



**7.1.3.a Green / Energy / Environment Audit**



# Nutan Urja Solutions

A 703, Balaji Witfield, Near Sunni's World,  
Sus Road, Sus, Pune 411 021

Phone: 83568 18381. Email: [nutanurja.solutions@gmail.com](mailto:nutanurja.solutions@gmail.com)

Date: 25/08/2020

## CERTIFICATE

This is to certify that we have conducted Green Audit at Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, Amravati for the year 2019-20.

The College has already adopted **Green** practices like:

- Installation of Rain Water Harvesting system
- Usage of Energy Efficient LED
- Usage of Energy Efficient BEE STAR Rated equipment

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

Nutan Urja Solutions,



K G Bhatwadekar,

Certified Energy Auditor,

EA - 22428



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The College has already adopted **Energy Efficient** practices like:

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment

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Date: 6/09/2019

## CERTIFICATE

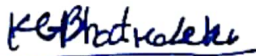
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The College has already adopted following projects for making the campus **Energy Efficient**.

- Installation of Rain Water Harvesting System

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Phone: 83568 18381. Email: [nutanurja.solutions@gmail.com](mailto:nutanurja.solutions@gmail.com)

Date:26/09/2018

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The College has already adopted **Energy Efficient** practices like:

- Usage of Energy Efficient LED Fittings
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Date: 26/09/2018

## CERTIFICATE

This is to certify that we have conducted Environmental Audit at Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, Amravati in the year 2017-18.

The College has already adopted following projects for making the campus **Energy Efficient**.

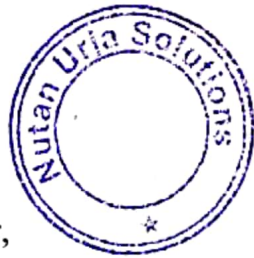
- Installation of Rain Water Harvesting System

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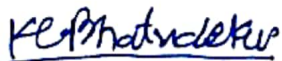
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**Report**  
**On**  
**Green Audit**  
**At**  
**Pravin Khodke Memorial Trust Amravati's**  
**Vinayak Vidnyan Mahavidyalaya**  
**Nandgaon Khandeshwar, Amravati**  
**(Year 2021-22)**



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## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar for awarding us the assignment of Green Audit of their college premises.

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

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



## Executive Summary

Green Audit of Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar 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	281	0.22
2	Minimum	76	0.06
3	Average	210	0.17
4	Total	2,517	2.01

### 2. Various Measures Adopted for Energy Conservation

1. Usage of LED lights at some indoor locations

### 3. Rain Water Harvesting

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

### 4. Waste Management

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

### 5. Notes and Assumptions

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



## Abbreviations

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



## 1. Introduction

Vinayak Vidnyan Mahavidyalaya Mahavidyalaya, Nandgaon Khandeshwar, Dist. Amravati was established in the year 2007 by the Pravin Khodke Memorial Trust, Amravati with view to boost higher education in the rural area. The college is affiliated to Sant Gadge Baba Amravati University, Amravati. Presently college offers two Under Graduate courses Bachelor of Science with subjects Botany, Zoology, Chemistry, Physics, Mathematics, Computer Science, Electronics and Bachelor of Commerce.

### 1.1 Objectives

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

### 1.2 Audit methodology

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





## 2. Study of Electrical Energy Consumption

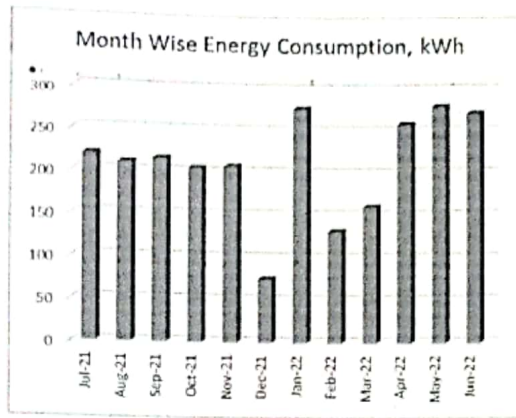
In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

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

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-22	272	3480
2	May-22	281	6860
3	Apr-22	259	2,927
4	Mar-22	161	2,046
5	Feb-22	132	1,716
6	Jan-22	278	3,670
7	Dec-21	76	912
8	Nov-21	207	2,588
9	Oct-21	205	2,583
10	Sep-21	216	2,743
11	Aug-21	210	2,688
12	Jul-21	220	2,618
	<b>Total</b>	<b>2,517</b>	<b>34,830</b>

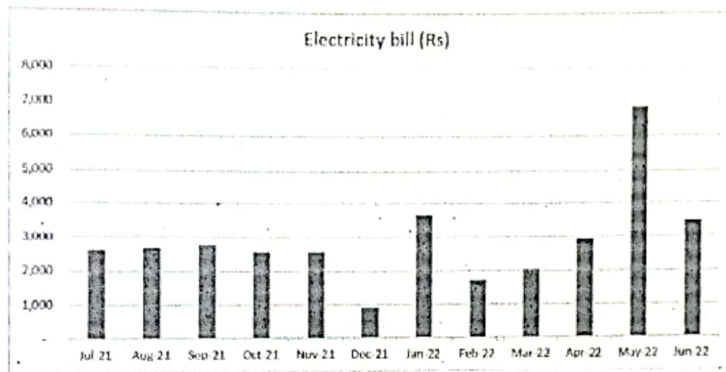
Variation in energy consumption is as follows,





**Figure 2.1: Month wise energy consumption**

Monthly variation in electricity bill is as follows,



**Figure 2.2: Month wise electricity bill**

Key observations of electricity bill are as follows,

**Table no 2.2: Key observations**

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	281	0.22
2	Minimum	76	0.06
3	Average	210	0.17
4	Total	2,517	2.01





### 3. Carbon Foot printing

1. A **Carbon Foot print** is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

#### 2. Basis for computation of CO<sub>2</sub> Emissions:

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

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

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

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

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

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-22	272	0.22
2	May-22	281	0.22
3	Apr-22	259	0.21
4	Mar-22	161	0.13
5	Feb-22	132	0.11
6	Jan-22	278	0.22
7	Dec-21	76	0.06
8	Nov-21	207	0.17
9	Oct-21	205	0.16
10	Sep-21	216	0.17
11	Aug-21	210	0.17
12	Jul-21	220	0.18
	<b>Total</b>	<b>2,517</b>	<b>2.01</b>

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



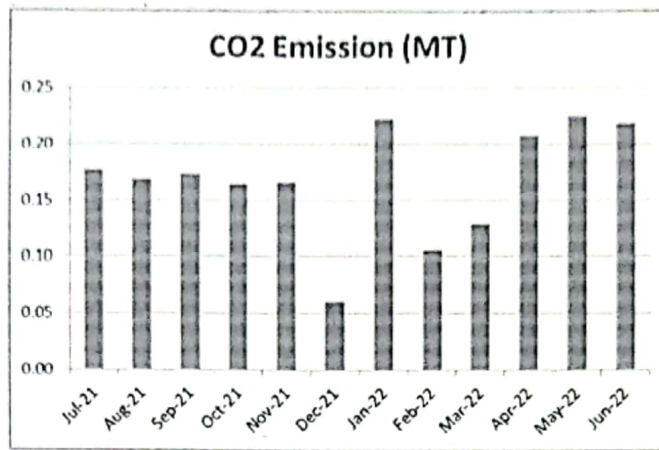


Figure 3.1: Month wise CO2 Emission



#### 4. Study of Rain Water Harvesting

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



## **5. Study of Waste Management**

### **5.1 Solid Waste Management**

The solid waste collected in college is bifurcated in dry waste and wet waste. The waste is collected and disposed by corporation.

### **5.2 e-Waste Management**

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



## **6. Study of Green Practices**

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

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

### **6.2 Usage of Public Transport**

During the Students transport study, it was revealed that the local students who are residing near areas make use of Public Transport like Municipal Transport local buses, local sharing type auto rickshaws. Some students use bicycles. The average number of students is approximately 40 %. Institute encourages students to not to use automobiles.

### **6.3 Pedestrian Friendly Roads**

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

### **6.4 Plastic Free Campus**

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

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

### **6.5 Paperless Office**

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



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

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

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



## Executive Summary

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

Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar consumes various resources for day to day operations, namely: Air, Water, Electrical Energy & LPG.

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

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

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

Sr no	Parameter	Energy consumed, (Units)	CO <sub>2</sub> Emission (MT)
1	Maximum	281	0.22
2	Minimum	76	0.06
3	Average	210	0.17
4	Total	2,517	2.01

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

- Usage of Natural Day light in corridors
- Implementation of Rain Water Harvesting

### 4. Recommendations:

1. Installation of Bio composting Plant.

### 5. Notes & Assumptions:

1. 1 kWh of Electrical Energy releases 0.8 Kg of CO<sub>2</sub> into atmosphere
2. 1 kWp Solar PV plant generates 5 kWh/day Electrical Energy for 300 days in an year.



## Abbreviations

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



## 1. Introduction

### 1.1 Important Definitions:

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

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

#### 1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

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





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

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

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

**1.2 Objectives**

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

**1.3 Audit Methodology:**

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

**1.4 General Details of College**

No	Head	Particulars
1	Name of Institution	Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar
2	Address	Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, Amravati 444 708.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati



## 2. Study of Consumption of Various Resources

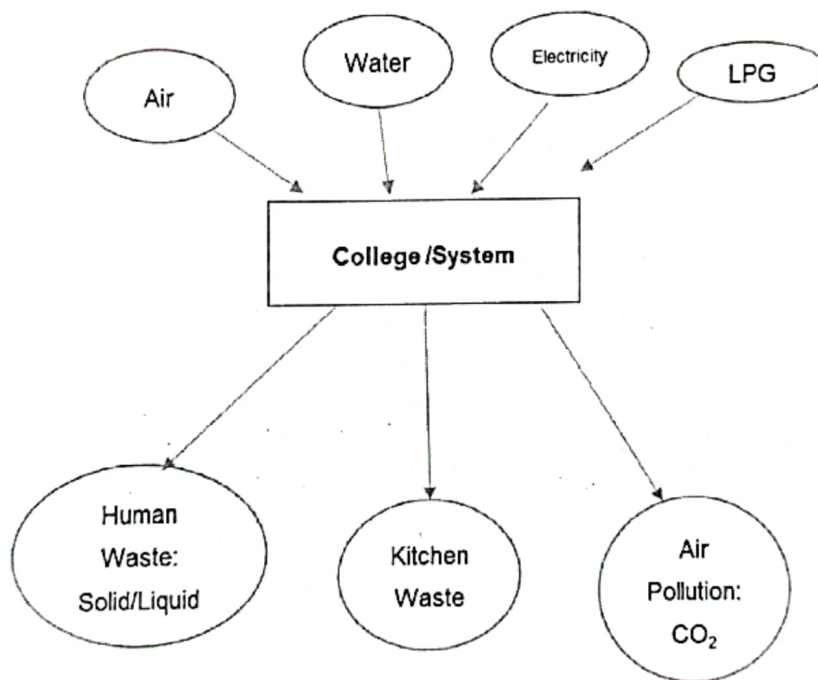
The Institute consumes following basic/derived Resources:

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

Also, college emits following pollutants to environment

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

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



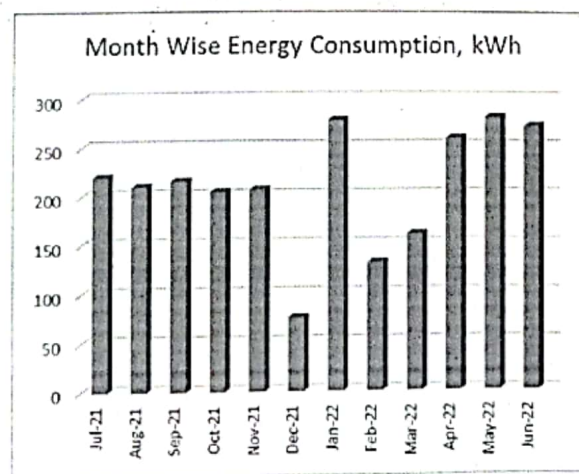
Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy & LPG as under.

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

**Table 2.1: Electrical Energy Consumption**

No	Month	Energy (kWh)
1	Jun-22	272
2	May-22	281
3	Apr-22	259
4	Mar-22	161
5	Feb-22	132
6	Jan-22	278
7	Dec-21	76
8	Nov-21	207
9	Oct-21	205
10	Sep-21	216
11	Aug-21	210
12	Jul-21	220
	<b>Total</b>	<b>2,517</b>
	Maximum	281
	Minimum	76
	Average	210

**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	281
2	Minimum	76
3	Average	210
4	Total	2571



### 3. Study of Environmental Pollution

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

#### 3.1 Air Pollution

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

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

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

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

No	Month	Energy Consumed, kWh	CO2 Emissions, MT
1	Jun-22	272	0.22
2	May-22	281	0.22
3	Apr-22	259	0.21
4	Mar-22	161	0.13
5	Feb-22	132	0.11
6	Jan-22	278	0.22
7	Dec-21	76	0.06
8	Nov-21	207	0.17
9	Oct-21	205	0.16
10	Sep-21	216	0.17
11	Aug-21	210	0.17
12	Jul-21	220	0.18
	<b>Total</b>	<b>2,517</b>	<b>2.01</b>
	Maximum	281	0.22
	Minimum	76	0.06
	Average	210	0.17



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

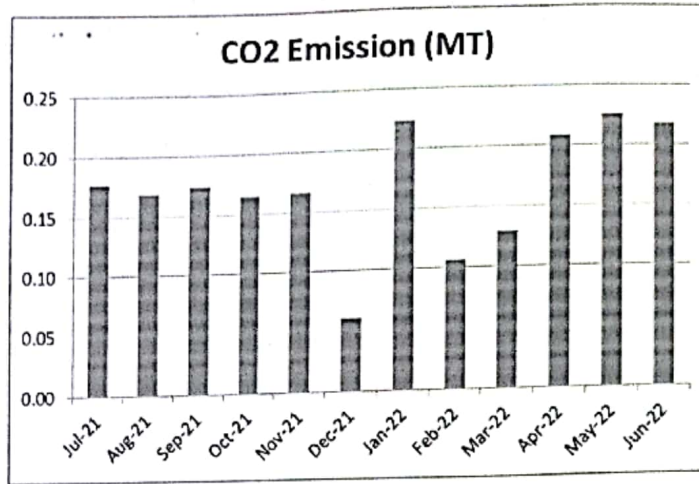


Figure 3.1: CO2 emission due to usage of electrical energy.

### 3.2 Study of Solid Waste Generation

The solid waste collected in college is bifurcated in dry waste and wet waste. The waste is collected and disposed by corporation.

### 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 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.



## 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 composting Plant.







**INVOICE**

<b>To</b> <b>Principal,</b> <b>Pravin Khodke Memorial Trust Amravati's</b> <b>Vinayak Vidnyan Mahavidyalaya,</b> <b>Nandgaon Khandeshwar.</b>	<b>Invoice No: 2022-23/36</b> <b>Date: 29/12/2022</b>
---	--

Work Order No	Verbal
PAN No	AQTPB1025F

No	Particulars	Charges per Unit, Rs.	Quantity Nos.	Amount in Rs.
1	Consultancy Service Charges for Energy Audit, Green Audit and Environmental Audit of college	12,000.00	01	12,000.00
2	<b>Total Invoice Value</b>			<b>12,000.00</b>
3	<b>Amount in Words: Rupees Twelve Thousand only.</b>			

**For Nutan Urja Solutions,**

**Authorized Signatory**



**Bank Details:**

Name of Bank	IDBI Bank
Branch	Pashan Branch
Name of Account	Nutan Urja Solutions
Current Account Number	0778102000008648
IFSC Code	IBKL0000778

# Nutan Urja Solutions

(ISO 9001:2015, ISO 50001:2018, ISO 14001:2015,  
ISO/ IEC 17020:2012)

A 703, Balaji Witefield, Near Sunni's World,  
Sus Road, Sus, Pune 411 021

Phone: 83568 18381. Email:  
[nutanurja.solutions@gmail.com](mailto:nutanurja.solutions@gmail.com)



Date: 13/12/2022

## CERTIFICATE

This is to certify that we have conducted Environmental Audit at Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, Amravati in the year 2021-22.

The College has already adopted following projects for making the campus **Energy Efficient**.

- Installation of Rain Water Harvesting System

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

Nutan Urja Solutions,

K G Bhatwadekar,  
Certified Energy Auditor,  
EA – 22428



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- Usage of Energy Efficient BEE STAR Rated equipment

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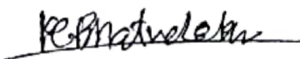
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Date: 15/09/2021

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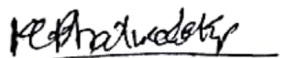
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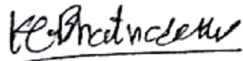
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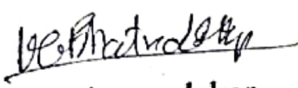
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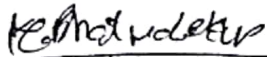
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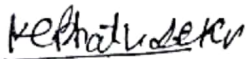
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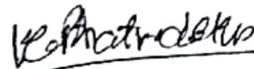
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**Report**  
**On**  
**Energy Audit**  
**At**  
**Pravin Khodke Memorial Trust Amravati's**  
**Vinayak Vidnyan Mahavidyalaya**  
**Nandgaon Khandeshwar, Amravati**  
**(Year 2021-22)**



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](mailto:nutanurja.solutions@gmail.com)

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## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, 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<sub>2</sub> emissions. College consumes Energy in the form of Electrical Energy used for various gadgets, Office & other facilities.

### 1. Present Energy Consumption

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

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

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	281	0.22
2	Minimum	76	0.06
3	Average	210	0.17
4	Total	2,517	2.01

### 2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.

### 3. Key Observations

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

### 4. Percentage of Usage of LED Lighting

The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 80 %.



## 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 4 Nos T-8 fittings with 20W LED fittings	80	880	2,564	35
2	Replacement of 41 Nos Old Ceiling Fans with STAR rating fans	533	5,863	89,134	182
	<b>Total</b>	<b>613</b>	<b>6,743</b>	<b>91,698</b>	<b>163</b>

## 6. Notes & Assumptions

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





## Abbreviations

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



## 1. Introduction

Vinayak Vidnyan Mahavidyalaya Mahavidyalaya, Nandgaon Khandeshwar, Dist. Amravati was established in the year 2007 by the Pravin Khodke Memorial Trust, Amravati with view to boost higher education in the rural area. The college is affiliated to Sant Gadge Baba Amravati University, Amravati. Presently college offers two Under Graduate courses Bachelor of Science with subjects Botany, Zoology, Chemistry, Physics, Mathematics, Computer Science, Electronics and Bachelor of Commerce.

### 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	Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar
2	Address	Pravin Khodke Memorial Trust Amravati's Vinayak Vidnyan Mahavidyalaya, Nandgaon Khandeshwar, Amravati 444 708.
3	Affiliation	Sant Gadge Baba Amravati University, Amravati



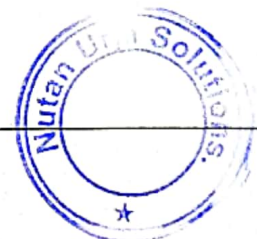
## 2. Study of connected load

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

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

No	Location	FTL (40W)	LED tube (20W)	Fan	Computers (65W)
1	Office		2	1	2
2	Principal	1	1	1	1
3	Class room 1		2	2	
4	Botany lab		3	4	
5	Physics lab	1	1	2	
6	Class room 2	1	1	2	
7	Staff Room 1	1	1	2	
8	Staff Room 2		1	2	1
9	Chemistry Lab		2	2	
10	Class Room 3		4	4	
11	Class Room 4		2	2	
12	Library		4	4	2
13	Class Room 5		2	6	
14	Class Room 6		2	4	
15	Boys Wash Room		1		
16	Girls Wash Room		1		
17	Class Room		2	2	
18	Common Room		1	1	
	<b>Total</b>	<b>4</b>	<b>33</b>	<b>41</b>	<b>6</b>

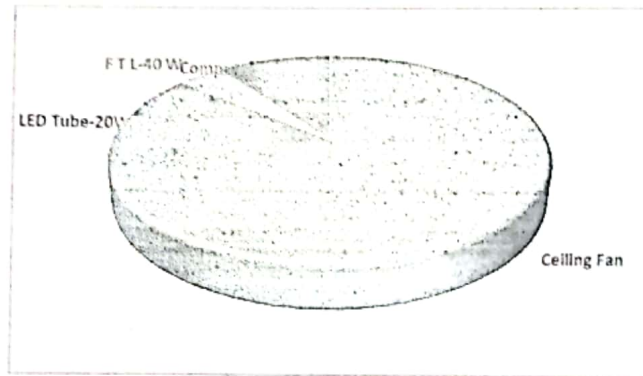
Individual fitting wise load is as under.



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

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	41	65	2.7
2	LED Tube-20W	33	20	0.7
3	F T L-40 W	4	40	0.2
4	Computers	6	65	0.4
	<b>Total</b>			<b>3.9</b>

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.

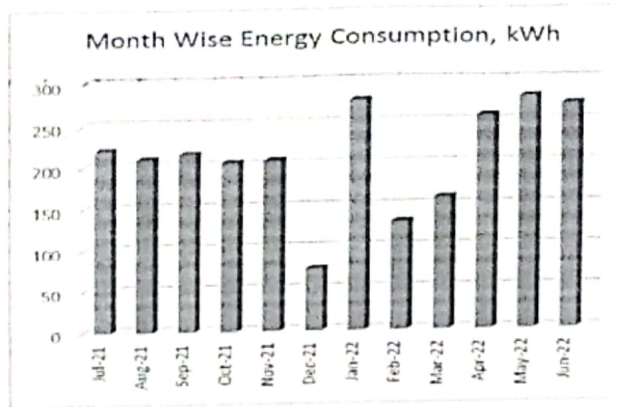
**Table no 3.1: Summary of electricity bills**

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-22	272	3480
2	May-22	281	6860
3	Apr-22	259	2,927
4	Mar-22	161	2,046
5	Feb-22	132	1,716
6	Jan-22	278	3,670
7	Dec-21	76	912
8	Nov-21	207	2,588
9	Oct-21	205	2,583
10	Sep-21	216	2,743
11	Aug-21	210	2,688
12	Jul-21	220	2,618
	<b>Total</b>	<b>2,517</b>	<b>34,830</b>

Variation in energy consumption is as follows,

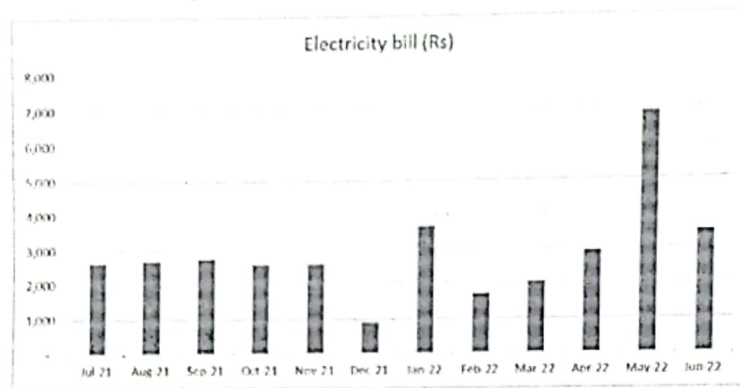






**Figure 3.1: Month wise energy consumption**

Monthly variation in electricity bill is as follows,



**Figure 3.2: Month wise electricity bill**

Key observations of electricity bill are as follows,

**Table no 3.2: Key observations**

Sr no	Parameter	Energy consumed, (Units)	CO2 Emission (MT)
1	Maximum	281	0.22
2	Minimum	76	0.06
3	Average	210	0.17
4	Total	2,517	2.01



#### 4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO<sub>2</sub> emissions), emitted due to various activities. In this we compute the emissions of Carbon-Di-Oxide, by usage of the various form of Electrical Energy used by the College for performing its day to day activities

##### 2. Basis for computation of CO<sub>2</sub> Emissions:

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

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

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

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

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

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-22	272	0.22
2	May-22	281	0.22
3	Apr-22	259	0.21
4	Mar-22	161	0.13
5	Feb-22	132	0.11
6	Jan-22	278	0.22
7	Dec-21	76	0.06
8	Nov-21	207	0.17
9	Oct-21	205	0.16
10	Sep-21	216	0.17
11	Aug-21	210	0.17
12	Jul-21	220	0.18
	<b>Total</b>	<b>2,517</b>	<b>2.01</b>



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

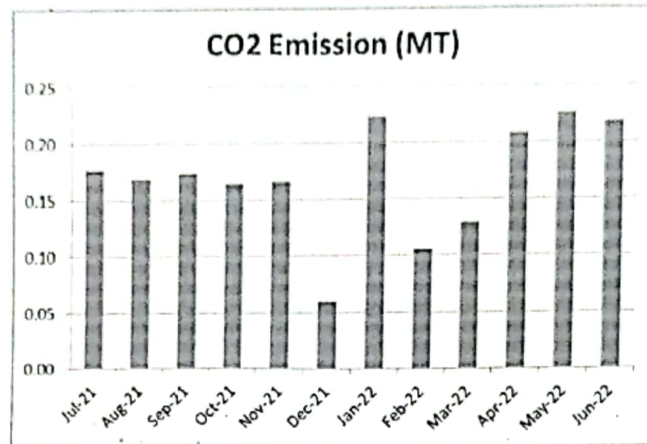


Figure 4.1: Month wise CO2 Emission



## 5. Study of usage of LED lighting

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

**Table 7.1: Total lighting load**

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	4	40	0.16
	<b>LED lighting load</b>			
1	LED tube	33	20	0.66
	<b>Total LED lighting load</b>			<b>0.66</b>
	<b>Total Lighting load</b>			<b>0.82</b>

It can be seen that out of total lighting load 80% load is LED lighting load.



## 6. Energy conservation proposals

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

In the facility, there are about 4 Nos, T-8, FTL fittings with Electronic/magnetic chokes. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of T-8 fittings	4	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fittin	20	W/Unit
4	Reduction in demad	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	0.32	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	80	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	880	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	2564	Rs lump sum
13	Simple Payback period	35	Months





## 6.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 41 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	41	Nos
2	Energy Demand of Old Ceiling Fan fitting	65	W/Unit
3	Energy Demand of STAR Rated Fan	52	W/Unit
4	Reduction in demad	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	2.132	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	533	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	5863	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	89134	Rs lump sum
13	Simple Payback period	182	Months



### 6.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 4 Nos T-8 fittings with 20W LED fittings	80	880	2,564	35
2	Replacement of 41 Nos Old Ceiling Fans with STAR rating fans	533	5,863	89,134	182
	<b>Total</b>	<b>613</b>	<b>6,743</b>	<b>91,698</b>	<b>163</b>

