Est. 1967

Shri Balaji Sansthan, Deulgaon Raja's

SHRI VYANKATESH ARTS, COMMERCE & SCIENCE COLLEGE

DEULGAON RAJA, DIST. BULDANA (M.S.) - 443 204

(Affiliated to Sant Gadge Baba Amravati University, Amravati)

SELF STUDY REPORT

Criteria-VII Institutional Values and Best Practices

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**

Content

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NAAC RE-ACCREDITED AT 'B' LEVEL

Affiliated to SGBAU, Amravati | College Code No. 309 | UGC Recog. U/S 2 (F) & 12 (B)

Outward No. SVC / IQAC / 2024

Date: 02 /05/2024

Declaration

This is to declare that the supporting documents provided in this file, including information, reports, numerical data, true copies, etc., have been verified by the Internal Quality Assurance Cell and the Head of the Institution. It is confirmed to be accurate and authentic.

Dr. E. B. Bhalerao

Coordinator, IQAC
Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja
Dist. Buldhana-443204 (MS)

02/05/2024

Dr. D. V. Gore

PRINCIPAL
Shri Vyankatesh Arts, Comm. & Science College, Deulgaon Raja
Dist.Buldana Pin - 443 204

Shri Vyankatesh College Deulgaon Raja

GREEN AUDIT REPORT -

Year -2022-23

Report

On

Green Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2022-23)

Prepared by

Nutan Urja Solutions

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

Sus Road, Sus, Pune 411 021

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

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Nutan Urja Solutions

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Green Audit of Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja 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	1,174	0.94
2	Minimum	180	0.14
3	Average	681	0.54
4	Total	8,171	6.54

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
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1. Introduction

Shri Vyankatesh Arts, Commerce & Science College is located in Deulgaon Raja, Dist. Buldhana. The college is established in 1967. 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 Sant Gadge Baba Amravati University, Amravati.

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	1174	11532
2	May-23	946	8834
3	Apr-23	783	7072
4	Mar-23	556	4879
5	Feb-23	629	5878
6	Jan-23	692	5328
7	Dec-22	746	7354
8	Nov-22	180	247
9	Oct-22	554	5784
10	Sep-22	477	5211
11	Aug-22	516	4268
12	Jul-22	918	3687
	Total	**8,171**	**70,074**

Variation in energy consumption is as follows,

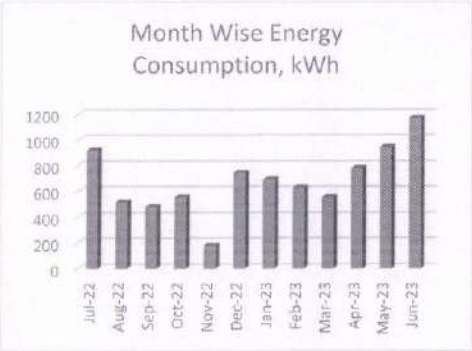


Figure 2.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

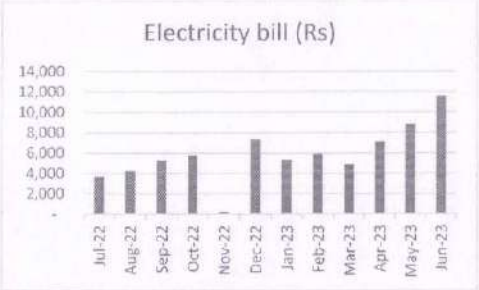


Figure 2.2: Month wise electricity bill

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	1,174	0.94
2	Minimum	180	0.14
3	Average	681	0.54
4	Total	8,171	6.54

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	1,174	0.94
2	May-23	946	0.76
3	Apr-23	783	0.63
4	Mar-23	556	0.44
5	Feb-23	629	0.50
6	Jan-23	692	0.55
7	Dec-22	746	0.60
8	Nov-22	180	0.14
9	Oct-22	554	0.44
10	Sep-22	477	0.38
11	Aug-22	516	0.41
12	Jul-22	918	0.73
	Total	**8,171**	**6.54**

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

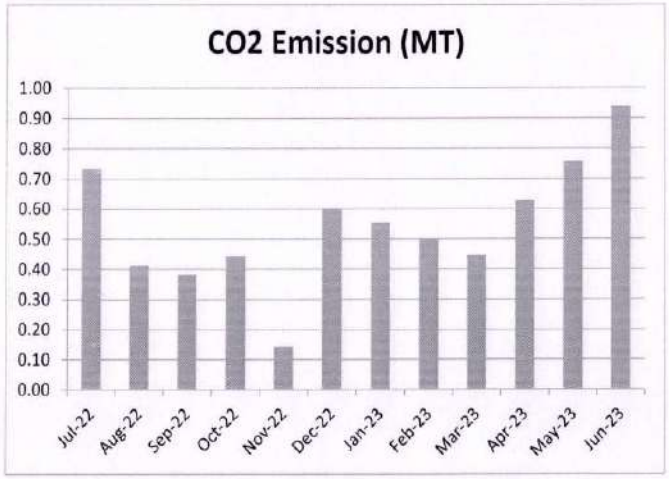
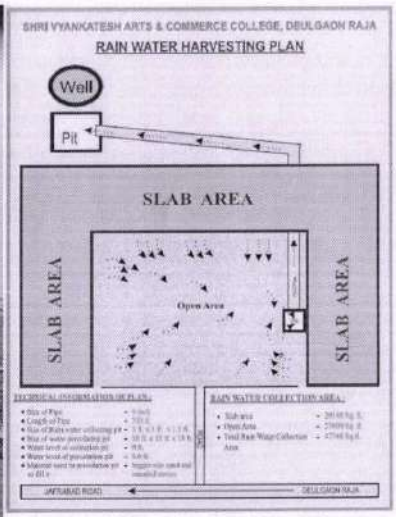


Figure 3.1: Month wise CO2 Emission

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



महाविद्यालयात भालसंवर्धन व पुनर्भरणासाठी तयार केलेल्या योजनेचा आराखडा.

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.

Nutan Urja Solutions

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights

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.

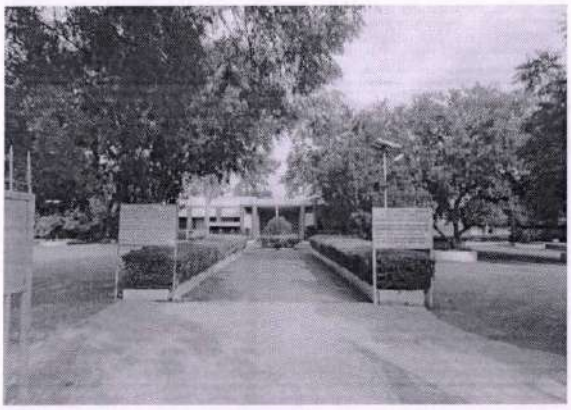
7.2 Usage of Public Transport

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

Year : 2021-22

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Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	1,178	0.94
2	Minimum	442	0.35
3	Average	677	0.54
4	Total	8,122	6.50

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
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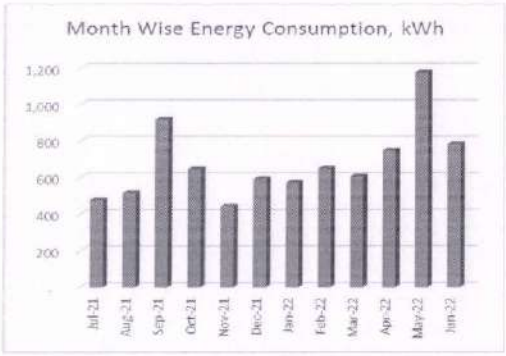
1	Jun-22	781	7,587
2	May-22	1,178	12,352
3	Apr-22	746	6,587
4	Mar-22	605	5,008
5	Feb-22	649	5,335
6	Jan-22	573	4,761
7	Dec-21	592	4,909
8	Nov-21	442	3,774
9	Oct-21	645	5,307
10	Sep-21	918	3,474
11	Aug-21	516	4,338
12	Jul-21	477	8,335
	Total	**8,122**	**71,767**

Variation in energy consumption is as follows,



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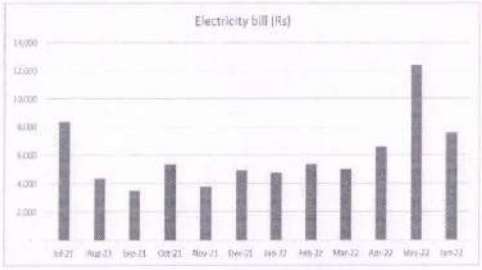

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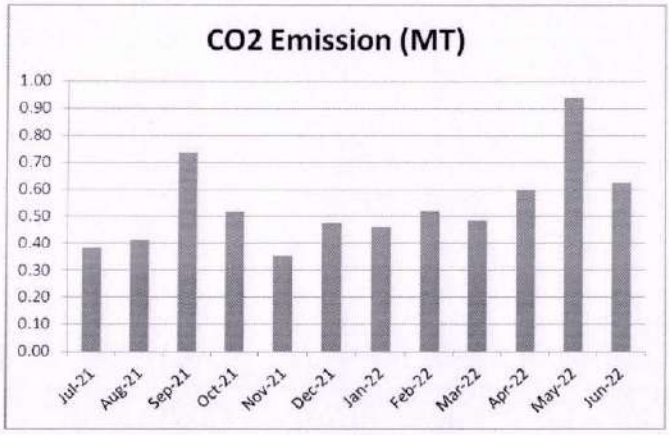

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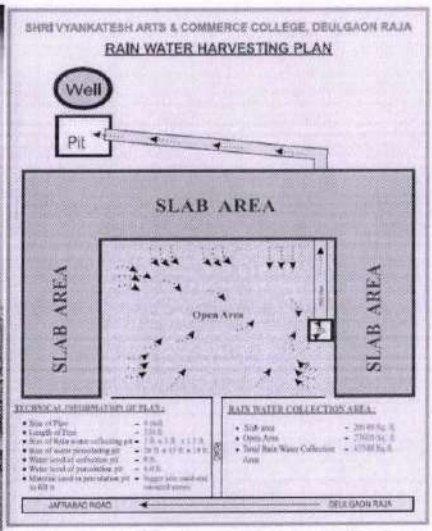

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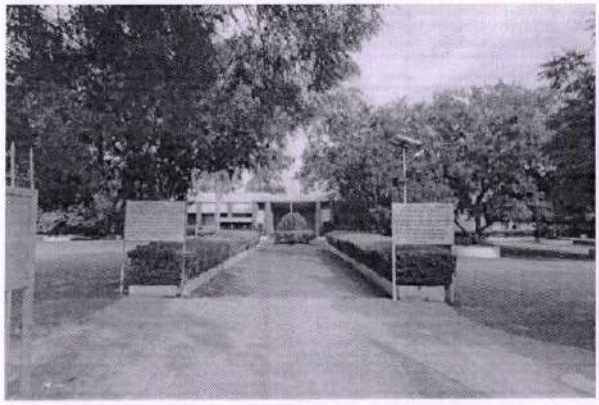

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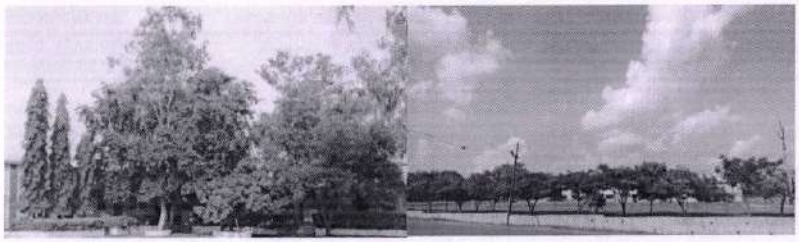

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Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	620	0.50
2	Minimum	476	0.38
3	Average	541	0.43
4	Total	6,492	5.19

2. Various Measures Adopted for Energy Conservation

1. Usage of STAR Rated ACs at new installations
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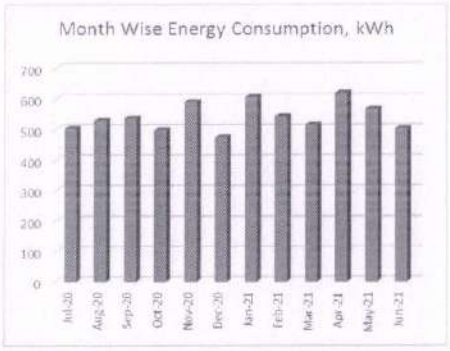
2. Study of Electrical Energy Consumption

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	504	4242
2	May-21	567	9970
3	Apr-21	620	5188
4	Mar-21	515	4469
5	Feb-21	544	4701
6	Jan-21	606	5178
7	Dec-20	476	4167
8	Nov-20	590	5054
9	Oct-20	499	4344
10	Sep-20	537	4681
11	Aug-20	530	35627
12	Jul-20	504	30752
	Total	**6,492**	**1,18,373**

Variation in energy consumption is as follows,



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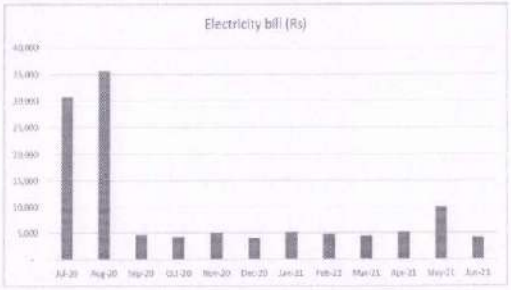

Figure 2.2: Month wise electricity bill

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	620	0.50
2	Minimum	476	0.38
3	Average	541	0.43
4	Total	6,492	5.19

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:

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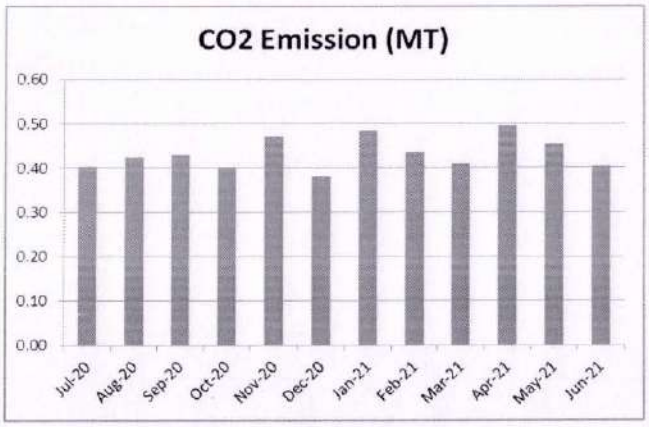
We herewith furnish the details of various forms of Energy consumption as under

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

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-21	504	0.40
2	May-21	567	0.45
3	Apr-21	620	0.50
4	Mar-21	515	0.41
5	Feb-21	544	0.44
6	Jan-21	606	0.48
7	Dec-20	476	0.38
8	Nov-20	590	0.47
9	Oct-20	499	0.40
10	Sep-20	537	0.43
11	Aug-20	530	0.42
12	Jul-20	504	0.40
	Total	**6,492**	**5.19**

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



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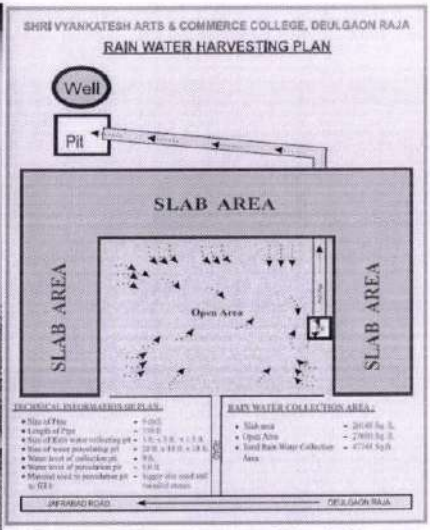
Photograph of Rain Water Harvesting pipe



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In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

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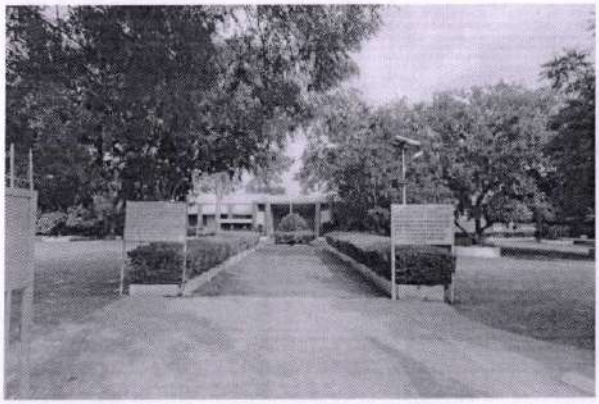

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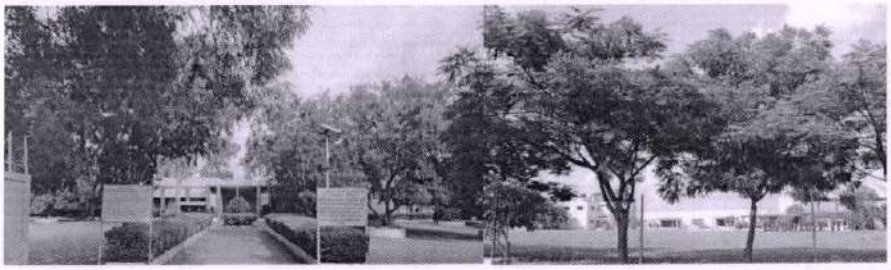
The Institute has beautiful maintained Garden.



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Year: 2019-20

Report

On

Green Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2019-20)

Prepared by

Nutan Urja Solutions

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

Sus Road, Sus, Pune 411 021

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

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Executive Summary

Green Audit of Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

1. Present Energy Consumption

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Table no 1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	1,994	1.60
2	Minimum	352	0.28
3	Average	779	0.62
4	Total	9,352	7.48

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.

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

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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
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1. Introduction

Shri Vyankatesh Arts, Commerce & Science College is located in Deulgaon Raja, Dist. Buldhana. The college is established in 1967. 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 Sant Gadge Baba Amravati University, Amravati.

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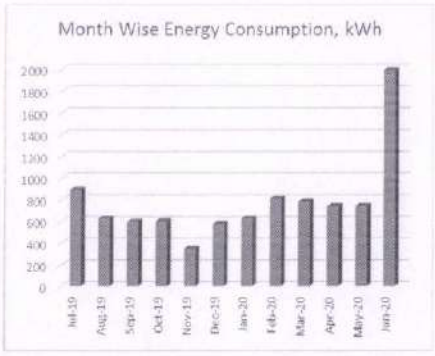
In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

Table no 2.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-20	1994	26098
2	May-20	741	22875
3	Apr-20	741	16639
4	Mar-20	785	8685
5	Feb-20	810	8792
6	Jan-20	628	6692
7	Dec-19	578	6120
8	Nov-19	352	3563
9	Oct-19	605	6070
10	Sep-19	598	5802
11	Aug-19	627	6306
12	Jul-19	893	9416
	Total	**9,352**	**1,27,058**

Variation in energy consumption is as follows,



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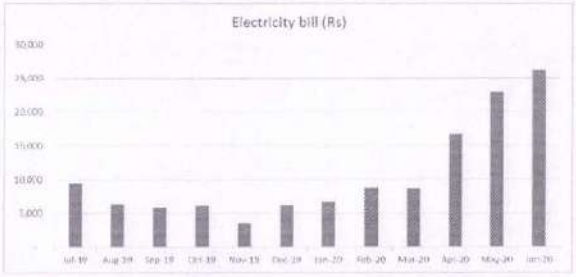

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Key observations of electricity bill are as follows,

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12	Jul-19	893	0.71
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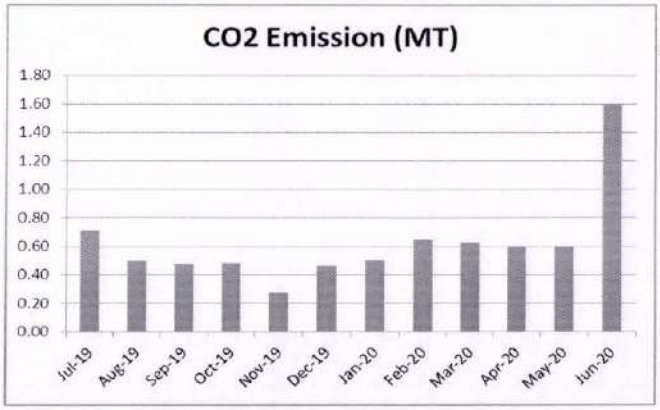
In the following Chart we present the CO2 emissions due to usage of Electrical Energy.



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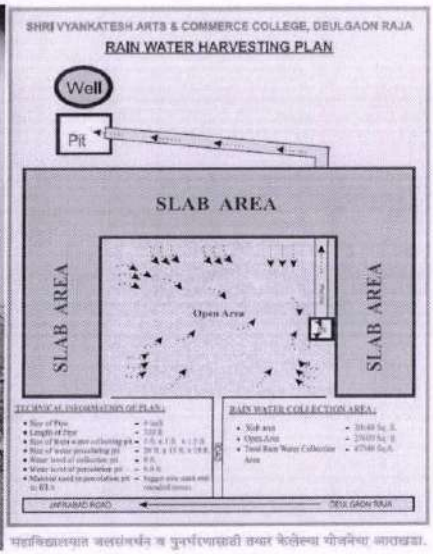

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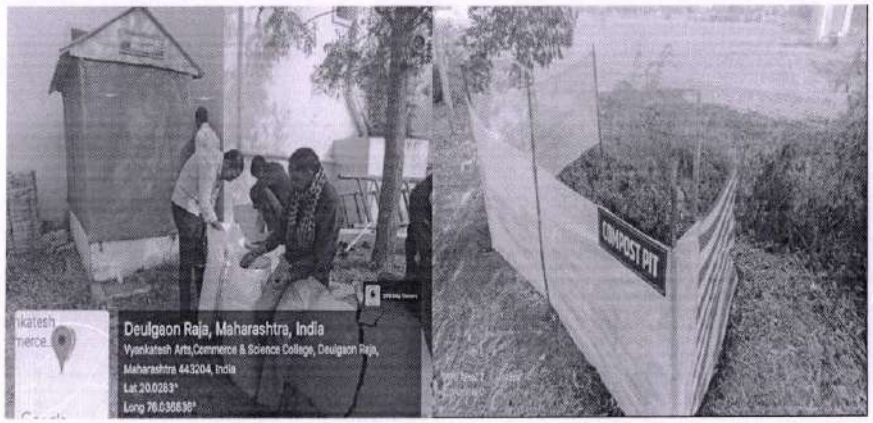

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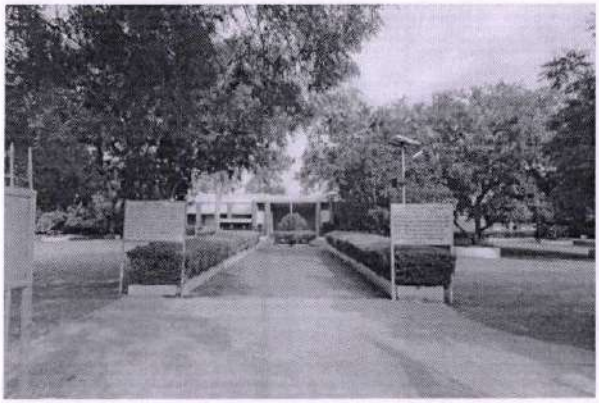

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Year: 2018-19

Report

On

Green Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

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(Year 2018-19)

Prepared by

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3	Average	735	0.59
4	Total	8,818	7.05

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5. Notes and Assumptions

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7	Dec-18	545	5477
8	Nov-18	652	6803
9	Oct-18	799	7347
10	Sep-18	572	-681
11	Aug-18	656	6025
12	Jul-18	457	4461
	Total	**8,818**	**76,872**

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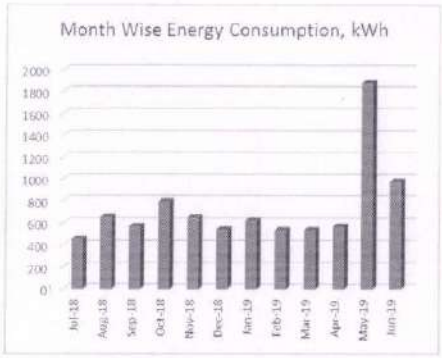

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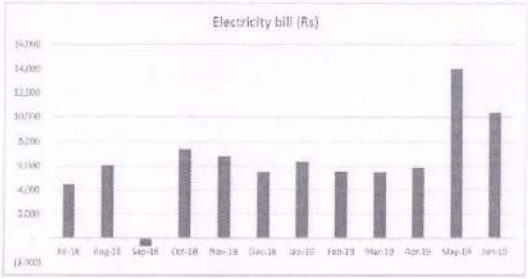

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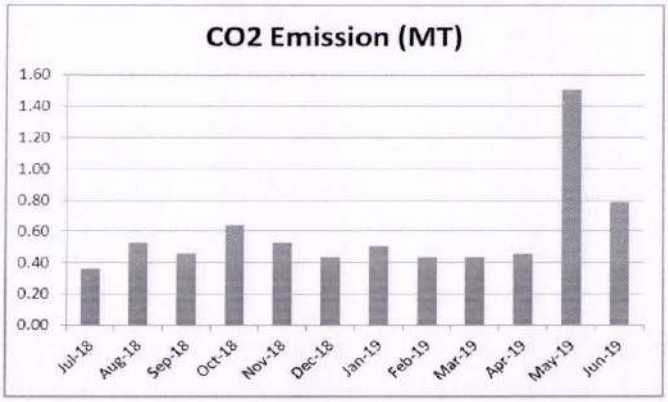

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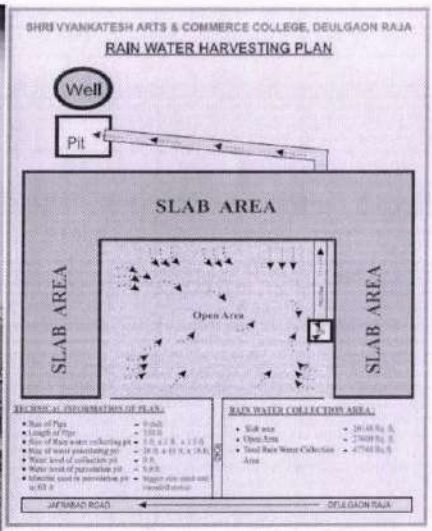

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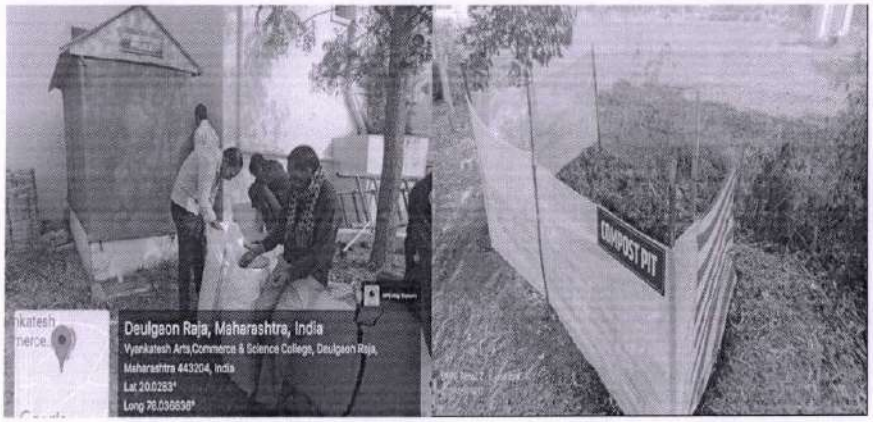

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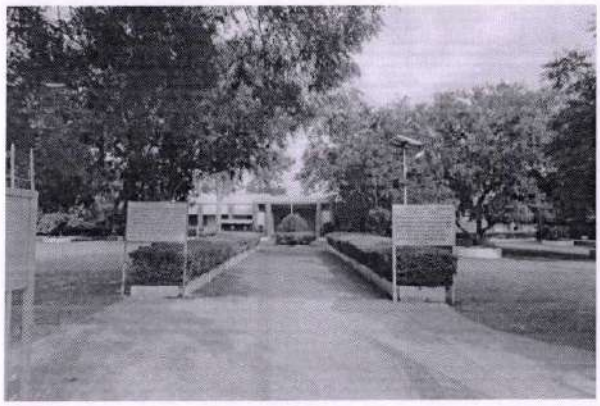

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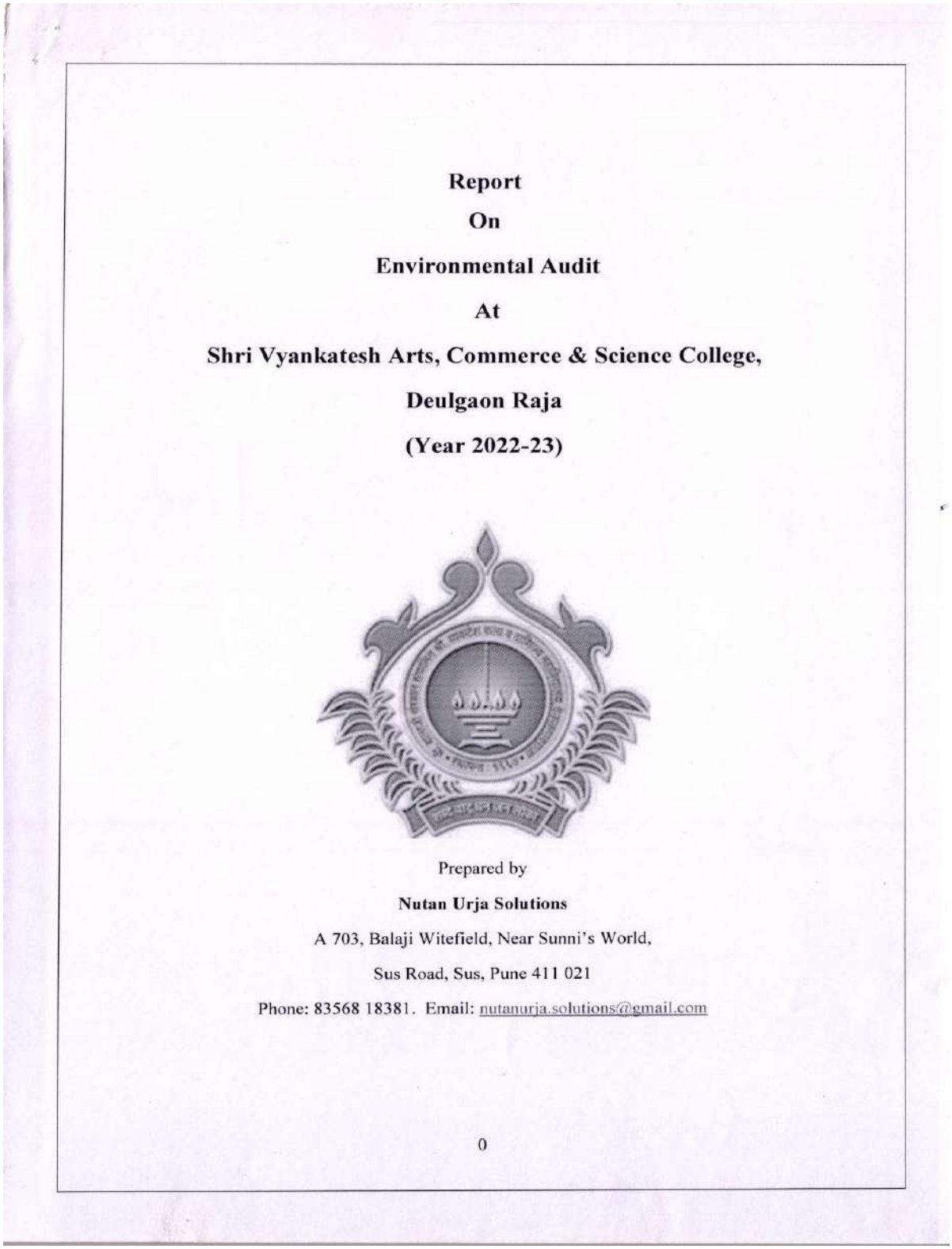
ENVIOURNMENT AUDITREPORT-

Year : 2022-23



Report

On

Environmental Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2022-23)

Prepared by

Nutan Urja Solutions

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

Sus Road, Sus, Pune 411 021

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

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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 Vyankatesh Arts, Commerce & Science College, Deulgaon Raja consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

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

2. Present Level of CO_2 Emissions:

No	Parameter /Value	Energy, kWh	CO_2 Emissions, MT
1	Maximum	1,174	0.94
2	Minimum	180	0.14
3	Average	681	0.54
4	Total	8,171	6.54

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.

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Abbreviations

AC	:	Air conditioner
PES	:	Progressive Education Society
CFL	:	Compact Fluorescent Lamp
FTL	:	Fluorescent Tube Light
LED	:	Light Emitting Diode
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PF	:	Power Factor
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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
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1986	The Environment Protection Act
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1989	Hazardous Waste (Management and Handling) Rules
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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 Vyankatesh Arts, Commerce & Science College
2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204
3	Affiliation	Sant Gadge Baba Amravati University, Amravati

2. Study of Consumption of Various Resources

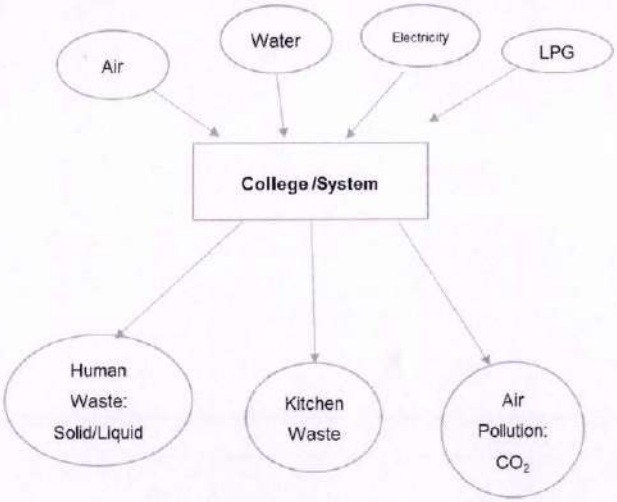
The Institute consumes following basic/derived Resources:

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

Also, college emits following pollutants to environment

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

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



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

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

Table 2.1: Electrical Energy Consumption

No	Month	Energy Consumed, kWh
1	Jun-23	1174
2	May-23	946
3	Apr-23	783
4	Mar-23	556
5	Feb-23	629
6	Jan-23	692
7	Dec-22	746
8	Nov-22	180
9	Oct-22	554
10	Sep-22	477
11	Aug-22	516
12	Jul-22	918
	Total	**8,171**
	Maximum	1,174
	Minimum	180
	Average	681

2.1 Variation of Monthly Electrical Energy Consumption

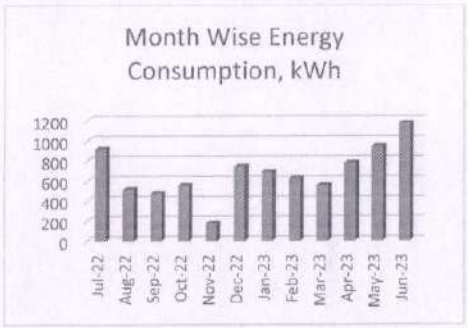


Figure 2.1 : Monthly Electrical Energy Consumption

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**	1,174
2	**Minimum**	180
3	**Average**	681
4	**Total**	8,171

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	1,174	0.94
2	May-23	946	0.76
3	Apr-23	783	0.63
4	Mar-23	556	0.44
5	Feb-23	629	0.50
6	Jan-23	692	0.55
7	Dec-22	746	0.60
8	Nov-22	180	0.14
9	Oct-22	554	0.44
10	Sep-22	477	0.38
11	Aug-22	516	0.41
12	Jul-22	918	0.73
	Total	**8,171**	**6.54**
	Maximum	1,174	0.94
	Minimum	180	0.14
	Average	681	0.54

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

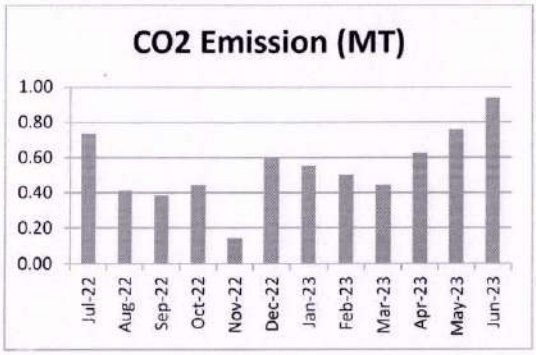


Figure 2.1: CO2 emission due to usage of electrical energy.

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:

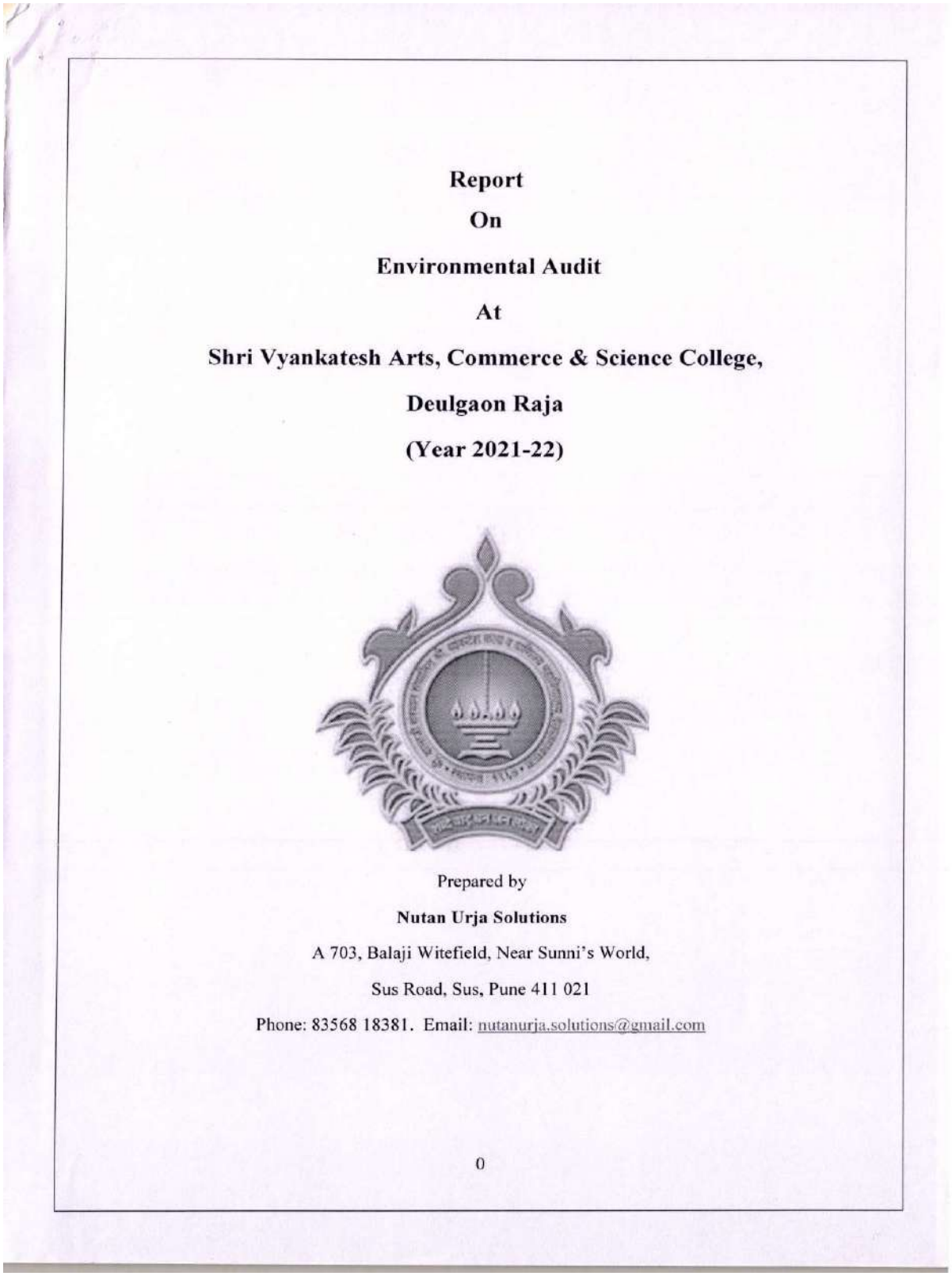
महाविद्यालयात जलसंवर्धन व पुनर्भरणासाठी तयार केलेल्या योजनेचा आराखडा.

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

Year: 2021-22



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- Solid Waste: Bio degradable Kitchen Waste, Garden Waste
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2. Present Level of CO_2 Emissions:

No	Parameter /Value	Energy, kWh	CO_2 Emissions, MT
1	Maximum	1,178	0.94
2	Minimum	442	0.35
3	Average	677	0.54
4	Total	8,122	6.50

3. The various projects already implemented for Environmental Conservation:

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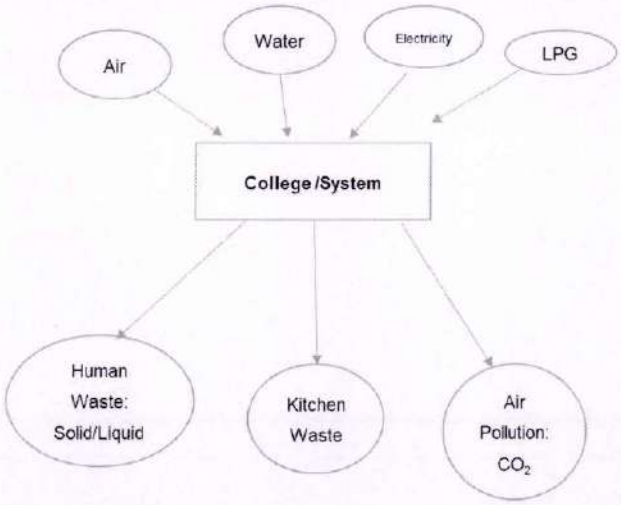

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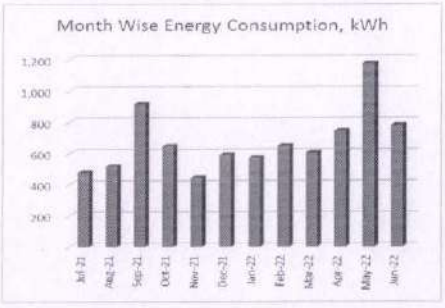

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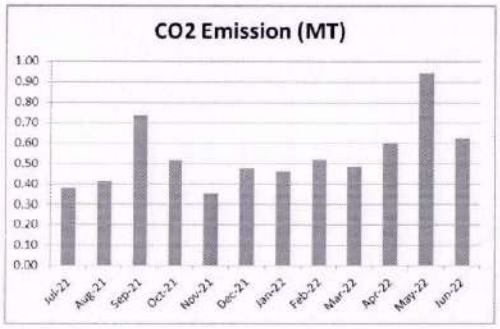

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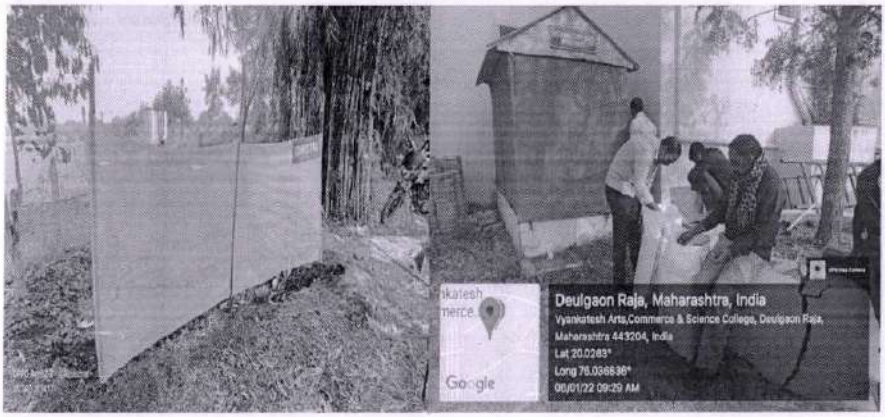

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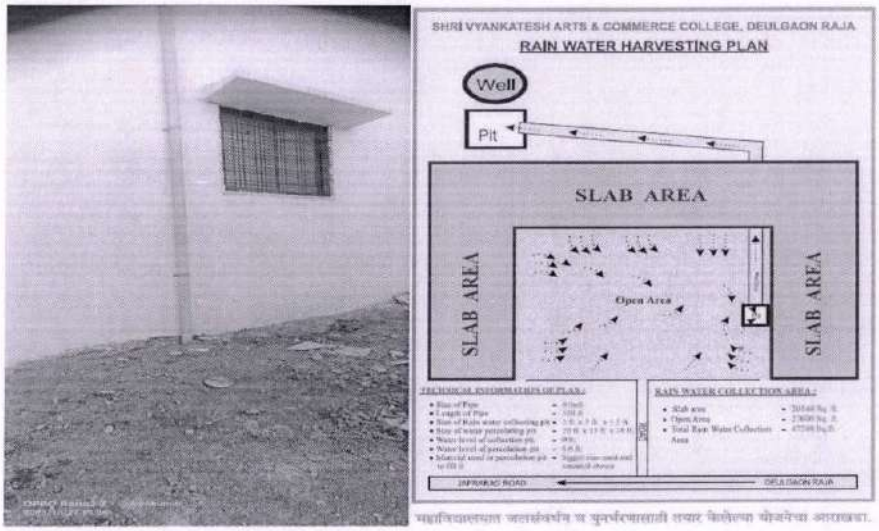

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2. Present Level of CO_2 Emissions:

No	Parameter /Value	Energy, kWh	CO_2 Emissions, MT
1	Maximum	620	0.50
2	Minimum	476	0.38
3	Average	541	0.43
4	Total	6,492	5.19

3. The various projects already implemented for Environmental Conservation:

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1. To study present usage of Natural resources the College is consuming
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2. Study of Consumption of Various Resources

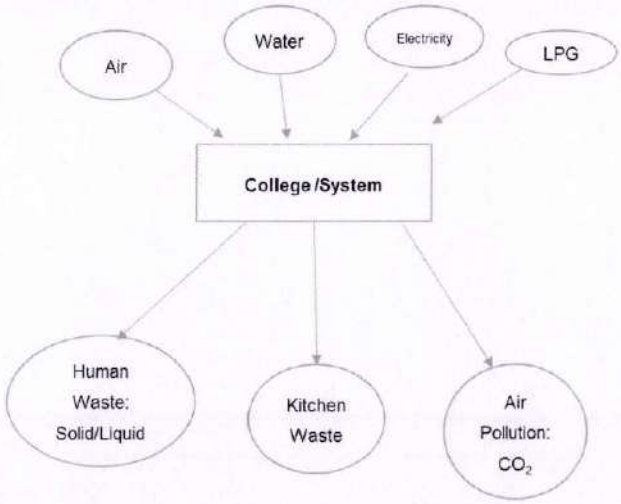
The Institute consumes following basic/derived Resources:

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.



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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-21	504
2	May-21	567
3	Apr-21	620
4	Mar-21	515
5	Feb-21	544
6	Jan-21	606
7	Dec-20	476
8	Nov-20	590
9	Oct-20	499
10	Sep-20	537
11	Aug-20	530
12	Jul-20	504
	Total	**6,492**
	Maximum	620
	Minimum	476
	Average	541

2.1 Variation of Monthly Electrical Energy Consumption

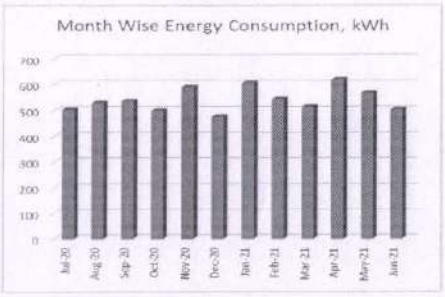

Figure 2.1 : Monthly Electrical Energy Consumption

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
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3	**Average**	541
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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-21	504	0.40
2	May-21	567	0.45
3	Apr-21	620	0.50
4	Mar-21	515	0.41
5	Feb-21	544	0.44
6	Jan-21	606	0.48
7	Dec-20	476	0.38
8	Nov-20	590	0.47
9	Oct-20	499	0.40
10	Sep-20	537	0.43
11	Aug-20	530	0.42
12	Jul-20	504	0.40
	Total	**6,492**	**5.19**
	Maximum	620	0.50
	Minimum	476	0.38
	Average	541	0.43

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

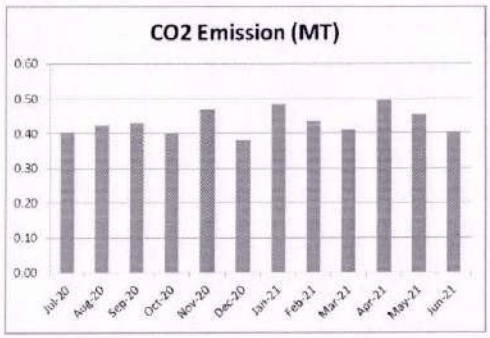

Figure 2.1: CO2 emission due to usage of electrical energy.

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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

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

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

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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.

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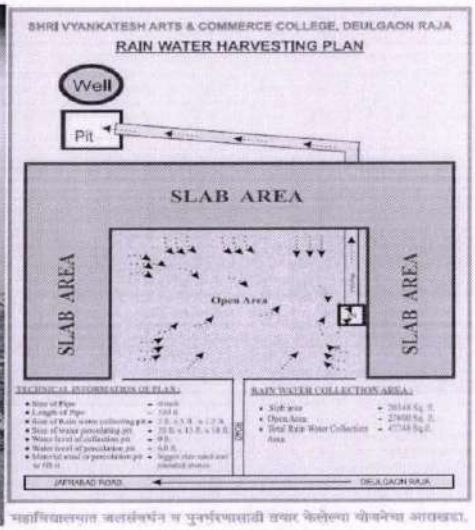

महाविद्यालयात जलसंवर्धन व पुनर्भरणासाठी तयार केलेल्या योजनेचा आराखडा.

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

Year: 2019-20

Report

On

Environmental Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2019-20)

Prepared by

Nutan Urja Solutions

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

Sus Road, Sus, Pune 411 021

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

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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 Vyankatesh Arts, Commerce & Science College, Deulgaon Raja consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

1. Various Pollution due to College Activities:

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

2. Present Level of CO_2 Emissions:

No	Parameter /Value	Energy, kWh	CO_2 Emissions, MT
1	Maximum	1,994	1.60
2	Minimum	352	0.28
3	Average	779	0.62
4	Total	9,352	7.48

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:

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5. Notes & Assumptions:

1. **1 kWh** of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere
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Abbreviations

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1. Introduction

1.1 Important Definitions:

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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

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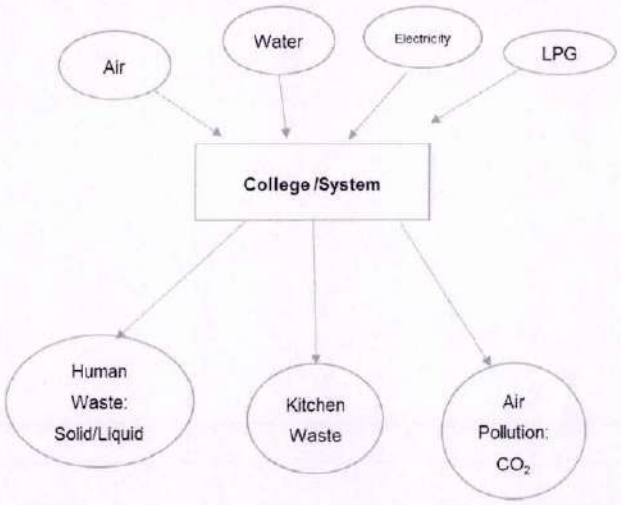

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The calculation of electrical energy consumption by college can be given as,

Table 2.1: Electrical Energy Consumption

No	Month	Energy Consumed, kWh
1	Jun-20	1994
2	May-20	741
3	Apr-20	741
4	Mar-20	785
5	Feb-20	810
6	Jan-20	628
7	Dec-19	578
8	Nov-19	352
9	Oct-19	605
10	Sep-19	598
11	Aug-19	627
12	Jul-19	893
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	Maximum	1,994
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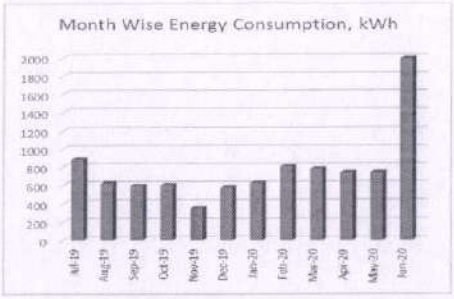

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No	Month	Energy Consumed, kWh	CO_2 Emissions, MT
1	Jun-20	1,994	1.60
2	May-20	741	0.59
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9	Oct-19	605	0.48
10	Sep-19	598	0.48
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12	Jul-19	893	0.71
	Total	**9,352**	**7.48**
	Maximum	1,994	1.60
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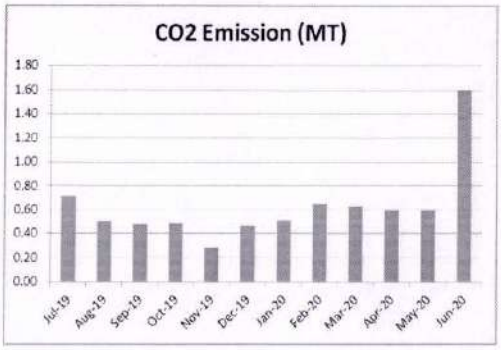
In the following Chart we present the CO2 emissions due to usage of Electrical Energy.



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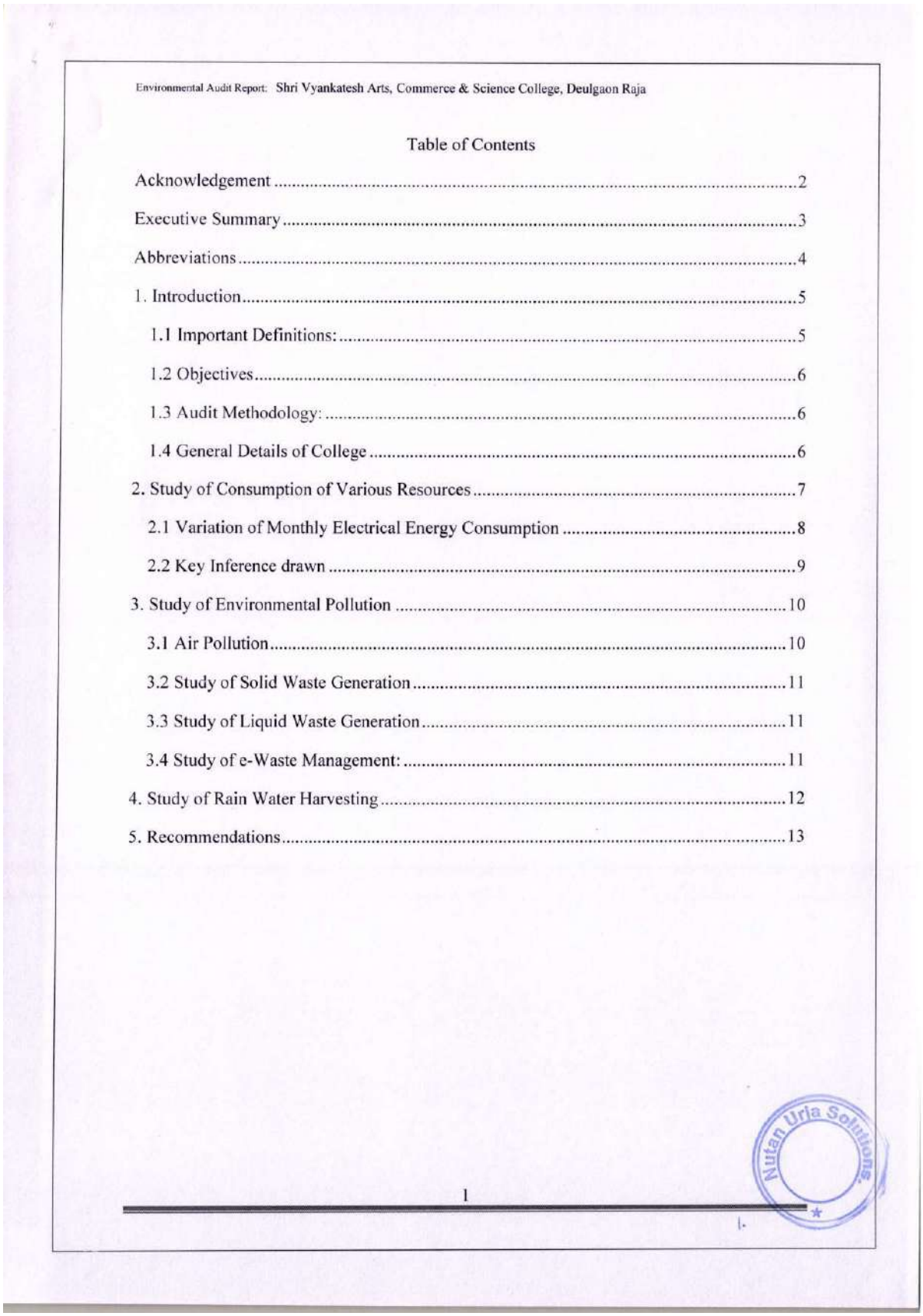

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2. Present Level of CO_2 Emissions:

No	Parameter /Value	Energy, kWh	CO_2 Emissions, MT
1	Maximum	1,883	1.51
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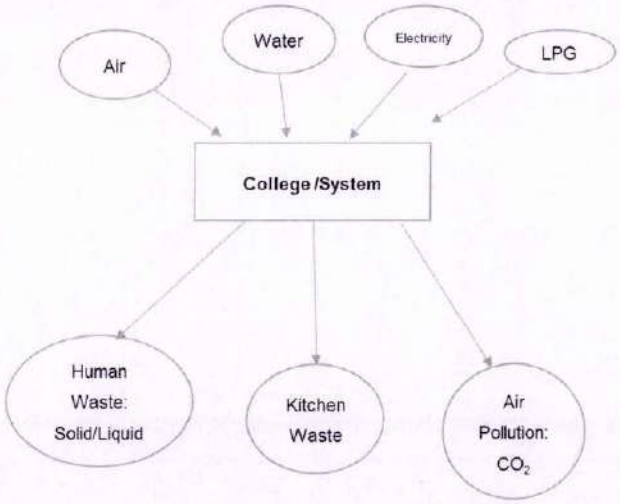

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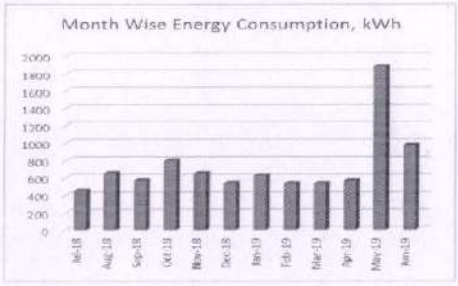

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In the following Table, we present the CO_2 emissions.

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

No	Month	Energy Consumed, kWh	CO_2 Emissions, MT
1	Jun-19	979	0.78
2	May-19	1,883	1.51
3	Apr-19	569	0.46
4	Mar-19	539	0.43
5	Feb-19	539	0.43
6	Jan-19	628	0.50
7	Dec-18	545	0.44
8	Nov-18	652	0.52
9	Oct-18	799	0.64
10	Sep-18	572	0.46
11	Aug-18	656	0.52
12	Jul-18	457	0.37
	Total	**8,818**	**5.19**
	Maximum	1,883	1.51
	Minimum	457	0.37
	Average	735	0.59

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

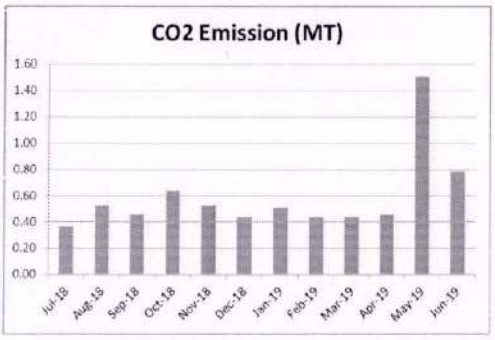


Figure 2.1: CO2 emission due to usage of electrical energy.

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.

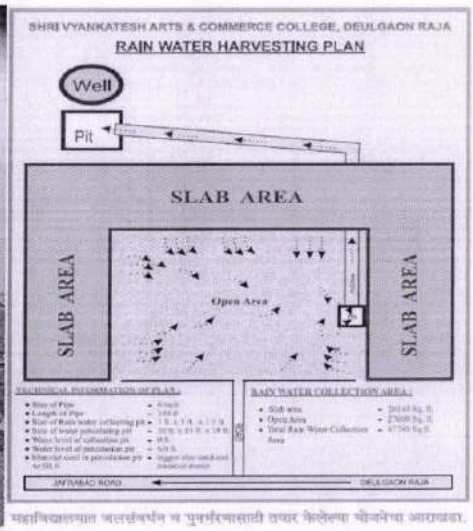
3.4 Study of e-Waste Management:

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:



महाविद्यालयात जलसंवर्धन व पुनर्भरणासाठी तयार केलेल्या योजनेचा आराखडा.

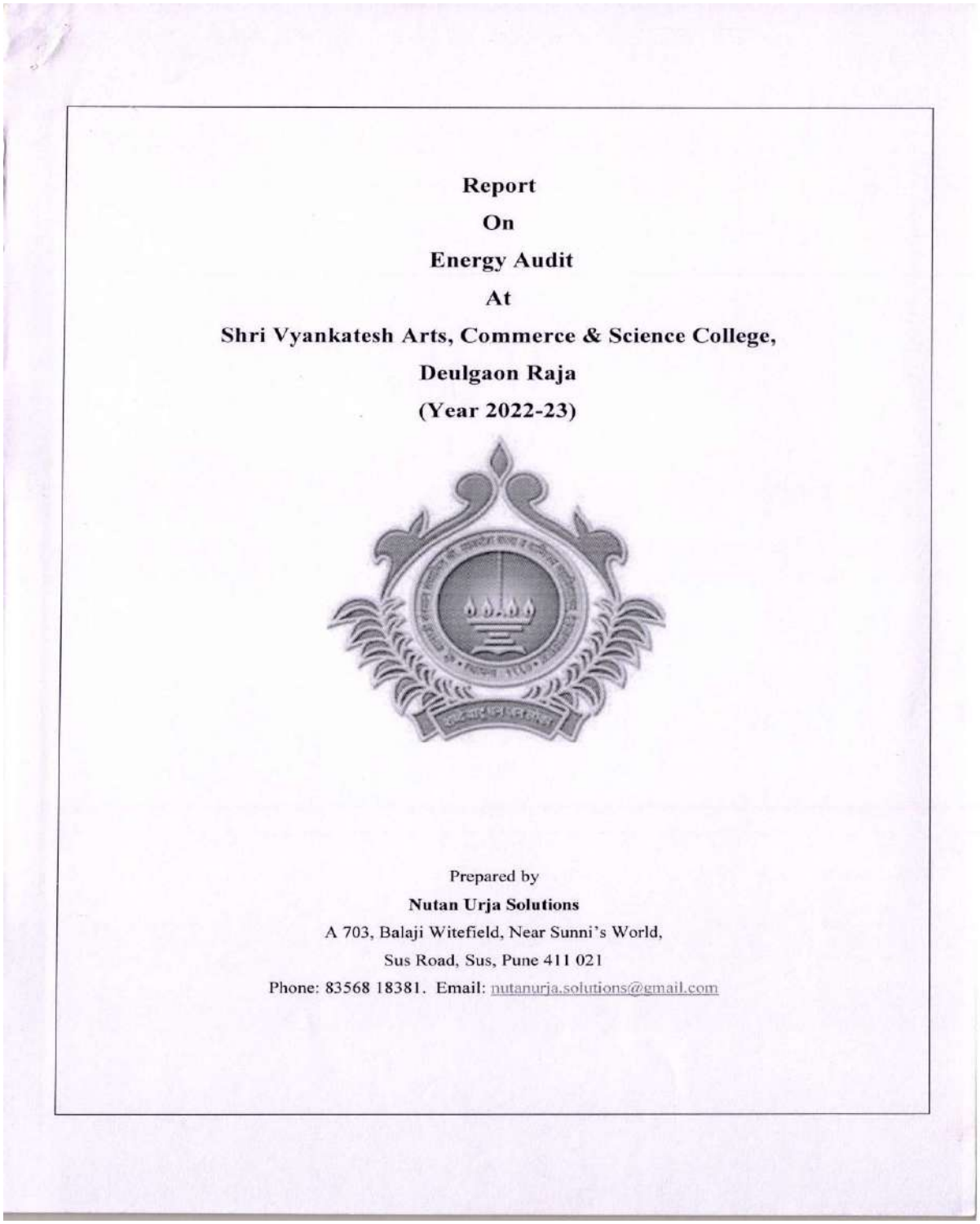
5. Recommendations

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

ENERGY AUDIT REPORT -

Year : 2022-23



Report

On

Energy Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2022-23)

Prepared by

Nutan Urja Solutions

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Contents

Nutan Urja Solutions

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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	1,174	0.94
2	Minimum	180	0.14
3	Average	681	0.54
4	Total	8,171	6.54

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. The college has installed 6 nos of solar street lights

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 94 %.

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 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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

Shri Vyankatesh Arts, Commerce & Science College is located in Deulgaon Raja, Dist. Buldhana. The college is established in 1967. 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 Sant Gadge Baba Amravati University, Amravati.

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 Vyankatesh Arts, Commerce & Science College
2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204.
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	CFL	LED tube (20W)	Computers (65W)	Fans	1.5TR ACs
	SCIENCE BUILDING					
1	Class Room 1		1		2	
2	Class Room 2		1		2	
3	Class Room 3		1		2	
4	Class Room 4		1		2	
5	Class Room 5	1	1		2	
6	Wash Room Ladies	2				
7	Chemistry Lab		4	1	2	
8	Micro Biology Lab	2	3		2	
9	Maths Lab		1		1	
10	Physics Lab	1	2		1	
11	Computer Lab		5	30	4	
12	Botany & Zoology Lab		4	1	2	
13	I.Q.A.C.		1	1	2	
	Arts & Commerce Building					
14	Office		5	5	6	
15	Wash Room Ladies		1			
16	Wash Room Gent's		1			
17	Record Room		1			
18	Watchman Room		1			
19	Exam Dept.	2	1	1	2	
20	Principal		6		1	2
21	Guest Room	2	1		2	
22	Wash Room Boy's		1			
23	New Ladies Room & Dept.		10		10	
24	Hall		54		16	
25	Girl's Reading Room		8		2	
26	Boy's Reading Room		18		5	
27	Staff Room		2		1	

28	News Paper Reading Room		2		1	
29	Interance		2	4	1	
30	Librarian Chember		3	1	1	
31	Stock Room		19	1	1	
32	Class Room 1		2		2	
33	Class Room 2		2		2	
34	Class Room 3		2		2	
35	Class Room 4		1		1	
36	Class Room 5		2		2	
37	Class Room 6		2		2	
38	Class Room 7		2		3	
39	Conference Hall		8		4	
40	I.Q.A.C. old		1		1	
41	Class Room		2		2	
42	Class Room		2		2	
43	Class Room		2		2	
44	Class Room		2		2	
45	Open Theatre		3		2	
46	Meeting Hall		4		2	2
47	Ladies Common Room		2		3	
48	Departments		6		4	
49	Canteen		1		1	
50	Indoor Sports		8		6	
51	Watch Room		1		1	
52	Corridor	2	6			
	Total	**12**	**222**	**45**	**119**	**4**

Individual fitting wise load is as under

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.3
2	LED Tube-20W	222	20	4.4
3	Computers	45	65	2.9
4	Ceiling Fan	119	65	7.7
5	AC- (1.5 Tr)	4	2200	8.8
6	Pumps (1 nos 2.5HP)			1.5
	Total			**18.0**

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

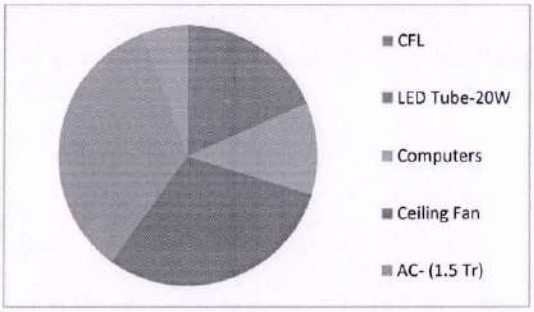

Figure 2.1: Distribution of connected load.

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	1174	11532
2	May-23	946	8834
3	Apr-23	783	7072
4	Mar-23	556	4879
5	Feb-23	629	5878
6	Jan-23	692	5328
7	Dec-22	746	7354
8	Nov-22	180	247
9	Oct-22	554	5784
10	Sep-22	477	5211
11	Aug-22	516	4268
12	Jul-22	918	3687
	Total	**8,171**	**70,074**

Variation in energy consumption is as follows,

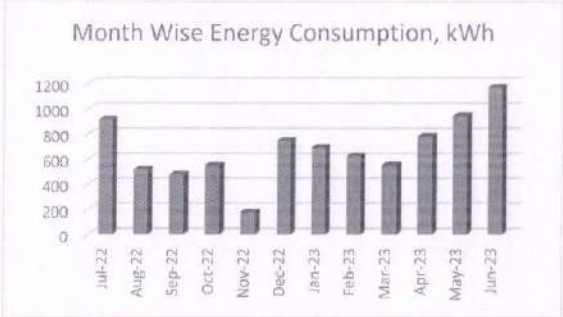

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

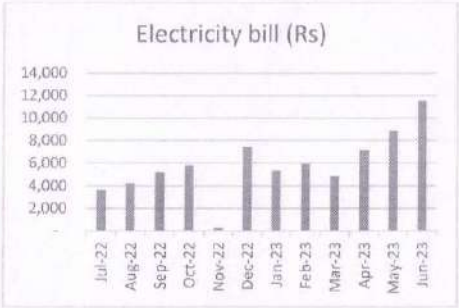

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	8171	6.54
2	Maximum	1,174	0.94
3	Minimum	180	0.14
4	Average	681	0.54

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	1,174	0.94
2	May-23	946	0.76
3	Apr-23	783	0.63
4	Mar-23	556	0.44
5	Feb-23	629	0.50
6	Jan-23	692	0.55
7	Dec-22	746	0.60
8	Nov-22	180	0.14
9	Oct-22	554	0.44
10	Sep-22	477	0.38
11	Aug-22	516	0.41
12	Jul-22	918	0.73
	Total	**8,171**	**6.54**

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

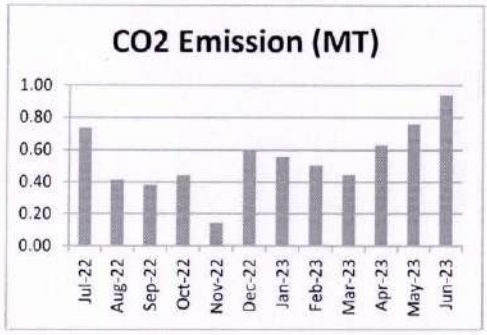

Figure 4.1: Month wise CO2 Emission

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 12 nos of CFLs, 222 nos of LED tubes.

5.2 Air-conditioners

In the facility, there are about 04 Nos. of 1.5 Tr old Air-conditioners.

5.3 Ceiling Fans

At building facility, there are about 119 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 2.5HP capacity.

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights

7. Study of usage of LED lighting

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

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.288
	LED lighting load			
1	LED tube	222	20	4.44
	Total LED lighting load			4.44
	Total Lighting load			4.728

It can be seen that out of total lighting load 94% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 119 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	119	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	23.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5950	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	65450	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	258706	Rs lump sum
13	Simple Payback period	47	Months

8.2 Installation of Solar PV panel

It is recommended to install 5 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

Year : 2021-22

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Energy Audit

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Shri Vyankatesh Arts, Commerce & Science College,

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2	Minimum	442	0.35
3	Average	677	0.54
4	Total	8,122	6.50

2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
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3. Key Observations

1. Usage of LED lights.
2. Usage of star rated equipment.
3. Maintained a good power factor.
4. The college has installed 6 nos of solar street lights

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 94 %.

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 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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

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1.2 Audit Methodology:

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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
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2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204.
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	CFL	LED tube (20W)	Computers (65W)	Fans	1.5TR ACs
	SCIENCE BUILDING					
1	Class Room 1		1		2	
2	Class Room 2		1		2	
3	Class Room 3		1		2	
4	Class Room 4		1		2	
5	Class Room 5	1	1		2	
6	Wash Room Ladies	2				
7	Chemistry Lab		4	1	2	
8	Micro Biology Lab	2	3		2	
9	Maths Lab		1		1	
10	Physics Lab	1	2		1	
11	Computer Lab		5	30	4	
12	Botany & Zoology Lab		4	1	2	
13	I.Q.A.C.		1	1	2	
	Arts & Commerce Building					
14	Office		5	5	6	
15	Wash Room Ladies		1			
16	Wash Room Gent's		1			
17	Record Room		1			
18	Watchman Room		1			
19	Exam Dept.	2	1	1	2	
20	Principal		6		1	2
21	Guest Room	2	1		2	
22	Wash Room Boy's		1			
23	New Ladies Room & Dept.		10		10	
24	Hall		54		16	
25	Girl's Reading Room		8		2	
26	Boy's Reading Room		18		5	
27	Staff Room		2		1	

28	News Paper Reading Room		2		1	
29	Interance		2	4	1	
30	Librarian Chember		3	1	1	
31	Stock Room		19	1	1	
32	Class Room 1		2		2	
33	Class Room 2		2		2	
34	Class Room 3		2		2	
35	Class Room 4		1		1	
36	Class Room 5		2		2	
37	Class Room 6		2		2	
38	Class Room 7		2		3	
39	Conference Hall		8		4	
40	I.Q.A.C. old		1		1	
41	Class Room		2		2	
42	Class Room		2		2	
43	Class Room		2		2	
44	Class Room		2		2	
45	Open Theatre		3		2	
46	Meeting Hall		4		2	2
47	Ladies Common Room		2		3	
48	Departments		6		4	
49	Canteen		1		1	
50	Indoor Sports		8		6	
51	Watch Room		1		1	
52	Corridor	2	6			
	Total	**12**	**222**	**45**	**119**	**4**

Individual fitting wise load is as under

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.3
2	LED Tube-20W	222	20	4.4
3	Computers	45	65	2.9
4	Ceiling Fan	119	65	7.7
5	AC- (1.5 Tr)	4	2200	8.8
6	Pumps (1 nos 2.5HP)			1.5
	Total			**18.0**

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

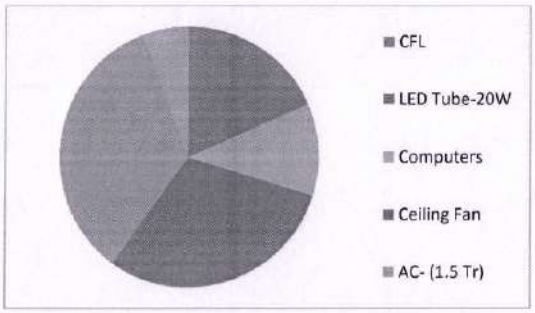


Figure 2.1: Distribution of connected load.

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	781	7,587
2	May-22	1,178	12,352
3	Apr-22	746	6,587
4	Mar-22	605	5,008
5	Feb-22	649	5,335
6	Jan-22	573	4,761
7	Dec-21	592	4,909
8	Nov-21	442	3,774
9	Oct-21	645	5,307
10	Sep-21	918	3,474
11	Aug-21	516	4,338
12	Jul-21	477	8,335
	Total	**8,122**	**71,767**

Variation in energy consumption is as follows,

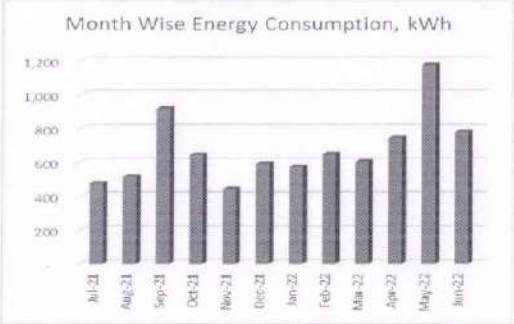


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

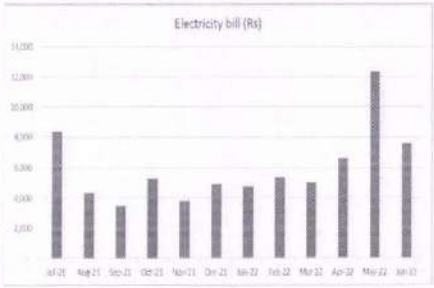


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	8122	6.50
2	Maximum	1,178	0.94
3	Minimum	442	0.35
4	Average	677	0.54

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-22	781	0.62
2	May-22	1,178	0.94
3	Apr-22	746	0.60
4	Mar-22	605	0.48
5	Feb-22	649	0.52
6	Jan-22	573	0.46
7	Dec-21	592	0.47
8	Nov-21	442	0.35
9	Oct-21	645	0.52
10	Sep-21	918	0.73
11	Aug-21	516	0.41
12	Jul-21	477	0.38
	Total	**8,122**	**6.50**

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

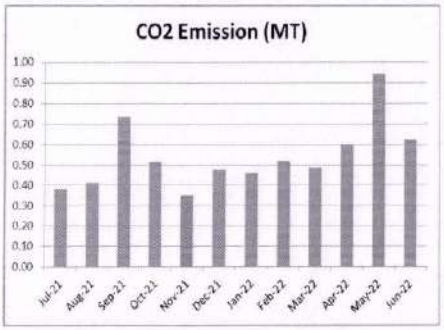


Figure 4.1: Month wise CO2 Emission

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 12 nos of CFLs, 222 nos of LED tubes.

5.2 Air-conditioners

In the facility, there are about 04 Nos. of 1.5 Tr old Air-conditioners.

5.3 Ceiling Fans

At building facility, there are about 119 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 2.5HP capacity.

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights

7. Study of usage of LED lighting

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

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.288
	LED lighting load			
1	LED tube	222	20	4.44
	Total LED lighting load			4.44
	Total Lighting load			4.728

It can be seen that out of total lighting load 94% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 119 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	119	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	23.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5950	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	65450	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	258706	Rs lump sum
13	Simple Payback period	47	Months

8.2 Installation of Solar PV panel

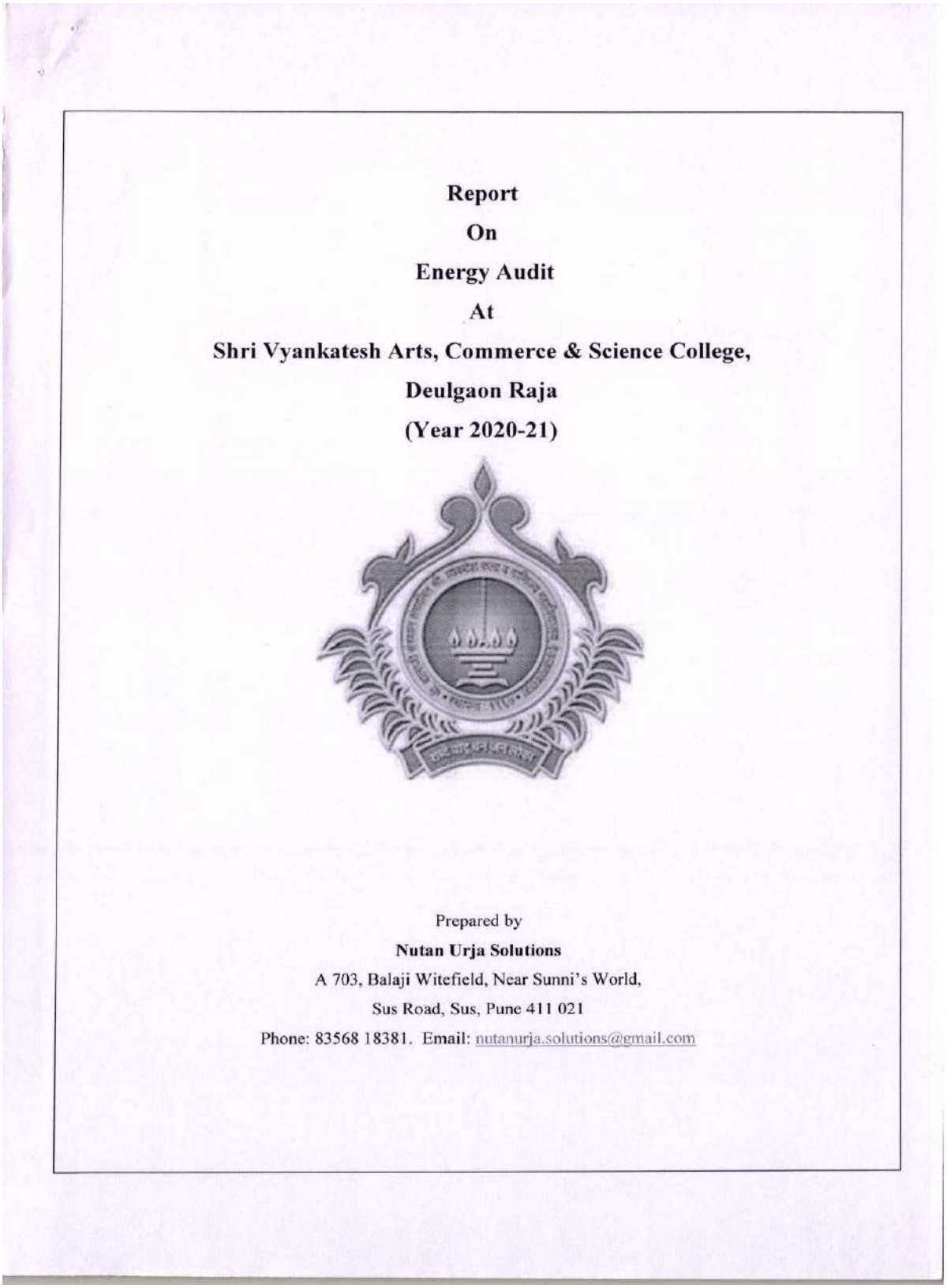
It is recommended to install 5 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

Year: 2020-21



Report

On

Energy Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2020-21)

Prepared by

Nutan Urja Solutions

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Contents

Acknowledgement

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

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

Executive Summary

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

1. Present Energy Consumption

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

Table no 2.1: Details of energy consumption

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	620	0.50
2	Minimum	476	0.38
3	Average	541	0.43
4	Total	6,492	5.19

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. The college has installed 6 nos of solar street lights

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 94 %.

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 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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

Shri Vyankatesh Arts, Commerce & Science College is located in Deulgaon Raja, Dist. Buldhana. The college is established in 1967. 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 Sant Gadge Baba Amravati University, Amravati.

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 Vyankatesh Arts, Commerce & Science College
2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204.
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	CFL	LED tube (20W)	Computers (65W)	Fans	1.5TR ACs
	SCIENCE BUILDING					
1	Class Room 1		1		2	
2	Class Room 2		1		2	
3	Class Room 3		1		2	
4	Class Room 4		1		2	
5	Class Room 5	1	1		2	
6	Wash Room Ladies	2				
7	Chemistry Lab		4	1	2	
8	Micro Biology Lab	2	3		2	
9	Maths Lab		1		1	
10	Physics Lab	1	2		1	
11	Computer Lab		5	30	4	
12	Botany & Zoology Lab		4	1	2	
13	I.Q.A.C.		1	1	2	
	Arts & Commerce Building					
14	Office		5	5	6	
15	Wash Room Ladies		1			
16	Wash Room Gent's		1			
17	Record Room		1			
18	Watchman Room		1			
19	Exam Dept.	2	1	1	2	
20	Principal		6		1	2
21	Guest Room	2	1		2	
22	Wash Room Boy's		1			
23	New Ladies Room & Dept.		10		10	
24	Hall		54		16	
25	Girl's Reading Room		8		2	
26	Boy's Reading Room		18		5	
27	Staff Room		2		1	

28	News Paper Reading Room		2		1	
29	Interance		2	4	1	
30	Librarian Chember		3	1	1	
31	Stock Room		19	1	1	
32	Class Room 1		2		2	
33	Class Room 2		2		2	
34	Class Room 3		2		2	
35	Class Room 4		1		1	
36	Class Room 5		2		2	
37	Class Room 6		2		2	
38	Class Room 7		2		3	
39	Conference Hall		8		4	
40	I.Q.A.C. old		1		1	
41	Class Room		2		2	
42	Class Room		2		2	
43	Class Room		2		2	
44	Class Room		2		2	
45	Open Theatre		3		2	
46	Meeting Hall		4		2	2
47	Ladies Common Room		2		3	
48	Departments		6		4	
49	Canteen		1		1	
50	Indoor Sports		8		6	
51	Watch Room		1		1	
52	Corridor	2	6			
	Total	**12**	**222**	**45**	**119**	**4**

Individual fitting wise load is as under

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.3
2	LED Tube-20W	222	20	4.4
3	Computers	45	65	2.9
4	Ceiling Fan	119	65	7.7
5	AC- (1.5 Tr)	4	2200	8.8
6	Pumps (1 nos 2.5HP)			1.5
	Total			**18.0**

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

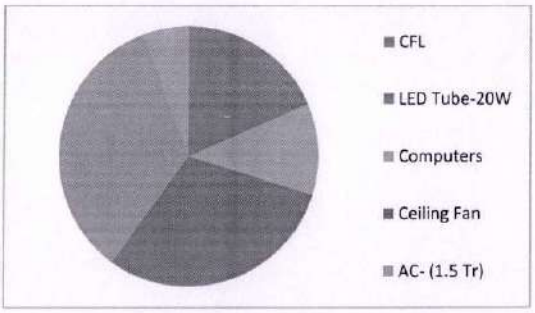


Figure 2.1: Distribution of connected load.

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	504	4242
2	May-21	567	9970
3	Apr-21	620	5188
4	Mar-21	515	4469
5	Feb-21	544	4701
6	Jan-21	606	5178
7	Dec-20	476	4167
8	Nov-20	590	5054
9	Oct-20	499	4344
10	Sep-20	537	4681
11	Aug-20	530	35627
12	Jul-20	504	30752
	Total	**6,492**	**1,18,373**

Variation in energy consumption is as follows,

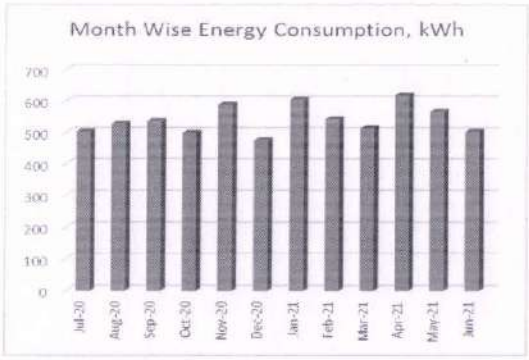


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

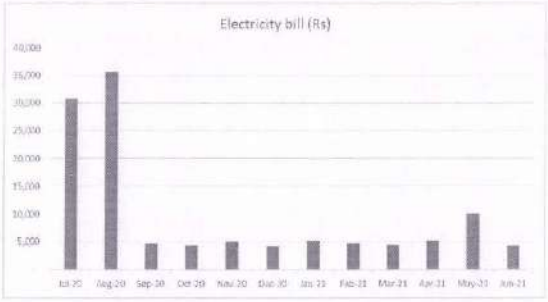


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	6492	5.19
2	Maximum	620	0.50
3	Minimum	476	0.38
4	Average	541	0.43

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-21	504	0.40
2	May-21	567	0.45
3	Apr-21	620	0.50
4	Mar-21	515	0.41
5	Feb-21	544	0.44
6	Jan-21	606	0.48
7	Dec-20	476	0.38
8	Nov-20	590	0.47
9	Oct-20	499	0.40
10	Sep-20	537	0.43
11	Aug-20	530	0.42
12	Jul-20	504	0.40
	Total	**6,492**	**5.19**

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

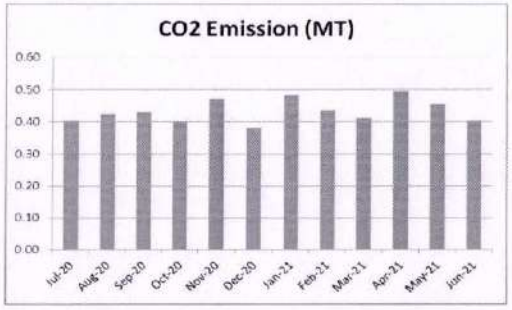


Figure 4.1: Month wise CO2 Emission

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 12 nos of CFLs, 222 nos of LED tubes.

5.2 Air-conditioners

In the facility, there are about 04 Nos. of 1.5 Tr old Air-conditioners.

5.3 Ceiling Fans

At building facility, there are about 119 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.

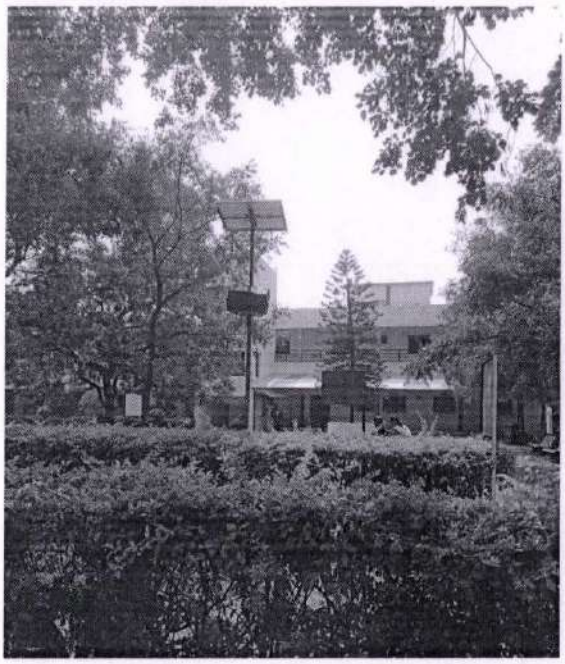
5.4 Water Pumps

There are in total 1 Water pumps with 2.5HP capacity.

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights



7. Study of usage of LED lighting

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

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.288
	LED lighting load			
1	LED tube	222	20	4.44
	Total LED lighting load			4.44
	Total Lighting load			4.728

It can be seen that out of total lighting load 94% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 119 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	119	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	23.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5950	kWh/Annum
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10	Annual Monetary saving	65450	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	258706	Rs lump sum
13	Simple Payback period	47	Months

8.2 Installation of Solar PV panel

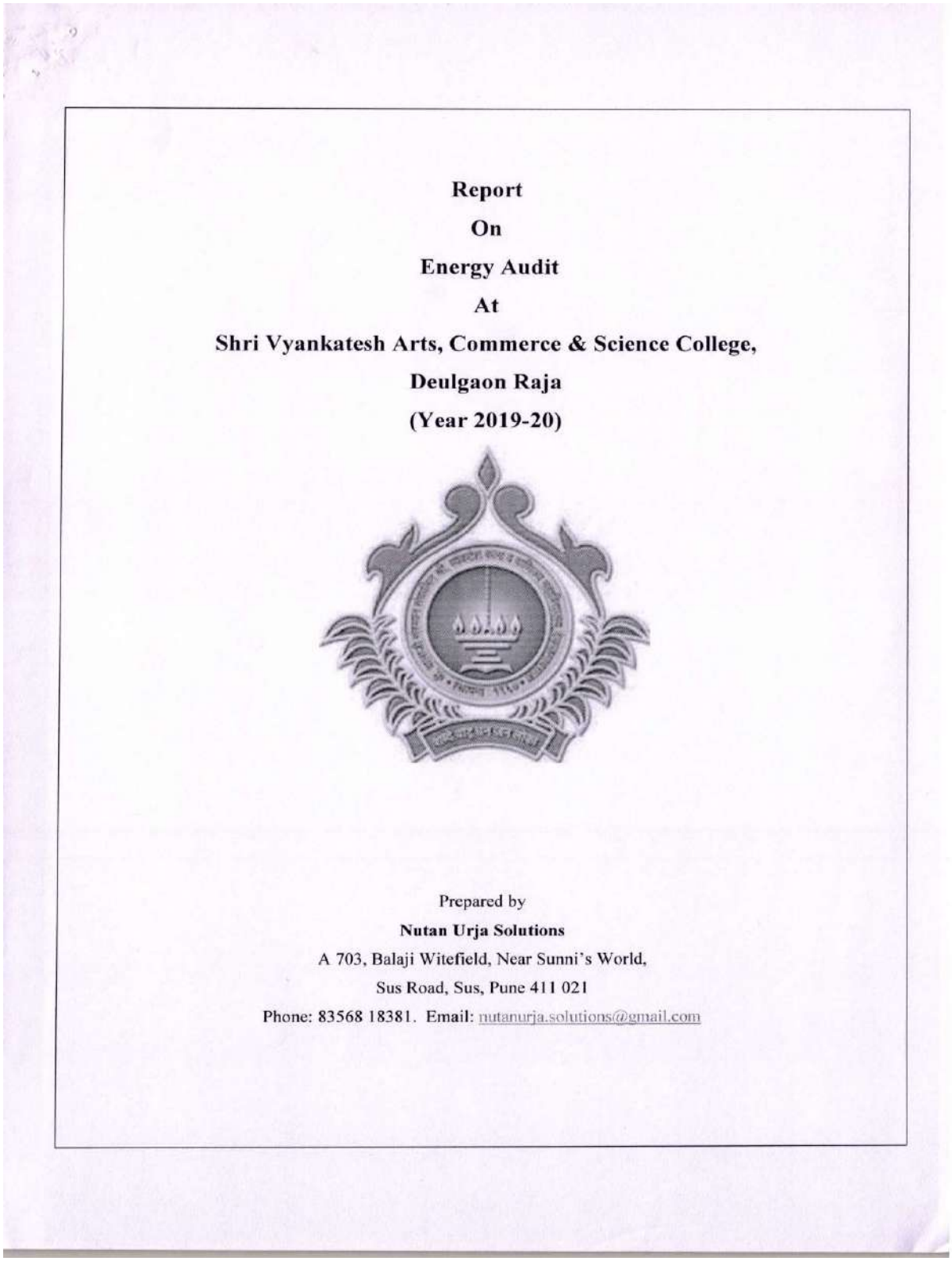
It is recommended to install 5 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

Year: 2019-20



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At

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Prepared by

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Nutan Urja Solutions

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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	1,994	1.60
2	Minimum	352	0.28
3	Average	779	0.62
4	Total	9,352	7.48

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. The college has installed 6 nos of solar street lights

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 94 %.

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 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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

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1.3 General Details of College

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2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204.
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	CFL	LED tube (20W)	Computers (65W)	Fans	1.5TR ACs
	SCIENCE BUILDING					
1	Class Room 1		1		2	
2	Class Room 2		1		2	
3	Class Room 3		1		2	
4	Class Room 4		1		2	
5	Class Room 5	1	1		2	
6	Wash Room Ladies	2				
7	Chemistry Lab		4	1	2	
8	Micro Biology Lab	2	3		2	
9	Maths Lab		1		1	
10	Physics Lab	1	2		1	
11	Computer Lab		5	30	4	
12	Botany & Zoology Lab		4	1	2	
13	I.Q.A.C.		1	1	2	
	Arts & Commerce Building					
14	Office		5	5	6	
15	Wash Room Ladies		1			
16	Wash Room Gent's		1			
17	Record Room		1			
18	Watchman Room		1			
19	Exam Dept.	2	1	1	2	
20	Principal		6		1	2
21	Guest Room	2	1		2	
22	Wash Room Boy's		1			
23	New Ladies Room & Dept.		10		10	
24	Hall		54		16	
25	Girl's Reading Room		8		2	
26	Boy's Reading Room		18		5	
27	Staff Room		2		1	

28	News Paper Reading Room		2		1	
29	Interance		2	4	1	
30	Librarian Chember		3	1	1	
31	Stock Room		19	1	1	
32	Class Room 1		2		2	
33	Class Room 2		2		2	
34	Class Room 3		2		2	
35	Class Room 4		1		1	
36	Class Room 5		2		2	
37	Class Room 6		2		2	
38	Class Room 7		2		3	
39	Conference Hall		8		4	
40	I.Q.A.C. old		1		1	
41	Class Room		2		2	
42	Class Room		2		2	
43	Class Room		2		2	
44	Class Room		2		2	
45	Open Theatre		3		2	
46	Meeting Hall		4		2	2
47	Ladies Common Room		2		3	
48	Departments		6		4	
49	Canteen		1		1	
50	Indoor Sports		8		6	
51	Watch Room		1		1	
52	Corridor	2	6			
	Total	**12**	**222**	**45**	**119**	**4**

Individual fitting wise load is as under

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.3
2	LED Tube-20W	222	20	4.4
3	Computers	45	65	2.9
4	Ceiling Fan	119	65	7.7
5	AC- (1.5 Tr)	4	2200	8.8
6	Pumps (1 nos 2.5HP)			1.5
	Total			**18.0**

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

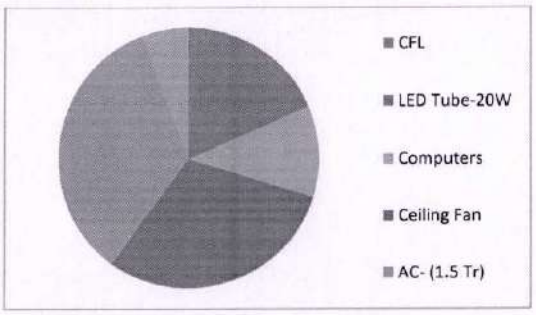

Figure 2.1: Distribution of connected load.

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-20	1994	26098
2	May-20	741	22875
3	Apr-20	741	16639
4	Mar-20	785	8685
5	Feb-20	810	8792
6	Jan-20	628	6692
7	Dec-19	578	6120
8	Nov-19	352	3563
9	Oct-19	605	6070
10	Sep-19	598	5802
11	Aug-19	627	6306
12	Jul-19	893	9416
	Total	**9,352**	**1,27,058**

Variation in energy consumption is as follows,

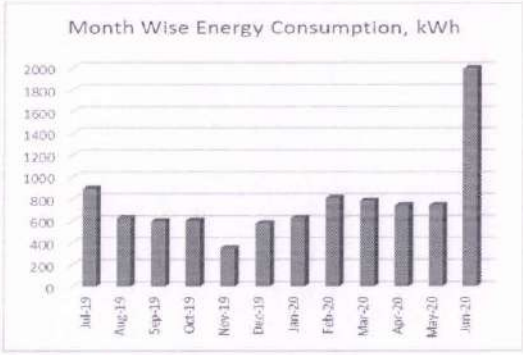

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

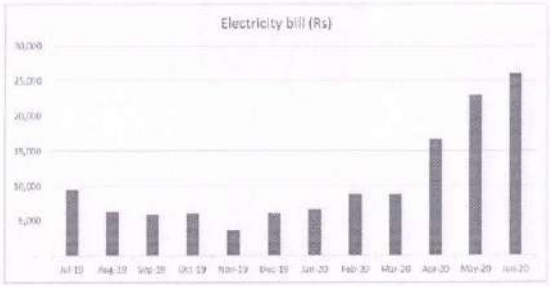

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	9,352	7.48
2	Maximum	1,994	1.60
3	Minimum	352	0.28
4	Average	779	0.62

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-20	1,994	1.60
2	May-20	741	0.59
3	Apr-20	741	0.59
4	Mar-20	785	0.63
5	Feb-20	810	0.65
6	Jan-20	628	0.50
7	Dec-19	578	0.46
8	Nov-19	352	0.28
9	Oct-19	605	0.48
10	Sep-19	598	0.48
11	Aug-19	627	0.50
12	Jul-19	893	0.71
	Total	**9,352**	**7.48**

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

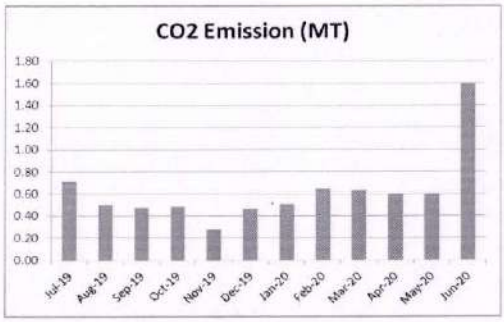

Figure 4.1: Month wise CO2 Emission

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 12 nos of CFLs, 222 nos of LED tubes.

5.2 Air-conditioners

In the facility, there are about 04 Nos. of 1.5 Tr old Air-conditioners.

5.3 Ceiling Fans

At building facility, there are about 119 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 2.5HP capacity.

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights

7. Study of usage of LED lighting

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

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.288
	LED lighting load			
1	LED tube	222	20	4.44
	Total LED lighting load			4.44
	Total Lighting load			4.728

It can be seen that out of total lighting load 94% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 119 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	119	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	23.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5950	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	65450	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	258706	Rs lump sum
13	Simple Payback period	47	Months

8.2 Installation of Solar PV panel

It is recommended to install 5 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

Year: 2018-19

Report

On

Energy Audit

At

Shri Vyankatesh Arts, Commerce & Science College,

Deulgaon Raja

(Year 2018-19)

Prepared by

Nutan Urja Solutions

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Sus Road, Sus, Pune 411 021

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

Contents

Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja for awarding us the assignment of Energy 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 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	1,883	1.51
2	Minimum	457	0.37
3	Average	735	0.59
4	Total	8,818	7.05

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. The college has installed 6 nos of solar street lights

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 94 %.

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 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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

Shri Vyankatesh Arts, Commerce & Science College is located in Deulgaon Raja, Dist. Buldhana. The college is established in 1967. 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 Sant Gadge Baba Amravati University, Amravati.

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 Vyankatesh Arts, Commerce & Science College
2	Address	Shri Vyankatesh Arts, Commerce & Science College, Deulgaon Raja, Dist. Buldhana 443 204.
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	CFL	LED tube (20W)	Computers (65W)	Fans	1.5TR ACs
	SCIENCE BUILDING					
1	Class Room 1		1		2	
2	Class Room 2		1		2	
3	Class Room 3		1		2	
4	Class Room 4		1		2	
5	Class Room 5	1	1		2	
6	Wash Room Ladies	2				
7	Chemistry Lab		4	1	2	
8	Micro Biology Lab	2	3		2	
9	Maths Lab		1		1	
10	Physics Lab	1	2		1	
11	Computer Lab		5	30	4	
12	Botany & Zoology Lab		4	1	2	
13	I.Q.A.C.		1	1	2	
	Arts & Commerce Building					
14	Office		5	5	6	
15	Wash Room Ladies		1			
16	Wash Room Gent's		1			
17	Record Room		1			
18	Watchman Room		1			
19	Exam Dept.	2	1	1	2	
20	Principal		6		1	2
21	Guest Room	2	1		2	
22	Wash Room Boy's		1			
23	New Ladies Room & Dept.		10		10	
24	Hall		54		16	
25	Girl's Reading Room		8		2	
26	Boy's Reading Room		18		5	
27	Staff Room		2		1	

28	News Paper Reading Room		2		1	
29	Interance		2	4	1	
30	Librarian Chember		3	1	1	
31	Stock Room		19	1	1	
32	Class Room 1		2		2	
33	Class Room 2		2		2	
34	Class Room 3		2		2	
35	Class Room 4		1		1	
36	Class Room 5		2		2	
37	Class Room 6		2		2	
38	Class Room 7		2		3	
39	Conference Hall		8		4	
40	I.Q.A.C. old		1		1	
41	Class Room		2		2	
42	Class Room		2		2	
43	Class Room		2		2	
44	Class Room		2		2	
45	Open Theatre		3		2	
46	Meeting Hall		4		2	2
47	Ladies Common Room		2		3	
48	Departments		6		4	
49	Canteen		1		1	
50	Indoor Sports		8		6	
51	Watch Room		1		1	
52	Corridor	2	6			
	Total	**12**	**222**	**45**	**119**	**4**

Individual fitting wise load is as under

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.3
2	LED Tube-20W	222	20	4.4
3	Computers	45	65	2.9
4	Ceiling Fan	119	65	7.7
5	AC- (1.5 Tr)	4	2200	8.8
6	Pumps (1 nos 2.5HP)			1.5
	Total			**18.0**

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

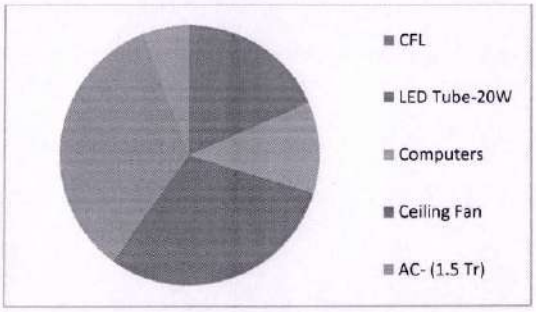


Figure 2.1: Distribution of connected load.

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-19	979	10326
2	May-19	1883	14000
3	Apr-19	569	5850
4	Mar-19	539	5427
5	Feb-19	539	5517
6	Jan-19	628	6320
7	Dec-18	545	5477
8	Nov-18	652	6803
9	Oct-18	799	7347
10	Sep-18	572	-681
11	Aug-18	656	6025
12	Jul-18	457	4461
	Total	**8,818**	**76,872**

Variation in energy consumption is as follows,

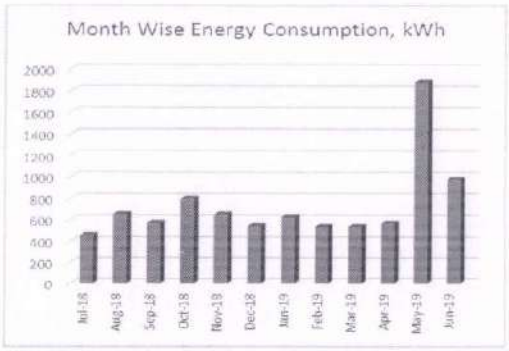


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

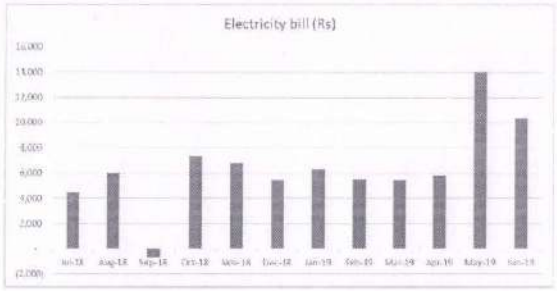


Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	1,883	1.81
2	Maximum	457	0.37
3	Minimum	735	0.59
4	Average	8,818	7.05

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-19	979	0.78
2	May-19	1,883	1.51
3	Apr-19	569	0.46
4	Mar-19	539	0.43
5	Feb-19	539	0.43
6	Jan-19	628	0.50
7	Dec-18	545	0.44
8	Nov-18	652	0.52
9	Oct-18	799	0.64
10	Sep-18	572	0.46
11	Aug-18	656	0.52
12	Jul-18	457	0.37
	Total	**8,818**	**7.05**

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

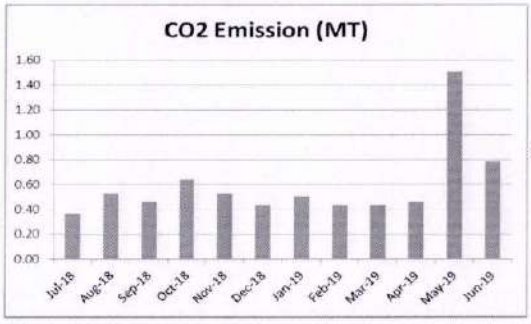


Figure 4.1: Month wise CO2 Emission

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 12 nos of CFLs, 222 nos of LED tubes.

5.2 Air-conditioners

In the facility, there are about 04 Nos. of 1.5 Tr old Air-conditioners.

5.3 Ceiling Fans

At building facility, there are about 119 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.

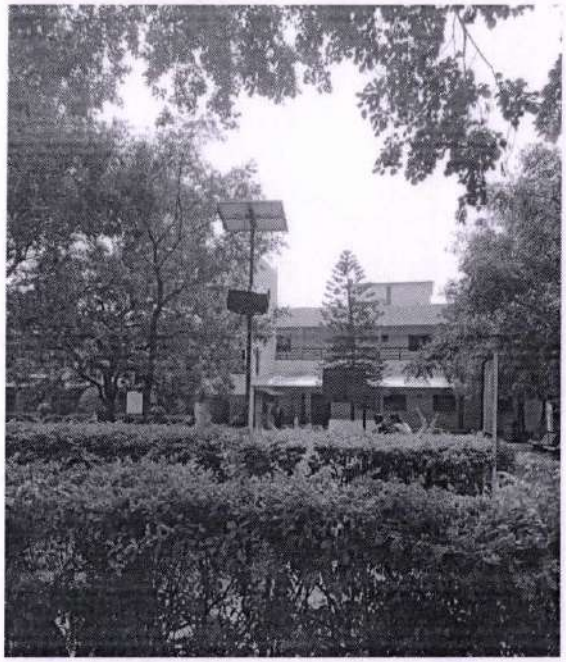
5.4 Water Pumps

There are in total 1 Water pumps with 2.5HP capacity.

6. Usage of Renewable Energy

In this chapter, we study the usage of Renewable Energy. The college has installed 6 nos of solar street lights.

Photograph of Solar Street Lights



7. Study of usage of LED lighting

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

Table 7.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	CFL	12	24	0.288
	LED lighting load			
1	LED tube	222	20	4.44
	Total LED lighting load			4.44
	Total Lighting load			4.728

It can be seen that out of total lighting load 94% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 119 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	119	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	40	W/Unit
4	Reduction in demad	25	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	23.8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	5950	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	65450	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	258706	Rs lump sum
13	Simple Payback period	47	Months

8.2 Installation of Solar PV panel

It is recommended to install 5 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 298 Nos Old Ceiling Fans with STAR rating fans	14,900	1,63,900	6,47,852	47
2	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	Total	**22,400**	**2,46,400**	**8,97,852**	**44**

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