Report

On

Green Audit

At

Shri Kakasaheb Hiralal Maganlal Chaudhari

Arts, Commerce & Science College

Nandurbar

(Year 2022-23)

Prepared by

Nutan Urja Solutions

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Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Comm & Sci College Nandurbar
Heera Pratishthan

Contents

Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar 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 Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar 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	1,545	1.24
2	Minimum	40	0.03
3	Average	433	0.35
4	Total	5,201	4.16

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 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

Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College is located in Nandurbar. The college is established by Hira Pratishthan in 2016. The college is well equipped with modern research laboratories which are recognized by the university. Wide range of co-curricular, extra-curricular and extension activities are implemented for the personality development of the students. The college is affiliated to Kaviyitri Bahinabai Chaudhari North Maharashtra University, Jalgaon.

1.1 Objectives

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

1.2 Audit methodology

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

2. Study of Electrical Energy Consumption

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

Table no 2.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	492	21,107
2	May-23	40	14,200
3	Apr-23	898	9,836
4	Mar-23	537	28,912
5	Feb-23	1545	20,240
6	Jan-23	213	-
7	Dec-22	476	-
8	Nov-22	142	-
9	Oct-22	141	-
10	Sep-22	239	5,940
11	Aug-22	239	13,263
12	Jul-22	239	10,293
	Total	**5,201**	**1,23,791**

Variation in energy consumption is as follows,

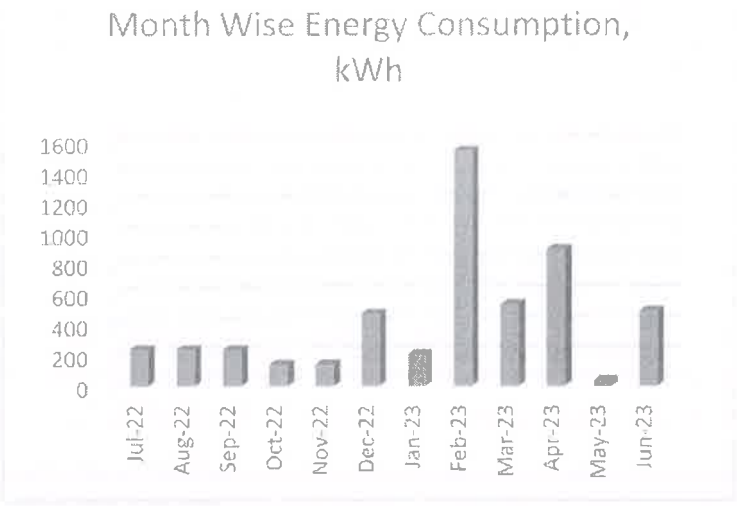


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

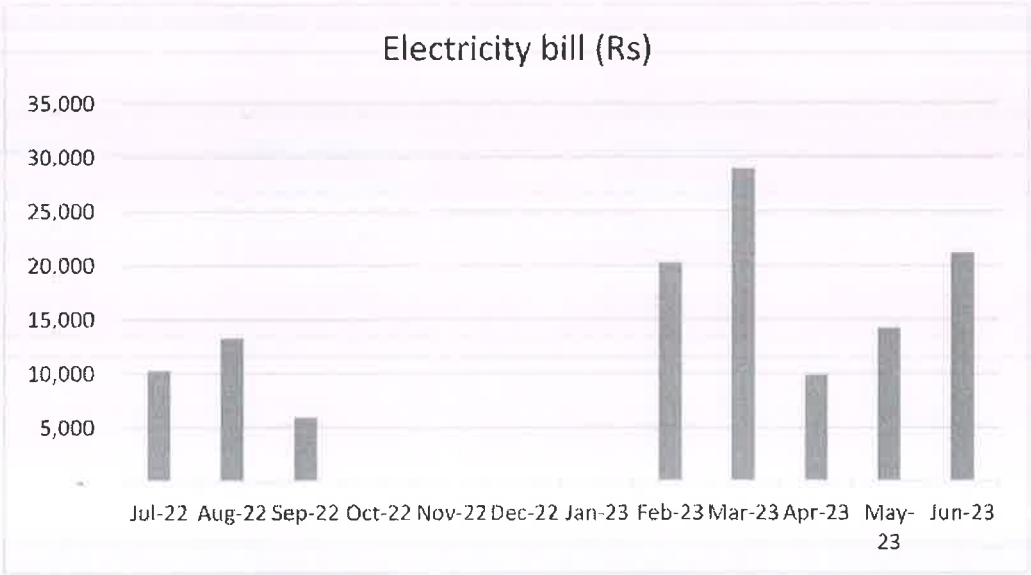


Figure 2.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 2.2: Key observations

Sr no	Parameter	Energy consumed, (Units)	CO2 Emmision (MT)
1	Maximum	1,545	1.24
2	Minimum	40	0.03
3	Average	433	0.35
4	Total	5,201	4.16

3. Carbon Foot printing

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

2. Basis for computation of CO_2 Emissions:

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

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

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

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

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

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-23	492	0.39
2	May-23	40	0.03
3	Apr-23	898	0.72
4	Mar-23	537	0.43
5	Feb-23	1,545	1.24
6	Jan-23	213	0.17
7	Dec-22	476	0.38
8	Nov-22	142	0.11
9	Oct-22	141	0.11
10	Sep-22	239	0.19
11	Aug-22	239	0.19
12	Jul-22	239	0.19
	Total	**5,201**	**4.16**

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

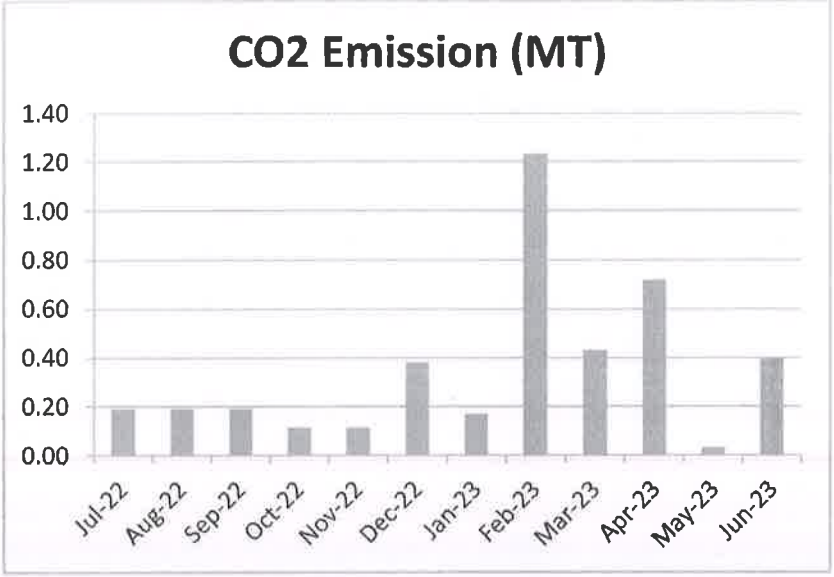


Figure 3.1: Month wise CO2 Emission

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 pipe

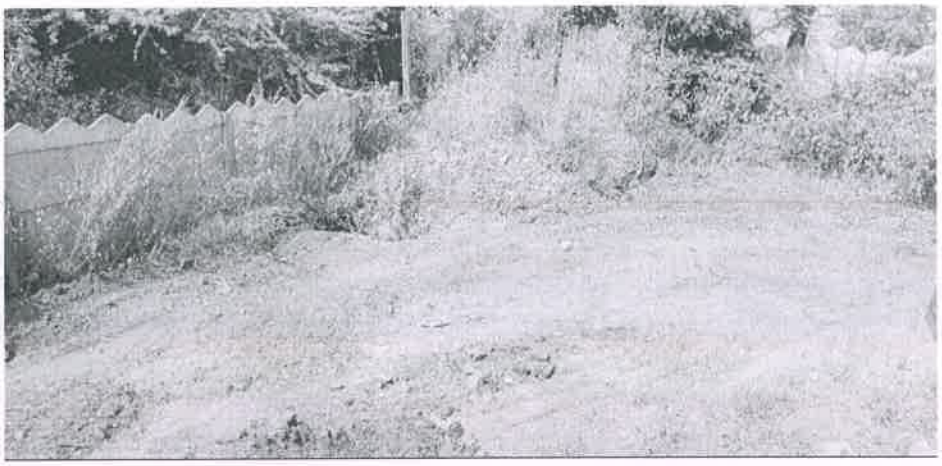
Hiralal Maganlal Chaudhari Art's,Comm.& Sci.College,Nandurbar Shri Kakasaheb Heera Pratishthan

5. Study of Waste Management

5.1 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:



5.2 e-Waste Management

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

6. Study of Green Practices

6.1 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.

6.2 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.

6.3 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

6.4 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

6.5 Paperless Office

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

6.6 Green Landscaping with Trees and Plants

The Institute has beautiful maintained Garden.

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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.

Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

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

2. Present Level of CO_2 Emissions:

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	1,545	1.24
2	Minimum	40	0.03
3	Average	433	0.35
4	Total	5,201	4.16

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_2** into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.

Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Comm. & Sci. College, Nandurbar
Heera Pratishthan

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	Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar
2	Address	Hira Campus, S. No. 381, Near Gajanan Maharaj Temple, Navapur Road, Nandurbar, 425 412.
3	Affiliation	Kaviyitri Bahinabai Chaudhari Nort Maharashtra University, Jalgaon

2. Study of Consumption of Various Resources

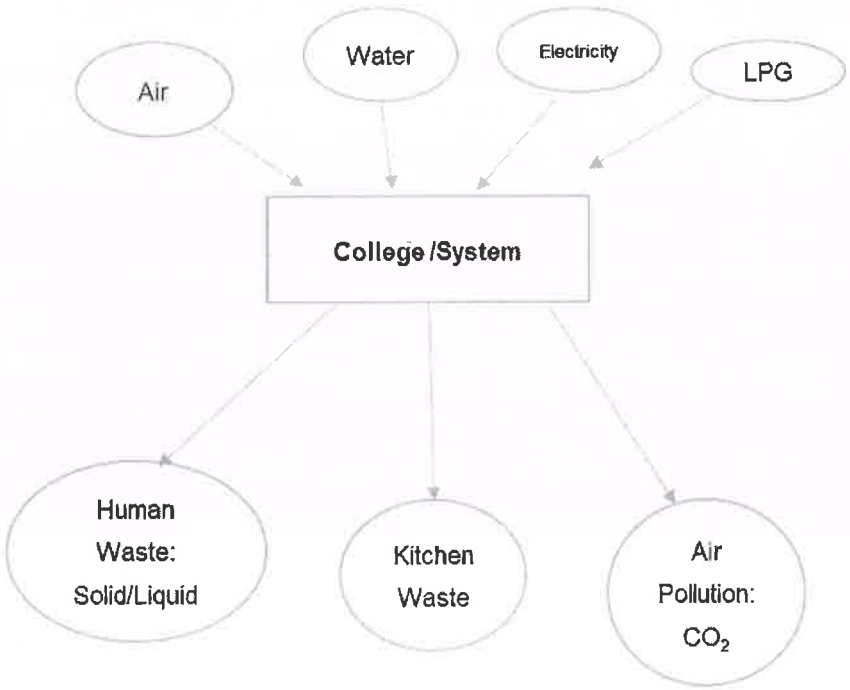
The Institute consumes following basic/derived Resources:

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

Also, college emits following pollutants to environment

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

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



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

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

Table 2.1: Electrical Energy Consumption

No	Month	Energy Consumed, kWh
1	Jun-23	492
2	May-23	40
3	Apr-23	898
4	Mar-23	537
5	Feb-23	1545
6	Jan-23	213
7	Dec-22	476
8	Nov-22	142
9	Oct-22	141
10	Sep-22	239
11	Aug-22	239
12	Jul-22	239
	Total	**5,201**
	Maximum	1,545
	Minimum	40
	Average	433

2.1 Variation of Monthly Electrical Energy Consumption

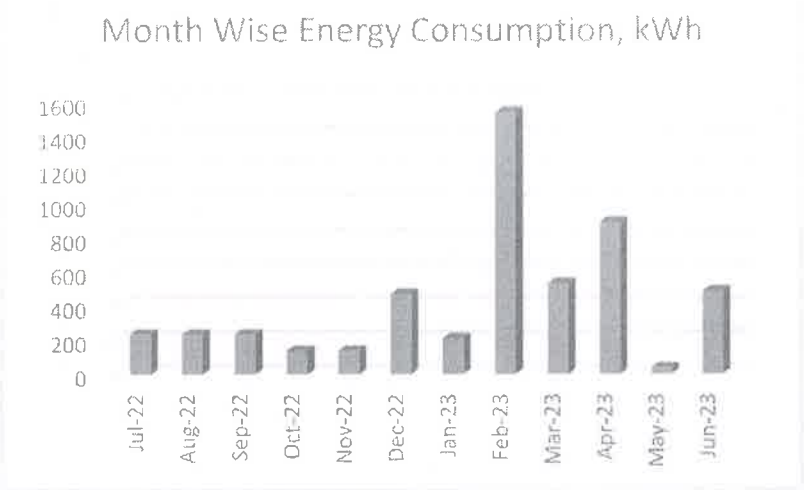


Figure 2.1 : Monthly Electrical Energy Consumption

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**	1,545
2	**Minimum**	40
3	**Average**	433
4	**Total**	5,201

3. Study of Environmental Pollution

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

3.1 Air Pollution

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

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

In the following Table, we present the CO_2 emissions.

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

No	Month	Energy Consumed, kWh	CO_2 Emissions, MT
1	Jun-23	492	21,107
2	May-23	40	14,200
3	Apr-23	898	9,836
4	Mar-23	537	28,912
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9	Oct-22	141	-
10	Sep-22	239	5,940
11	Aug-22	239	13,263
12	Jul-22	239	10,293
	Total	**5,201**	**1,23,791**
	Maximum	1,545	1.24
	Minimum	40	0.03
	Average	433	0.35

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

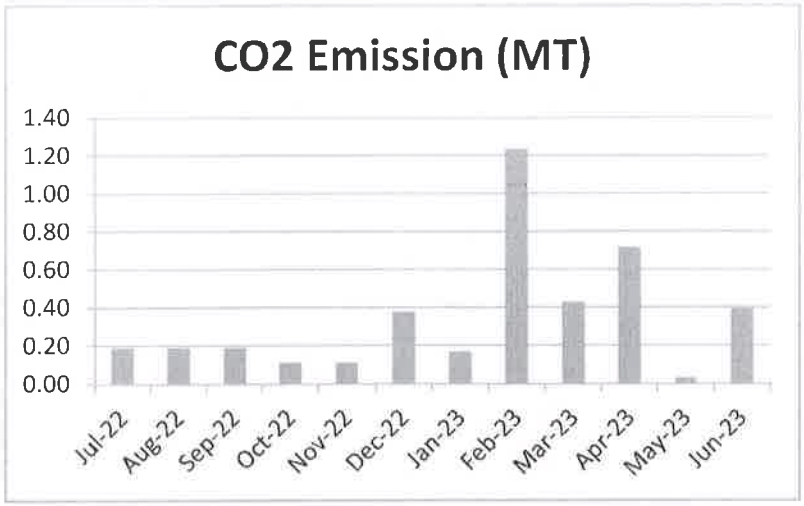

Figure 2.1: CO2 emission due to usage of electrical energy.

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 Council 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:

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

Executive Summary

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

1. Present Energy Consumption

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

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	1,545	1.24
2	Minimum	40	0.03
3	Average	433	0.35
4	Total	5,201	4.16

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.

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. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 55 %.

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 40 Nos T-8 fittings with 20W LED fittings	800	8,800	26,740	35
2	Replacement of 153 Nos Old Ceiling Fans with STAR rating fans	1,989	21,879	3,32,622	182
	Total	**2,789**	**30,679**	**3,59,362**	**141**

7 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

Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar. The college is running Degree courses, Bachelor of Science, Bachelor of Commerce and Bachelor of Arts classes. The College has today become one of the premier institutions of the town.

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	Shri Kakasaheb Hiralal Maganlal Chaudhari Arts, Commerce and Science College, Nandurbar
2	Address	Hira Campus, S. No. 381, Near Gajanan Maharaj Temple, Navapur Road, Nandurbar, 425 412.
3	Affiliation	Kaviyitri Bahinabai Chaudhari Nort Maharashtra University, Jalgaon

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)	CFL	LED tube (20W)	LED bulb (12W)	Computers (65W)	Fans	1.5 Tr rated AC
	GROUND FLOOR							
1	Chairman Cabin				17		2	1
2	Office			2	8	4	5	
3	Ladies Staff Room			1			2	
4	Gent's Staff Room			1			2	
5	Wash Room		1					
6	Library	1		1			4	
7	B.A.LLB	1		1			4	
8	Class Room 6	1		1			4	
9	Class Room 7	1		1			4	
10	Class Room 8			2			4	
11	Kitchen 9	1					1	
12	Kitchen 10	1					1	
13	Girl's Wash Room		1					
14	Boy's Wash Room		1					
15	Class Room 11	1		1			4	
16	Class Room 12	1		1			4	
17	Class Room 13	1		1			4	
18	LLB 14			2			4	
19	Computer Lab 15	2		1			2	
20	Passage				18		5	
	FIRST FLOOR							
21	Principal Cabin 16				4		2	
22	Administrative Office 17			1	5	3	4	
23	Staff Room 18			2			1	
24	Exam Department 19		1			1	2	
25	Gent's Wash Room	1						
26	I.Q.A.C. 20			2		3	2	
27	Class Room 21	1		1			4	

28	Class Room 22			2			4	
29	Dept. of Geography 23			4			4	1
30	Practical Lab 2 - 24			6			4	
31	Ladies Toilet	3					2	
32	Gents Toilet			2				
33	Class Room 26			2			5	
34	Class Room 27	1		5			5	
35	Library 28	2					6	
36	Class Room 29	1		1			3	
37	Passage				5		5	
	SECOND FLOOR							
38	Class Room 30	2					4	
39	Class Room 31						2	
40	Dept. of Botany 32	2					3	
41	Class Room 33	2					4	
42	Dept. of Physics 34	2					3	
43	Dept. of Zoology 35	4					4	
44	Dept. of Chemistry 36	4					4	
45	Gents Rest Room			2				
46	Computer Lab 37			4		144	6	1
47	Conference Hall			5			8	
48	Server Room 39			2			2	
49	Dept. of Microbiology 40	2					2	
50	Class Room 41	2					2	
51	Passage			2	16			
	Total	**40**	**4**	**59**	**73**	**155**	**153**	**3**

Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	40	40	1.6
2	CFL	4	24	0.1
3	LED Tube-20W	59	20	1.2
4	LED bulb	73	12	0.9
5	Computers	155	65	10.1
6	Ceiling Fan	153	65	9.9
7	AC (1.5Tr)	3	1838	5.5
8	AC- (1.5 Tr old)	1	2200	2.2
9	Pumps (1 nos 2HP)			1.5
	Total			**19.1**

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

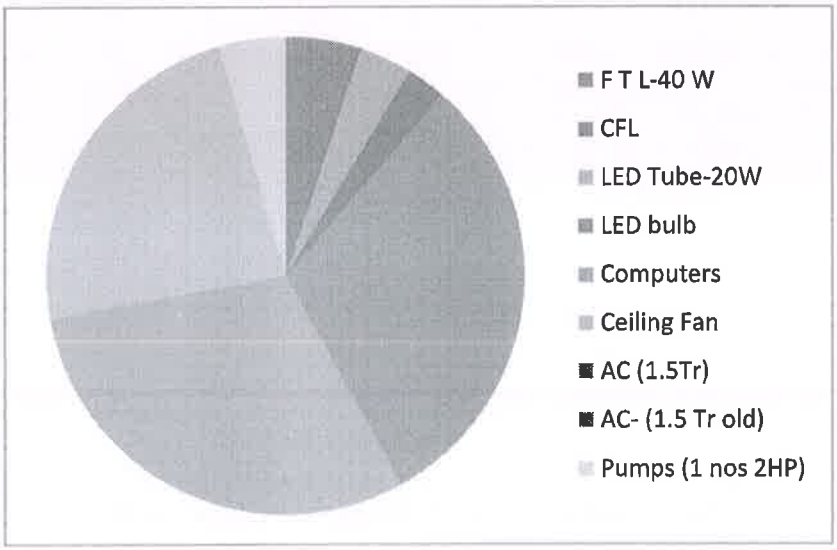

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

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

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	492	21,107
2	May-23	40	14,200
3	Apr-23	898	9,836
4	Mar-23	537	28,912
5	Feb-23	1545	20,240
6	Jan-23	213	-
7	Dec-22	476	-
8	Nov-22	142	-
9	Oct-22	141	-
10	Sep-22	239	5,940
11	Aug-22	239	13,263
12	Jul-22	239	10,293
	Total	**5,201**	**1,23,791**

Variation in energy consumption is as follows,

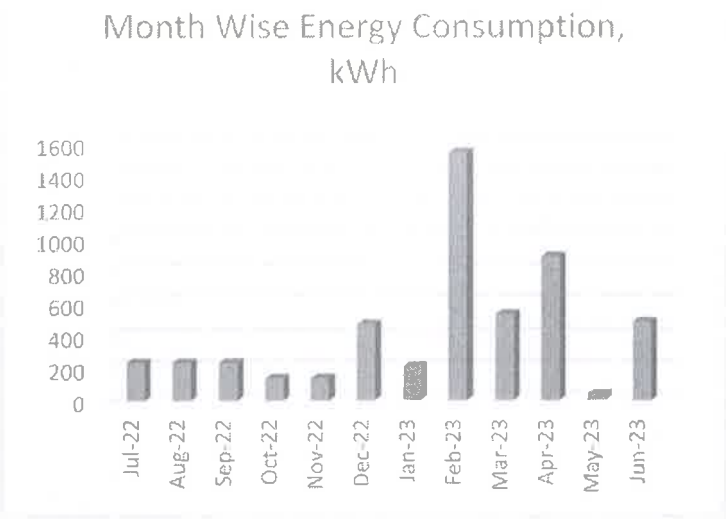

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

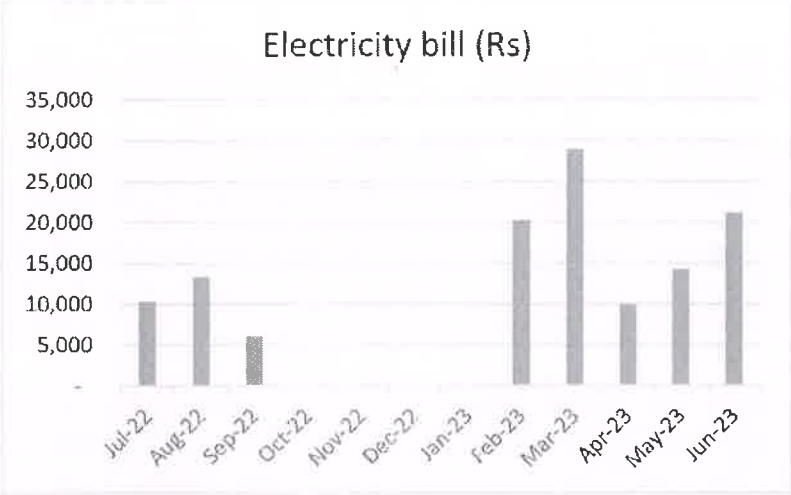

Figure 3.2: Month wise electricity bill

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	1,545	1.24
2	Minimum	40	0.03
3	Average	433	0.35
4	Total	5,201	4.16

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4. Carbon Foot printing

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

2. Basis for computation of CO_2 Emissions:

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

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

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

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

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

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-23	492	0.39
2	May-23	40	0.03
3	Apr-23	898	0.72
4	Mar-23	537	0.43
5	Feb-23	1,545	1.24
6	Jan-23	213	0.17
7	Dec-22	476	0.38
8	Nov-22	142	0.11
9	Oct-22	141	0.11
10	Sep-22	239	0.19
11	Aug-22	239	0.19
12	Jul-22	239	0.19
	Total	**5,201**	**4.16**

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

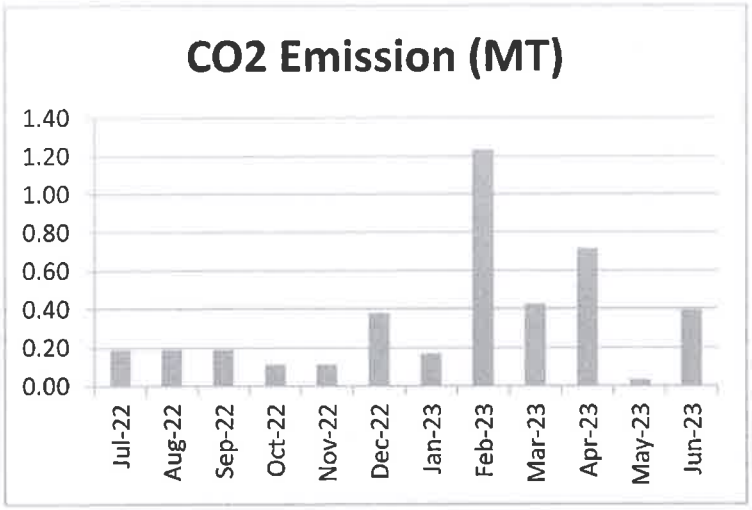

Figure 4.1: Month wise CO2 Emission

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 40 FTL fittings with Electronic/ magnetic chokes , 4 nos of CFLs, 59 nos of LED tubes, 73 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings.

5.2 Air-conditioners

In the facility,there is 3 nos of ACs of 1.5Tr capacity.

5.3 Ceiling Fans

At building facility, there are about 153 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 2HP capacity.

6. Study of usage of LED lighting

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

Table 6.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	40	40	1.60
2	CFL	4	24	0.10
	LED lighting load			
1	LED tube	59	20	1.18
2	LED bulbs	73	12	0.88
	Total LED lighting load	40	40	**2.06**
	Total Lighting load	4	24	**3.75**

It can be seen that out of total lighting load 49% 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 40 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	40	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	3.2	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	800	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	8800	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	25640	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 153 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	153	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	7.956	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1989	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	21879	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	332622	Rs lump sum
13	Simple Payback period	182	Months

7.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 40 Nos T-8 fittings with 20W LED fittings	800	8,800	26,740	35
2	Replacement of 153 Nos Old Ceiling Fans with STAR rating fans	1,989	21,879	3,32,622	182
	Total	**2,789**	**30,679**	**3,59,362**	**141**