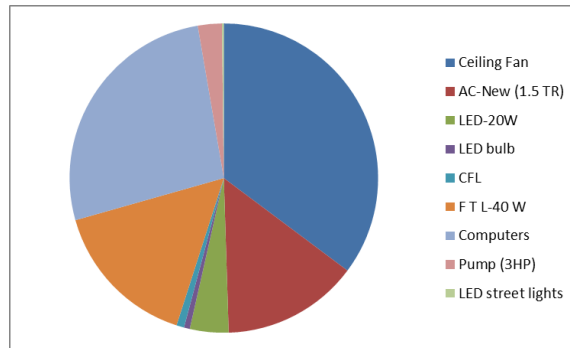
136	Computer Laboratory PG	6			15	5	
137	HOD Computer	2			4	2	
138	PG CLR	1				2	
139	PG CLR	1				1	
140	Toilet	1					
141	Passage	5					
	<b>(Fourth floor)</b>						
142	IT Class Room 1	5				6	
143	IT Class Room 2	5				6	
144	E&TC Class Room 3	5				6	
145	IT Laboratory 1	3			10	5	
146	Staff Room	1				2	
147	IT Laboratory 2	4			10	4	
148	Staff Room	1				2	
149	IT Laboratory 3	6			10	8	
150	E&TC Class Room 4	3				6	
151	Toilet	1					
152	Toilet	1					
153	IT Laboratory 5	4			8	6	
154	IT Laboratory 6	5			12	7	
155	IT Laboratory 7	5			8	7	
156	Language Lab I	5				6	
157	HOD IT	2			4	3	
158	TR UG	1				1	
159	Staff Room	1				1	
160	Toilet	1					
161	Passage	5	25				
	<b>Total</b>	<b>352</b>	<b>182</b>	<b>46</b>	<b>369</b>	<b>487</b>	<b>7</b>

Apart from above load, the school has pumps, LED street lights, CFLs and LED focus street lights on streets and grounds. 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	487	65	31.7
2	AC-New (1.5 TR)	7	1838	12.9
3	LED-20W	182	20	3.6
4	LED bulb	46	12	0.6
5	CFL	30	24	0.7
6	F T L-40 W	352	40	14.1
7	Computers	369	65	24.0
8	Pump (3HP)			2.3
9	LED street lights	5	35	0.2
	Total			89.9

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



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

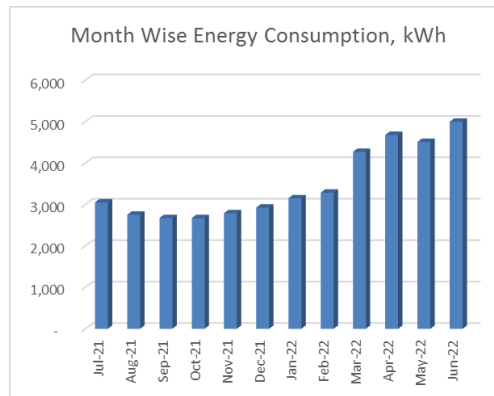
### 3. Study of Electrical Energy Consumption

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

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

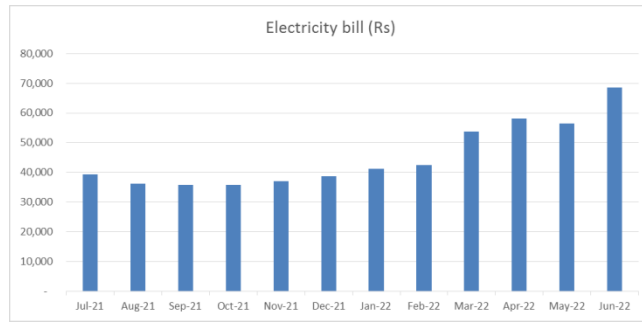
No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-22	5,001	68,600
2	May-22	4,513	56,449
3	Apr-22	4,682	58,226
4	Mar-22	4,274	53,700
5	Feb-22	3,289	42,427
6	Jan-22	3,154	41,224
7	Dec-21	2,927	38,676
8	Nov-21	2,791	37,056
9	Oct-21	2,674	35,753
10	Sep-21	2,676	35,792
11	Aug-21	2,755	36,251
12	Jul-21	3,053	39,350
	<b>Total</b>	<b>41,789</b>	<b>543,504</b>

Variation in energy consumption is as follows,



**Figure 3.1: Month wise energy consumption**

Monthly variation in electricity bill 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	5,001	4.00
2	Minimum	2,674	2.14
3	Average	3,482	2.79
4	Total	41,789	33.43

## 4. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

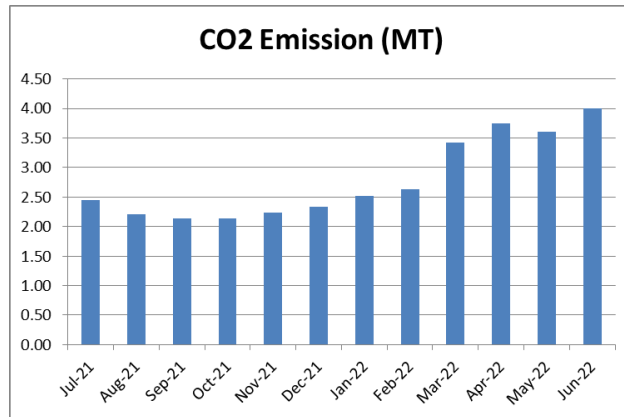
We herewith furnish the details of various forms of Energy consumption as under

**Table 4.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-22	5,001	4.00
2	May-22	4,513	3.61
3	Apr-22	4,682	3.75
4	Mar-22	4,274	3.42
5	Feb-22	3,289	2.63
6	Jan-22	3,154	2.52
7	Dec-21	2,927	2.34
8	Nov-21	2,791	2.23
9	Oct-21	2,674	2.14
10	Sep-21	2,676	2.14
11	Aug-21	2,755	2.20
12	Jul-21	3,053	2.44
	<b>Total</b>	<b>41,789</b>	<b>33.43</b>



In the following Chart we present the CO2 emissions due to usage of Electrical Energy.



**Figure 4.1: Month wise CO2 Emission**

## **5. Study of utilities**

### **5.1 Study of Lighting**

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 352 FTL fittings with Electronic/ magnetic chokes, 182 LED tubes, 30 number of CFL lights, 46 nos of LED bulbs and 5 No of LED street lights. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are. There are.

### **5.2 Air-conditioners**

There is 7nos of star rated new AC of 1.5Tr capacity.

### **5.3 Ceiling Fans**

At building facility, there are about 487 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.

### **5.4 Water Pumps**

There are in total 1 Water pumps with 3HP 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	F T L-40 W	352	40	14.1
2	CFL	30	24	0.7
	<b>LED lighting load</b>			
1	LED tube	182	20	3.6
2	LED bulb	46	12	0.6
3	LED street lights	5	35	0.2
	<b>Total LED lighting load</b>			<b>4.4</b>

It can be seen that out of total lighting load 23% load is LED lighting load.

## 7. Energy conservation proposals

### 7.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 352 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	352	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	28.16	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	7040	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	77440	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	225632	Rs lump sum
13	Simple Payback period	35	Months

## 7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 487 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	487	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	25.324	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	6331	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	69641	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	1058738	Rs lump sum
13	Simple Payback period	182	Months

### 7.3 Installation of 20kW Solar PV panel

It is recommended to install 20 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

<b>No</b>	<b>Particulars</b>	<b>Value</b>	<b>Unit</b>
1	Installation of 20kW PV unit	20	kW
2	Energy saving	30000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	330000	Rs/ Annum
5	Investment required	1000000	Rs lump sum
6	Simple payback period	36	Months

#### 7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 352 Nos T-8 fittings with 20W LED fittings	7,040	77,440	225,632	35
2	Replacement of 487 Nos Old Ceiling Fans with STAR rating fans	6,331	69,641	1,058,738	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1,000,000	36
	<b>Total</b>	<b>43,371</b>	<b>477,081</b>	<b>2,284,370</b>	<b>57</b>

**Report**  
**On**  
**Environmental Audit**  
**At**  
**Paramhansa Ramkrishna Maunibaba Shikshan Santha's**  
**Anuradha Engineering College**  
**Chikhli**



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## **Acknowledgement**

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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.

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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<sub>2</sub> on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

### 2. Present Level of CO<sub>2</sub> Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO <sub>2</sub> Emission (MT)
1	Maximum	5,001	4.00
2	Minimum	2,674	2.14
3	Average	3,482	2.79
4	Total	41,789	33.43

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

- Usage of Energy Efficient BEE STAR Rated ACs
- 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<sub>2</sub>** 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	Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli.
2	Address	Anuradha Nagar, Sakegaon Road, Chikhli, Buldhana, Maharashtra. 443201.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

## 2. Study of Consumption of Various Resources

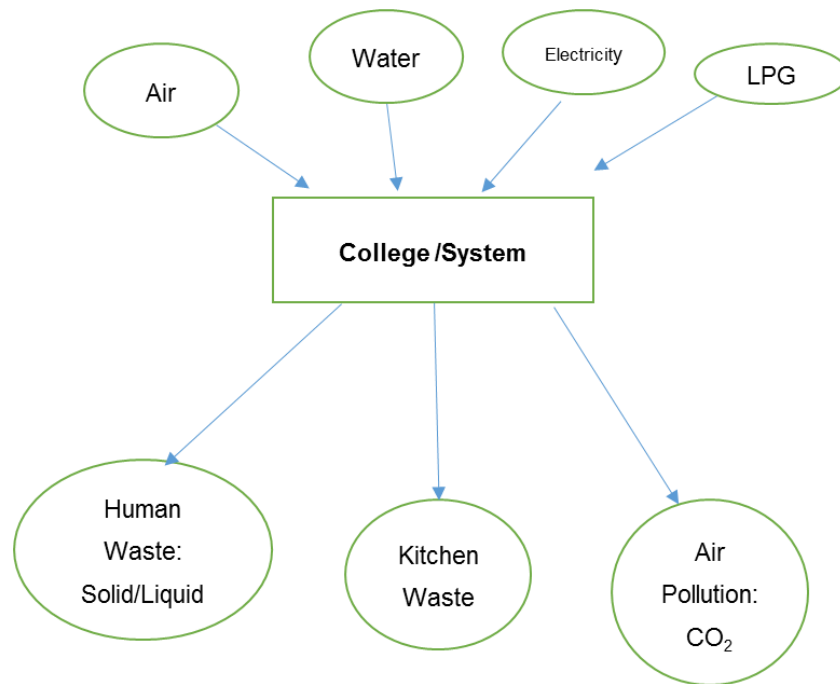
The Institute consumes following basic/derived Resources:

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.



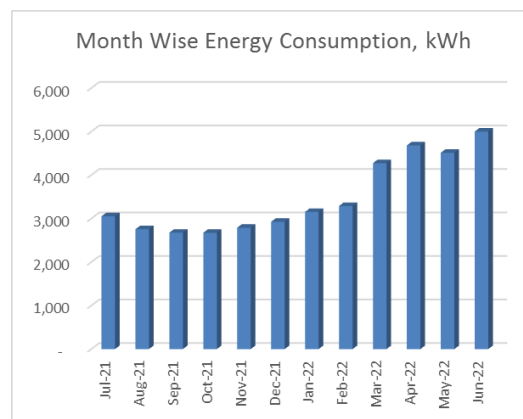
Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy & LPG as under.

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

**Table 2.1: Electrical Energy Consumption**

No	Month	Energy (kWh)
1	Jun-22	5,001
2	May-22	4,513
3	Apr-22	4,682
4	Mar-22	4,274
5	Feb-22	3,289
6	Jan-22	3,154
7	Dec-21	2,927
8	Nov-21	2,791
9	Oct-21	2,674
10	Sep-21	2,676
11	Aug-21	2,755
12	Jul-21	3,053
	<b>Total</b>	<b>41,789</b>
	<b>Maximum</b>	5,001
	<b>Minimum</b>	2,674
	<b>Average</b>	3,482

## 2.1 Variation of Monthly Electrical Energy Consumption



**Figure 2.1 : Monthly Electrical Energy Consumption**



## 2.2 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	5,001
2	Minimum	2,674
3	Average	3,482
4	Total	41,789

### 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.

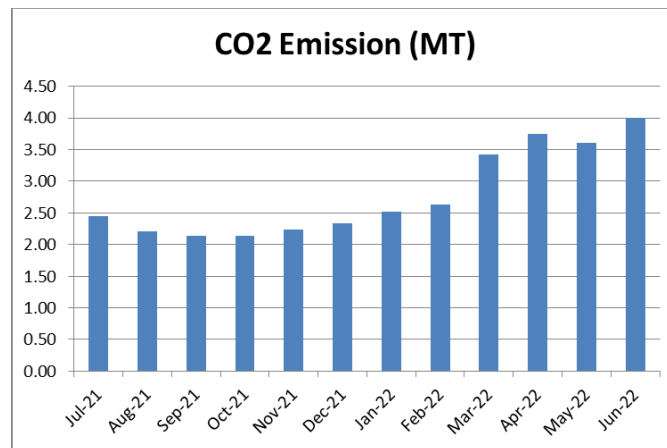
- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO<sub>2</sub> in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO<sub>2</sub> in the atmosphere

In the following Table, we present the CO<sub>2</sub> emissions.

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-22	5,001	4.00
2	May-22	4,513	3.61
3	Apr-22	4,682	3.75
4	Mar-22	4,274	3.42
5	Feb-22	3,289	2.63
6	Jan-22	3,154	2.52
7	Dec-21	2,927	2.34
8	Nov-21	2,791	2.23
9	Oct-21	2,674	2.14
10	Sep-21	2,676	2.14
11	Aug-21	2,755	2.20
12	Jul-21	3,053	2.44
	<b>Total</b>	<b>41,789</b>	<b>33.43</b>
	<b>Maximum</b>	5,001	4.00
	<b>Minimum</b>	2,674	2.14
	<b>Average</b>	3,482	2.79

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.



**Figure 2.1: CO2 emission due to usage of electrical energy.**

### **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 Pipe:**



## **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

**Report**  
**On**  
**Green Audit**  
**At**  
**Paramhansa Ramkrishna Maunibaba Shikshan Santha's**  
**Anuradha Engineering College**  
**Chikhli**



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## **Acknowledgement**

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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 Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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**

<b>Sr no</b>	<b>Parameter</b>	<b>Energy consumed, (Units)</b>	<b>CO2 Emission (MT)</b>
1	Maximum	5,001	4.00
2	Minimum	2,674	2.14
3	Average	3,482	2.79
4	Total	41,789	33.43

### 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.

### 3. Rain Water Harvesting

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

### 4. 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.

### 5. 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 institution Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is situated in the Anuradha Nagar, Chikhli ; Dist:-Buldana in Maharashtra state. The campus is situated on sprawling 37 acre acres land 3km from Chikhli town on Sakegaon road. The institution has developed a beautiful campus with residential facility for the students and staff, sport facilities, Garden, Canteen, etc. The institution is a dream founder Chairman Shri Siddhavinayak Bondre realized by the blessings of Sant Paramhansa Ramkrishna Maunibaba. It was established in the year 1993 with two branches & now has grown to six branches and M.Tech.

### **1.1 Objectives**

1. To study present level of Energy Consumption
2. To Study the present CO<sub>2</sub> 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

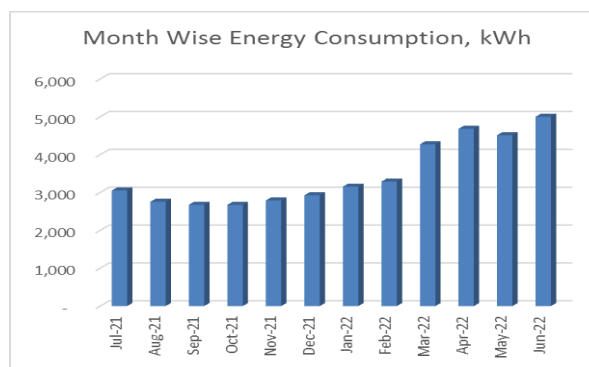
## 2. Study of Electrical Energy Consumption

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

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

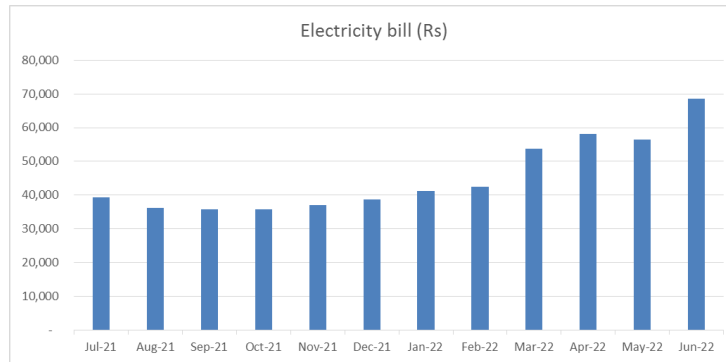
No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-22	5,001	68,600
2	May-22	4,513	56,449
3	Apr-22	4,682	58,226
4	Mar-22	4,274	53,700
5	Feb-22	3,289	42,427
6	Jan-22	3,154	41,224
7	Dec-21	2,927	38,676
8	Nov-21	2,791	37,056
9	Oct-21	2,674	35,753
10	Sep-21	2,676	35,792
11	Aug-21	2,755	36,251
12	Jul-21	3,053	39,350
	<b>Total</b>	<b>41,789</b>	<b>543,504</b>

Variation in energy consumption is as follows,



**Figure 2.1: Month wise energy consumption**

Monthly variation in electricity bill is as follows,



**Figure 2.2: Month wise electricity bill**

Key observations of electricity bill are as follows,

**Table no 2.2: Key observations**

<b>Sr no</b>	<b>Parameter</b>	<b>Energy consumed, (Units)</b>	<b>CO2 Emission (MT)</b>
1	Maximum	5,001	4.00
2	Minimum	2,674	2.14
3	Average	3,482	2.79
4	Total	41,789	33.43

### 3. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

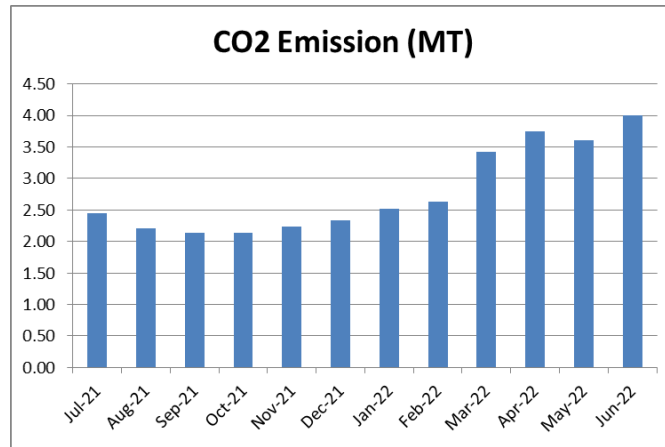
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-22	5,001	4.00
2	May-22	4,513	3.61
3	Apr-22	4,682	3.75
4	Mar-22	4,274	3.42
5	Feb-22	3,289	2.63
6	Jan-22	3,154	2.52
7	Dec-21	2,927	2.34
8	Nov-21	2,791	2.23
9	Oct-21	2,674	2.14
10	Sep-21	2,676	2.14
11	Aug-21	2,755	2.20
12	Jul-21	3,053	2.44
	<b>Total</b>	<b>41,789</b>	<b>33.43</b>

In the following Chart we present the CO<sub>2</sub> emissions due to usage of Electrical Energy.



**Figure 3.1: Month wise CO2 Emission**



#### **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**



## **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 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. Institute encourages students to not to use automobiles.

### 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**  
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**Energy Audit**  
**At**  
**Paramhansa Ramkrishna Maunibaba Shikshan Santha's**  
**Anuradha Engineering College**  
**Chikhli**  
**(Year 2020-21)**



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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.

Sl. No.	Manager	Address	Phone
1	Manager	Chikhli	9822012345
2	Manager	Chikhli	9822012346
3	Manager	Chikhli	9822012347
4	Manager	Chikhli	9822012348

1. Energy Conservation Programme
2. Energy Audit
3. Energy Conservation Measures
4. Energy Conservation Measures
5. Energy Conservation Measures
6. Energy Conservation Measures
7. Energy Conservation Measures
8. Energy Conservation Measures
9. Energy Conservation Measures
10. Energy Conservation Measures

## Executive Summary

After the Field measurements & analysis, we present herewith important observations made and various measures to reduce the Energy Consumption & mitigate the CO<sub>2</sub> 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	3,964	3.17
2	Minimum	2,571	2.06
3	Average	3,207	2.57
4	Total	38,482	30.79

### 2. Energy Conservation Projects already installed

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. 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.



#### 4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 23 %.

#### 5. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 352 Nos T-8 fittings with 20W LED fittings	7,040	77,440	225,632	35
2	Replacement of 487 Nos Old Ceiling Fans with STAR rating fans	6,331	69,641	1,058,738	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1,000,000	36
	<b>Total</b>	<b>43,371</b>	<b>477,081</b>	<b>2,284,370</b>	<b>57</b>

#### 6. 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 institution Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is situated in the Anuradha Nagar, Chikhli ; Dist:-Buldana in Maharashtra state. The campus is situated on sprawling 37 acre acres land 3km from Chikhli town on Sakegaon road. The institution has developed a beautiful campus with residential facility for the students and staff, sport facilities, Garden, Canteen, etc. The institution is a dream founder Chairman Shri Siddhavinayak Bondre realized by the blessings of Sant Paramhansa Ramkrishna Maunibaba. It was established in the year 1993 with two branches & now has grown to six branches and M.Tech.

### 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	Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli.
2	Address	Anuradha Nagar, Sakegaon Road, Chikhli, Buldhana, Maharashtra. 443201.
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	FTL (40W)	LED tube (20W)	LED bulb (12W)	Computers (65W)	Fans	1.5TR Star rated AC
<b>Office Building</b>							
1	T & P Cell		4		2	2	
2	Dark Room Physics		1			1	
3	Engineering Physics Lab		4			2	
4	Industrial Waste Treatment Lab		4			4	
5	Mechanical Operations Lab		2			2	
6	A 007	2				3	
7	Chemical Reaction Engg. Lab	2					
8	Heat Transfer Lab		4			2	
9	Mass Transfer Lab	4	1			2	
10	Wash Room Staff		1				
11	Wash Room Boys		1				
12	Wash Room Girls		1			6	
13	Chemical Lab	2	1			2	
14	H.O.D.		1		1	1	
15	Tutorial		1			1	
16	Class Room		2			4	
17	Class Room		3			4	
18	Server Room		2			3	1
19	Computer Centre		4		50	14	
20	Class Room PG		2			3	
21	Staff Room		1			1	
22	Class Room		4			3	
23	Wash Room Staff		1				
24	Wash Room Boys		1				
25	Wash Room Girls		1				
26	Transfer Fenomena Lab		2		1	3	

27	H.O.D.	1			2	1	
28	Tutorial Room	1	1			2	
29	Advanced Software Lab		2			2	
30	Open Source Lab		4		19	4	
31	Programming Lab		4		18	4	
32	Web Technologies Lab		2		20	4	
33	Class Room		5			4	
34	Class Room		3		1	5	
35	Advanced Programming Lab		2		18	4	
36	Class Room		3			4	
37	Wash Room Staff		1				
38	Wash Room Boys		1				
39	Wash Room Girls		1				
40	Girls common room		2			3	
41	H.O.D.		2			2	
42	Tutorial Room		1		2	2	
43	AI & MI Lab		2			4	
44	Open Source Lab		2		16	4	
45	Programming Lab		2			4	
46	Web Technologies Lab		3	1		2	
47	Class Room		4			4	
48	A 308		4			4	
49	Advanced Programming Lab		2		17	9	
50	Class room		4			4	
51	Wash Room Staff		1				
52	Wash Room Boys		1				
53	Wash Room Girls		1				
54	Staff Room		2			2	
55	Chairman's Cabin		3		1	2	1
56	Secretary's Cabin		1	11		2	
57	Engg. Chemistry Lab		4			2	
58	Former Chairman Photo Gallery			22		4	
59	Meeting Hall		14			4	1
60	Trustee's Cabin		4		1	2	1
61	IQAC Cell		3		3	2	
62	Administrative Office	4	5		12	8	
63	Former Chairman Cabin		1			1	

64	Principal Cabin			12	1	2	1
65	Wash Room Ladies Staff		1				
66	Tea / Refreshment Room		1				
67	Wash Room Gents Staff		1				
68	H.O.D.		1		1	1	
69	Tutorial Room		1			2	
70	Seminar Hall		6			6	
71	Additional W/S	9				5	
72	Toilet Staff	1					
73	Toilet Staff	1					
74	Civil Laboratory 5	4				5	
75	Boys Common Room	5				4	
76	Girls Common Room	4				4	
77	Toilet Ladies	1					
78	Toilet Gents	2					
79	Passage	3					
80	Laboratory	5				4	2
81	Toilet	4					
82	Passage	10					
	<b>(First floor)</b>						
82	Civil Class Room 1	3				4	
83	Civil Class Room 2	4				6	
84	Civil Class Room 3	4				6	
85	Civil PG Lab 1	7				6	
86	TR 1	5				6	
87	Civil Laboratory 4	5				6	
88	Drawing Hall	5				6	
89	Toilet Staff	1					
90	Toilet Staff	1					
91	Civil Laboratory 5	5				6	
92	Civil Class Room 4	5				6	
93	Civil Class Room 5	5				6	
94	Toilet Ladies	4					
95	Toilet Gents	4					
96	Civil Laboratory 09	2				4	
97	HOD Civil	5			4	6	
98	Toilet	4					
99	Passage	10					
	<b>(Second floor)</b>						

100	Electrical Class Room 1	5				6	
101	Electrical Class Room 2	4				6	
102	Laboratory	4				6	
103	Electrical Laboratory3	5				6	
104	Electrical Laboratory	5				6	
105	Electrical Laboratory	5				6	
106	Electrical Laboratory 4	5				6	
107	Toilet	2					
108	Toilet	2					
109	Laboratory for Electrical 5	5			2	6	
110	Laboratory for Electrical 6	5				6	
111	Laboratory	5				6	
112	Research lab	5			2	3	
113	MBA Comp Lab	3				4	
114	HOD Electrical	5			4	6	
115	Toilet	1					
116	Passage	7					
	<b>(Third floor)</b>						
117	Computer Class Room 1	5			10	6	
118	Computer Class Room 2	5			10	6	
119	Laboratory	5				6	
120	Computer Laboratory 1	3			10	5	
121	Staff Room	1				2	
122	Computer Laboratory 2	4			10	4	
123	Staff Room	1				2	
124	Computer Laboratory 3	8			15	6	
125	Computer Laboratory4	3			15	4	
126	Staff Room	1				2	
127	Toilet	1					
128	Toilet	1					
129	Computer Laboratory 5	5			10	4	
130	Computer Laboratory 6	4			10	4	
131	Staff Room	1				2	
132	E&TC PG Classroom 1	4				5	
133	E&TC PG Classroom 2	1				1	
134	Toilet Ladies	1					
135	Toilet Gents	1					

136	Computer Laboratory PG	6			15	5	
137	HOD Computer	2			4	2	
138	PG CLR	1				2	
139	PG CLR	1				1	
140	Toilet	1					
141	Passage	5					
	<b>(Fourth floor)</b>						
142	IT Class Room 1	5				6	
143	IT Class Room 2	5				6	
144	E&TC Class Room 3	5				6	
145	IT Laboratory 1	3			10	5	
146	Staff Room	1				2	
147	IT Laboratory 2	4			10	4	
148	Staff Room	1				2	
149	IT Laboratory 3	6			10	8	
150	E&TC Class Room 4	3				6	
151	Toilet	1					
152	Toilet	1					
153	IT Laboratory 5	4			8	6	
154	IT Laboratory 6	5			12	7	
155	IT Laboratory 7	5			8	7	
156	Language Lab I	5				6	
157	HOD IT	2			4	3	
158	TR UG	1				1	
159	Staff Room	1				1	
160	Toilet	1					
161	Passage	5	25				
	<b>Total</b>	<b>352</b>	<b>182</b>	<b>46</b>	<b>369</b>	<b>487</b>	<b>7</b>

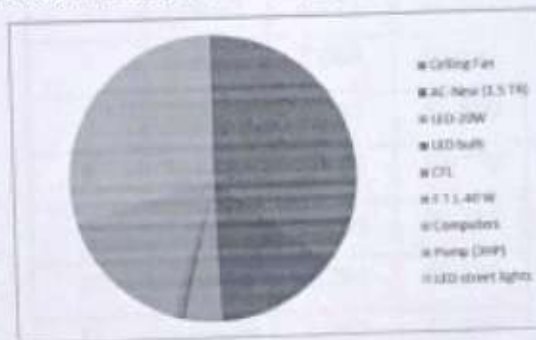
Apart from above load, the school has pumps, LED street lights, CFLs and LED focus street lights on streets and grounds. Individual fitting wise load is as under.



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

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	487	65	31.7
2	AC-New (1.5 TR)	7	1838	12.9
3	LED-20W	182	20	3.6
4	LED bulb	46	12	0.6
5	CFL	30	24	0.7
6	F T L-40 W	352	40	14.1
7	Computers	369	65	24.0
8	Pump (3HP)			2.3
9	LED street lights	5	35	0.2
	Total			89.9

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



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

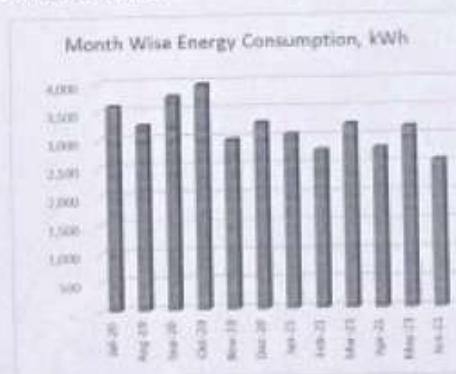
### 3. Study of Electrical Energy Consumption

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-21	2,571	34,602
2	May-21	3,174	40,815
3	Apr-21	2,798	37,319
4	Mar-21	3,231	42,521
5	Feb-21	2,773	37,468
6	Jan-21	3,068	40,644
7	Dec-20	3,281	42,808
8	Nov-20	2,985	39,779
9	Oct-20	3,964	50,282
10	Sep-20	3,764	48,136
11	Aug-20	3,267	42,919
12	Jul-20	3,606	46,817
	<b>Total</b>	<b>38,482</b>	<b>504,110</b>

Variation in energy consumption is as follows,



**Figure 3.1: Month wise energy consumption**

Monthly variation in electricity bill is as follows,

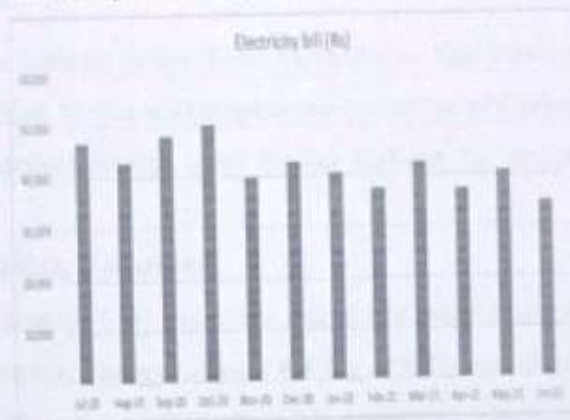


Figure 3.2: Month wise electricity bill

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	3,964	3.17
2	Minimum	2,571	2.06
3	Average	3,207	2.57
4	Total	38,482	30.79

#### 4. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

➤ 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

Based on the above Data we compute the CO<sub>2</sub> 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 & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-21	2,571	2.06
2	May-21	3,174	2.54
3	Apr-21	2,798	2.24
4	Mar-21	3,231	2.58
5	Feb-21	2,773	2.22
6	Jan-21	3,068	2.45
7	Dec-20	3,281	2.62
8	Nov-20	2,985	2.39
9	Oct-20	3,964	3.17
10	Sep-20	3,764	3.01
11	Aug-20	3,267	2.61
12	Jul-20	3,606	2.88
	<b>Total</b>	<b>38,482</b>	<b>30.79</b>

In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

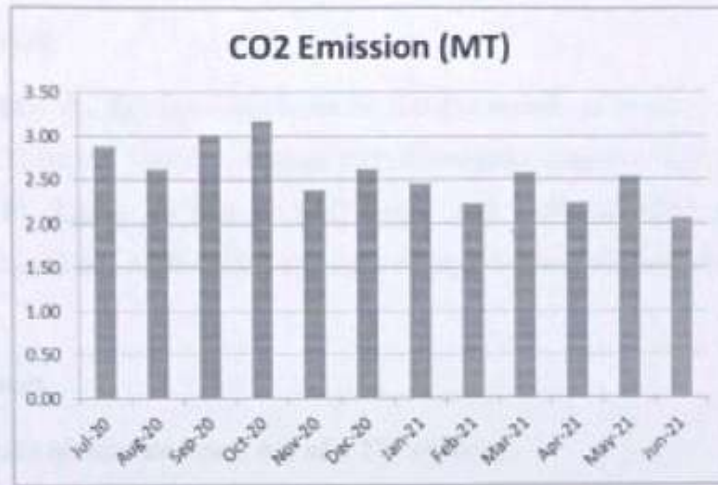


Figure 4.1: Month wise CO2 Emission

## **5. Study of utilities**

### **5.1 Study of Lighting**

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 352 FTL fittings with Electronic/ magnetic chokes, 182 LED tubes, 30 number of CFL lights, 46 nos of LED bulbs and 5 No of LED street lights. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are. There are.

### **5.2 Air-conditioners**

There is 7nos of star rated new AC of 1.5Tr capacity.

### **5.3 Ceiling Fans**

At building facility, there are about 487 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.

### **5.4 Water Pumps**

There are in total 1 Water pumps with 3HP 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	F T L-40 W	352	40	14.1
2	CFL	30	24	0.7
	<b>LED lighting load</b>			
1	LED tube	182	20	3.6
2	LED bulb	46	12	0.6
3	LED street lights	5	35	0.2
	<b>Total LED lighting load</b>			<b>4.4</b>

It can be seen that out of total lighting load 23% load is LED lighting load.

## 7. Energy conservation proposals

### 7.1 Replacement of Old T-8 FTLs with 20 W LED fittings

In the facility, there are about 352 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	352	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	28.16	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	7040	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	77440	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	225632	Rs lump sum
13	Simple Payback period	35	Months



## 7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 487 no of fans. It is recommended to replace these old fans with STAR Rated fans.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Old Ceiling Fan fittings	487	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	25.324	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	6331	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	69641	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	1058738	Rs lump sum
13	Simple Payback period	182	Months

### 7.3 Installation of 20kW Solar PV panel

It is recommended to install 20 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 20kW PV unit	20	kW
2	Energy saving	30000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	330000	Rs/ Annum
5	Investment required	1000000	Rs lump sum
6	Simple payback period	36	Months

#### 7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 352 Nos T-8 fittings with 20W LED fittings	7,040	77,440	225,632	35
2	Replacement of 487 Nos Old Ceiling Fans with STAR rating fans	6,331	69,641	1,058,738	182
3	Installation of 20kW grid connected PV panel	30,000	330,000	1,000,000	36
	<b>Total</b>	<b>43,371</b>	<b>477,081</b>	<b>2,284,370</b>	<b>57</b>

**Report  
On  
Environmental Audit  
At  
Paramhansa Ramkrishna Maunibaba Shikshan Santha's  
Anuradha Engineering College  
Chikhli  
(Year 2020-21)**



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## Acknowledgement

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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.

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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<sub>2</sub> on account of Electricity & LPG Consumption
- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
- Liquid Waste: Human liquid waste

### 2. Present Level of CO<sub>2</sub> Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO <sub>2</sub> Emission (MT)
1	Maximum	3,964	3.17
2	Minimum	2,571	2.06
3	Average	3,207	2.57
4	Total	38,482	30.79

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

- Usage of Energy Efficient BEE STAR Rated ACs
- 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<sub>2</sub> into atmosphere

2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.



1. Introduction

1.1 Background

1.2 Objectives of the Audit

1.3 Scope of the Audit

1.4 Methodology

1.5 Limitations

1.6 Organization

1.7 Acknowledgements

1.8 References

1.9 Appendix

1.10 Glossary

1.11 Abbreviations

1.12 Contact Information

1.13 Declaration of the Auditor

## 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 complied 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	Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli.
2	Address	Anuradha Nagar, Sakegaon Road, Chikhli, Buldhana, Maharashtra. 443201.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati.

## 2. Study of Consumption of Various Resources

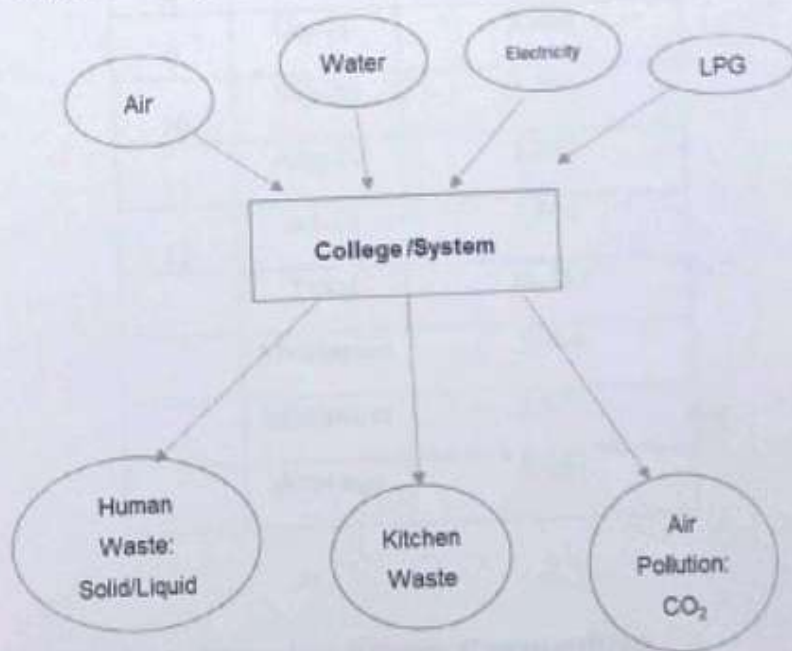
The Institute consumes following basic/derived Resources:

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.



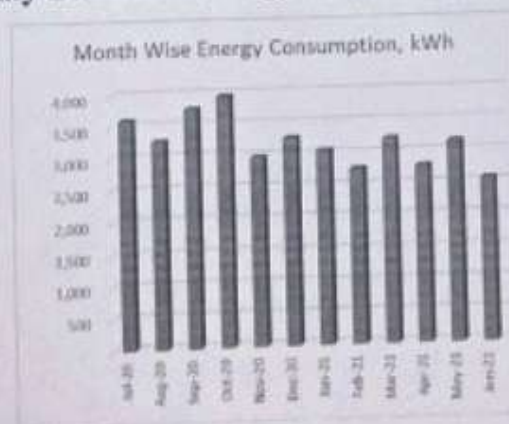
Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy & LPG as under.

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

**Table 2.1: Electrical Energy Consumption**

No	Month	Energy (kWh)
1	Jun-21	2,571
2	May-21	3,174
3	Apr-21	2,798
4	Mar-21	3,231
5	Feb-21	2,773
6	Jan-21	3,068
7	Dec-20	3,281
8	Nov-20	2,985
9	Oct-20	3,964
10	Sep-20	3,764
11	Aug-20	3,267
12	Jul-20	3,606
	<b>Total</b>	<b>38,482</b>
	<b>Maximum</b>	<b>3,964</b>
	<b>Minimum</b>	<b>2,571</b>
	<b>Average</b>	<b>3,207</b>

**2.1 Variation of Monthly Electrical Energy Consumption**



**Figure 2.1 : Monthly Electrical Energy Consumption**

## 2.2 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	3,964
2	Minimum	2,571
3	Average	3,207
4	Total	38,482

### 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<sub>2</sub> in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO<sub>2</sub> in the atmosphere

In the following Table, we present the CO<sub>2</sub> emissions.

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions:**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-21	2,571	2.06
2	May-21	3,174	2.54
3	Apr-21	2,798	2.24
4	Mar-21	3,231	2.58
5	Feb-21	2,773	2.22
6	Jan-21	3,068	2.45
7	Dec-20	3,281	2.62
8	Nov-20	2,985	2.39
9	Oct-20	3,964	3.17
10	Sep-20	3,764	3.01
11	Aug-20	3,267	2.61
12	Jul-20	3,606	2.88
	<b>Total</b>	<b>38,482</b>	<b>30.79</b>
	<b>Maximum</b>	3,964	3.17
	<b>Minimum</b>	2,571	2.06
	<b>Average</b>	3,207	2.57



In the following Chart we present the CO2 emissions due to usage of Electrical Energy.

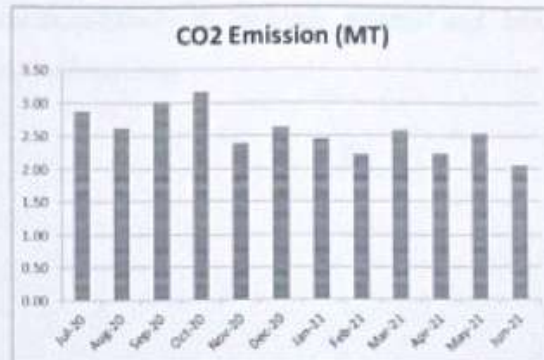


Figure 2.1: CO2 emission due to usage of electrical energy.

### 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 Pipe:



## 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

**Report  
On  
Green Audit  
At  
Paramhansa Ramkrishna Maunibaba Shikshan Santha's  
Anuradha Engineering College  
Chikhli  
(Year 2020-21)**



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## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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 Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli 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	3,964	3.17
2	Minimum	2,571	2.06
3	Average	3,207	2.57
4	Total	38,482	30.79

### 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.

### 3. Rain Water Harvesting

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

### 4. 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.

### 5. 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

### 1.1 Objectives

1. Identify the main areas of Energy Consumption
2. To check the current CEE rating
3. To check the present energy consumption and energy efficiency
4. To identify the areas of energy conservation
5. To check the energy efficiency of the equipment
6. To identify the areas of energy conservation

### 1.2 Scope of the Study

1. Study of existing system
2. Study of energy efficiency measures
3. To prepare the report with the energy efficiency audit and recommendations

## **1. Introduction**

The institution Paramhansa Ramkrishna Maunibaba Shikshan Santha's Anuradha Engineering College Chikhli is situated in the Anuradha Nagar, Chikhli ; Dist:-Buldana in Maharashtra state. The campus is situated on sprawling 37 acre acres land 3km from Chikhli town on Sakegaon road. The institution has developed a beautiful campus with residential facility for the students and staff, sport facilities, Garden, Canteen, etc. The institution is a dream founder Chairman Shri Siddhavinayak Bondre realized by the blessings of Sant Paramhansa Ramkrishna Maunibaba. It was established in the year 1993 with two branches & now has grown to six branches and M.Tech.

### **1.1 Objectives**

1. To study present level of Energy Consumption
2. To Study the present CO<sub>2</sub> 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

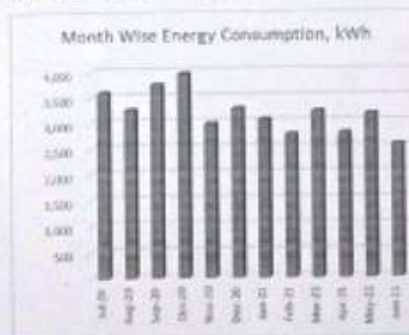
## 2. Study of Electrical Energy Consumption

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-21	2,571	34,602
2	May-21	3,174	40,815
3	Apr-21	2,798	37,319
4	Mar-21	3,231	42,521
5	Feb-21	2,773	37,468
6	Jan-21	3,068	40,644
7	Dec-20	3,281	42,808
8	Nov-20	2,985	39,779
9	Oct-20	3,964	50,282
10	Sep-20	3,764	48,136
11	Aug-20	3,267	42,919
12	Jul-20	3,606	46,817
	<b>Total</b>	<b>38,482</b>	<b>504,110</b>

Variation in energy consumption is as follows,



**Figure 2.1: Month wise energy consumption**

Monthly variation in electricity bill is as follows,

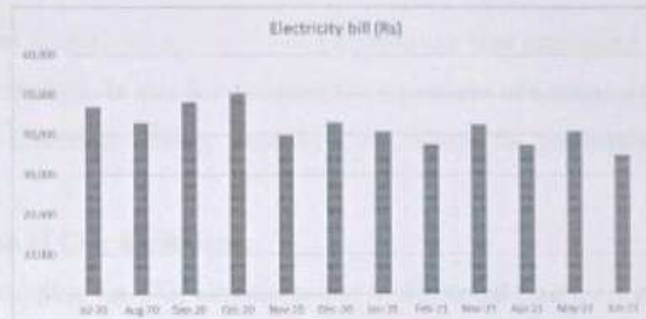


Figure 2.2: Month wise electricity bill

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	3,964	3.17
2	Minimum	2,571	2.06
3	Average	3,207	2.57
4	Total	38,482	30.79

### 3. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> 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<sub>2</sub> Emissions:

The basis of Calculation for CO<sub>2</sub> emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO<sub>2</sub>** into atmosphere.

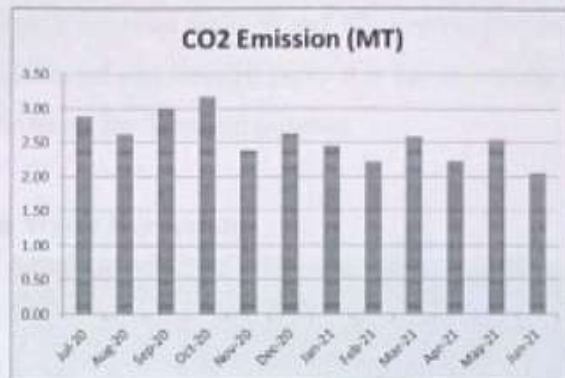
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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

**Table 3.1: Month wise Consumption of Electrical Energy & CO<sub>2</sub> Emissions**

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-21	2,571	2.06
2	May-21	3,174	2.54
3	Apr-21	2,798	2.24
4	Mar-21	3,231	2.58
5	Feb-21	2,773	2.22
6	Jan-21	3,068	2.45
7	Dec-20	3,281	2.62
8	Nov-20	2,985	2.39
9	Oct-20	3,964	3.17
10	Sep-20	3,764	3.01
11	Aug-20	3,267	2.61
12	Jul-20	3,606	2.88
	<b>Total</b>	<b>38,482</b>	<b>30.79</b>

In the following Chart we present the CO<sub>2</sub> emissions due to usage of Electrical Energy.



**Figure 3.1: Month wise CO2 Emission**

#### 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





## 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 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.

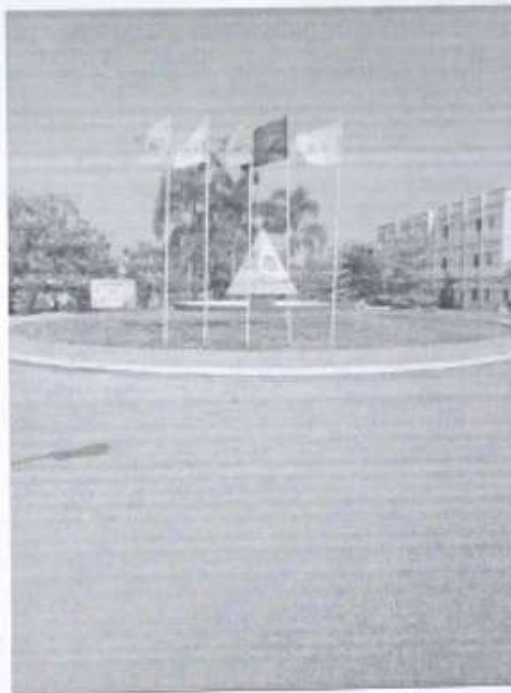
### 7.2 Usage of Public Transport

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. Institute encourages students to not to use automobiles.

### 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

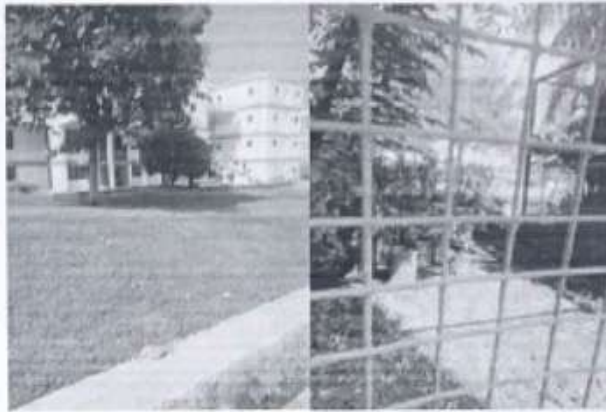
- Usage of paper tea cups in the Institute canteen
- Display of boards in the campus for Plastic Free campus

#### **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**