

धनाजी नाना चौधरी विद्या प्रबोधिनी संचालित  
**लोकसेवक मधुकरराव चौधरी**  
**समाजकार्य महाविद्यालय, जळगांव**  
शंकरराव नगर, तळेले कॉलनी जवळ, जुना खेडी रोड,  
जळगाव-४२५००१ (महाराष्ट्र).



Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit  
**Loksevak Madhukarrao Chaudhari**  
**College of Social Work, Jalgaon**

Shankarrao Nagar, Near Talele Colony,  
Old Khedi Road, Jalgaon (M.S.) 425001

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DR. RAKESH P. CHAUDHARI  
PRINCIPAL  
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College of Social Work, Jalgaon

## INDEX

<b>SL NO</b>	<b>CONTENT</b>	<b>PAGE NO.</b>
<b>1</b>	<b>GREEN AUDIT REPORT</b>	<b>3 TO 18</b>
<b>2</b>	<b>ENVIORNMENT AUDIT REPORT</b>	<b>19 TO 34</b>
<b>3</b>	<b>ENERGY AUDIT REPORT</b>	<b>35 TO 56</b>

**Report**  
**On**  
**Green Audit**  
**At**  
**Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak**  
**Madhukarrao Chaudhari College of Social Work,**  
**Jalgaon**  
**(Year 2022-23)**



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## Contents

Acknowledgement .....	2
Executive Summary .....	3
Abbreviations .....	5
1. Introduction.....	6
1.1 Objectives.....	6
1.2 Audit methodology.....	6
2. Study of Electrical Energy Consumption .....	7
3. Carbon Foot printing.....	9
4. Study of Usage of Alternate Energy .....	11
5. Study of Rain Water Harvesting.....	12
6. Study of Waste Management .....	13
6.1 Solid Waste Management.....	13
6.2 e-Waste Management.....	13
7. Study of Green Practices.....	14
7.1 No of students who don't use own Vehicle for coming to Institute.....	14
7.2 Usage of Public Transport.....	14
7.3 Pedestrian Friendly Roads.....	14
7.4 Plastic Free Campus .....	14
7.5 Paperless Office.....	15
7.6 Green Landscaping with Trees and Plants .....	15

## **Acknowledgement**

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon 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 Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon is conducted by Nutan Urja Solutions, Pune. Based On the audit field study, following important points can be presented.

### 1. Present Energy Consumption

Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon uses Electrical Energy as the source of Energy for various equipment in the college campus. In the following Table, we present the details of Energy Consumption.

**Table no 1: Details of energy consumption**

<b>Sr no</b>	<b>Parameter</b>	<b>Energy consumed, (Units)</b>	<b>CO2 Emission (MT)</b>
1	Maximum	1,723	1.38
2	Minimum	537	0.43
3	Average	1,269	1.01
4	Total	15,224	12.18

### 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. Usage of Renewable Energy

The collage has installed 5 kW Solar PV Power Plant.

### 4. Rain Water Harvesting

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

### 5. 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.

#### **6. 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**

Loksevak Madhukarrao Chaudhari College of Social Work is located in Jalgaon. The college is established by Dhanaji Nana Chaudhari Vidya Prabodhini in 1996. The college is well equipped with modern research laboratories which are recognized by the university. Wide range of co-curricular, extra-curricular and extension activities are implemented for the personality development of the students. The college is affiliated to Kaviyitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

### **1.1 Objectives**

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

### **1.2 Audit methodology**

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

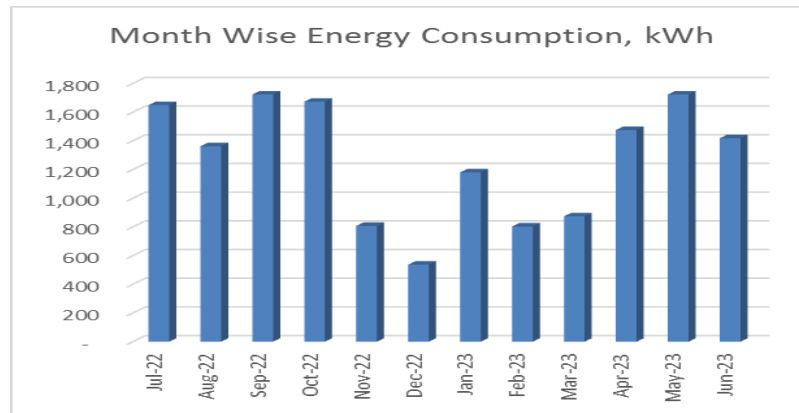
## 2. Study of Electrical Energy Consumption

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

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

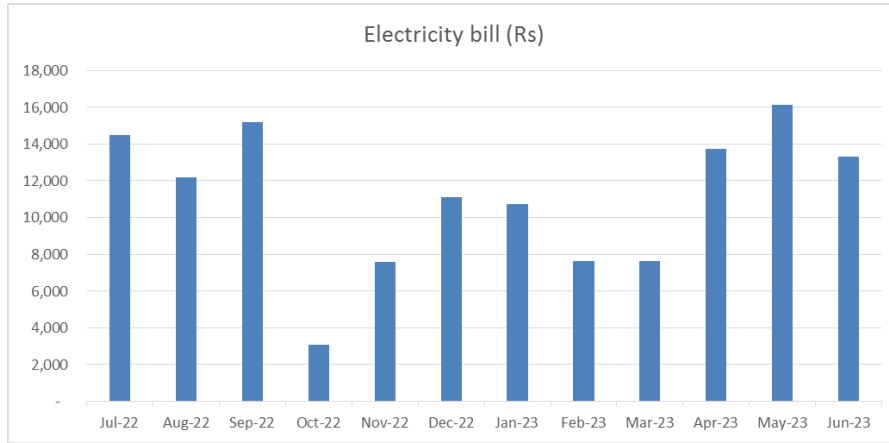
No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	1,418	13,320
2	May-23	1,723	16,122
3	Apr-23	1,475	13,728
4	Mar-23	874	7,615
5	Feb-23	803	7,649
6	Jan-23	1,180	10,720
7	Dec-22	537	11,117
8	Nov-22	807	7,599
9	Oct-22	1,673	3,073
10	Sep-22	1,723	15,192
11	Aug-22	1,362	12,179
12	Jul-22	1,649	14,496
	<b>Total</b>	<b>15,224</b>	<b>132,810</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	1,723	1.38
2	Minimum	537	0.43
3	Average	1,269	1.01
4	Total	15,224	12.18

### 3. Carbon Foot printing

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

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

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

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

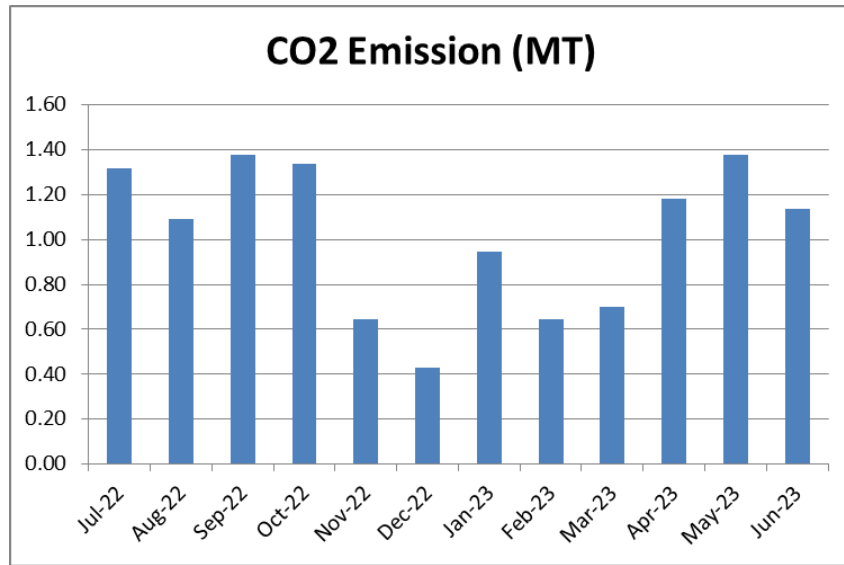
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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

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

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-23	1,418	1.13
2	May-23	1,723	1.38
3	Apr-23	1,475	1.18
4	Mar-23	874	0.70
5	Feb-23	803	0.64
6	Jan-23	1,180	0.94
7	Dec-22	537	0.43
8	Nov-22	807	0.65
9	Oct-22	1,673	1.34
10	Sep-22	1,723	1.38
11	Aug-22	1,362	1.09
12	Jul-22	1,649	1.32
	<b>Total</b>	<b>15,224</b>	<b>12.18</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 Usage of Alternate Energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Solar PV System of 5kW capacity.

**Table 4.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement**

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	15,224	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	7500	kWh/Annum
3	Total Energy Requirement of College	22,724	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	33	%

#### Photograph of Solar PV plant



## 5. 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



## **6. Study of Waste Management**

### **6.1 Solid Waste Management**

The College has already installed a Bio composting Plant, wherein, the bio-degradable waste is composted & is used as fertilizer for the garden.

### **6.2 e-Waste Management**

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



## 7. Study of Green Practices

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

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

### 7.2 Usage of Public Transport

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

### 7.3 Pedestrian Friendly Roads

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

#### Photograph of Road within campus



### 7.4 Plastic Free Campus

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

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

### **7.5 Paperless Office**

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

### **7.6 Green Landscaping with Trees and Plants**

The Institute has beautiful maintained Garden.



**Figure 7.1: Beautiful maintained Garden of college**

**Report**  
**On**  
**Environmental Audit**  
**Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit**  
**Loksevak Madhukarrao Chaudhari College of Social Work,**  
**Jalgaon**  
**(Year 2022-23)**



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## Table of Contents

Acknowledgement .....	2
Executive Summary .....	3
Abbreviations .....	4
1. Introduction.....	5
1.1 Important Definitions: .....	5
1.2 Objectives.....	6
1.3 Audit Methodology: .....	6
1.4 General Details of College .....	7
2. Study of Consumption of Various Resources .....	8
2.1 Variation of Monthly Electrical Energy Consumption .....	9
2.2 Key Inference drawn .....	10
3. Study of Environmental Pollution .....	11
3.1 Air Pollution.....	11
3.2 Study of Solid Waste Generation .....	12
3.3 Study of Liquid Waste Generation.....	12
3.4 Study of e-Waste Management: .....	12
4. Study of Rain Water Harvesting .....	13
5. Recommendations.....	14

## **Acknowledgement**

We at Nutan Urja Solutions, Pune wish to express our sincere gratitude to the management of Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon for assigning the work of Environmental Audit of college campus.

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

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

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

## Executive Summary

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

Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon 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:

No	Parameter /Value	Energy, kWh	CO <sub>2</sub> Emissions, MT
1	Maximum	1,723	1.38
2	Minimum	537	0.43
3	Average	1,269	1.01
4	Total	15,224	12.18

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

- Usage of Natural Day light in corridors
- Implementation of Bio Composting pit for disposal of Bio degradable waste
- Implementation of Rain Water Harvesting
- Installation of 5 kW Solar PV Power Plant.

### 4. Recommendations:

1. Installation of Bio Gas Generator Plant instead of Bio composting Plant.
2. Installation of Sewage treatment Plant to make campus a Zero Discharge campus

### 5. Notes & Assumptions:

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

## Abbreviations

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

## 1. Introduction

### 1.1 Important Definitions:

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

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

#### 1.1.2. Environmental Audit: Definition:

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

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

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

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

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

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

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



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

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

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

### 1.2 Objectives

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

### 1.3 Audit Methodology:

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

### 1.4 General Details of College

No	Head	Particulars
1	Name of Institution	Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon.
2	Address	Old Khedi Rd, near Talele Colony, Shankarrao Nagar, Sagar Nagar, Jalgaon 425 001.
3	Affiliation	Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon.

## 2. Study of Consumption of Various Resources

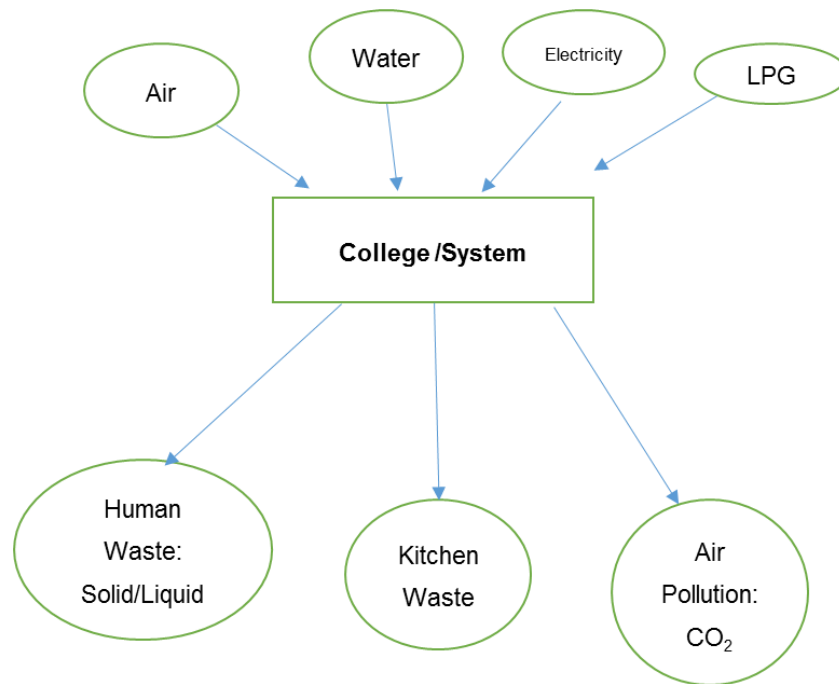
The Institute consumes following basic/derived Resources:

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

Also, college emits following pollutants to environment

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

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



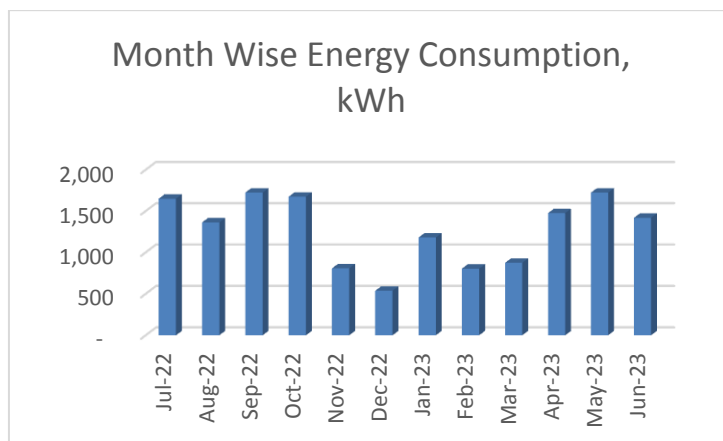
Now we compute the Generation of CO<sub>2</sub> on account of consumption of Electrical Energy & LPG as under.

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

**Table 2.1: Electrical Energy Consumption**

No	Month	Energy Consumed, kWh
1	Jun-23	1,418
2	May-23	1,723
3	Apr-23	1,475
4	Mar-23	874
5	Feb-23	803
6	Jan-23	1,180
7	Dec-22	537
8	Nov-22	807
9	Oct-22	1,673
10	Sep-22	1,723
11	Aug-22	1,362
12	Jul-22	1,649
	<b>Total</b>	<b>15,224</b>
	<b>Maximum</b>	<b>1,723</b>
	<b>Minimum</b>	<b>537</b>
	<b>Average</b>	<b>1,269</b>

**2.1 Variation of Monthly Electrical Energy Consumption**



**Figure 2.1 : Monthly Electrical Energy Consumption**

## 2.2 Key Inference drawn

From the above analysis, we present following important parameters:

**Table 2.2: Variation in Important Parameters**

No	Parameter/ Value	Energy Consumed, kWh
1	Maximum	1,723
2	Minimum	537
3	Average	1,269
4	Total	15,224

### 3. Study of Environmental Pollution

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

#### 3.1 Air Pollution

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

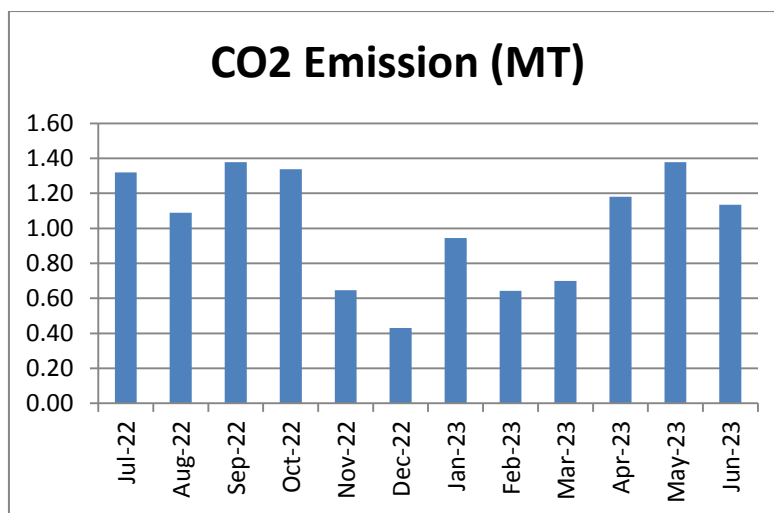
- 1 unit (kWh) of Electrical Energy emits 0.8 Kg of CO<sub>2</sub> in the atmosphere
- 1 Kg of LPG emits 3 Kg of CO<sub>2</sub> in the atmosphere

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

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

No	Month	Energy Consumed, kWh	CO <sub>2</sub> Emissions, MT
1	Jun-23	1,418	1.13
2	May-23	1,723	1.38
3	Apr-23	1,475	1.18
4	Mar-23	874	0.70
5	Feb-23	803	0.64
6	Jan-23	1,180	0.94
7	Dec-22	537	0.43
8	Nov-22	807	0.65
9	Oct-22	1,673	1.34
10	Sep-22	1,723	1.38
11	Aug-22	1,362	1.09
12	Jul-22	1,649	1.32
	<b>Total</b>	<b>15,224</b>	<b>12.18</b>
	<b>Maximum</b>	1,723	1.38
	<b>Minimum</b>	537	0.43
	<b>Average</b>	1,269	1.01

In the following Chart we present the CO<sub>2</sub> 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.

### **3.3 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:**





## **5. Recommendations**

In order to reduce the dependency on Natural resources and also in order to reduce the various pollutions arising due to the day to day operations of the College we herewith recommend following recommendations.

- Installation of Bio Gas Generator Plant instead of Bio composting Plant.
- Installation of Sewage treatment Plant to make campus a Zero Discharge campus

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## Contents

Acknowledgement .....	2
Executive Summary .....	3
Abbreviations .....	5
1. Introduction.....	6
1.1 Objectives.....	6
1.2 Audit Methodology: .....	6
1.3 General Details of College .....	7
2. Study of connected load.....	8
3. Study of Electrical Energy Consumption .....	10
4. Carbon Foot printing.....	12
5. Study of utilities .....	14
5.1 Study of Lighting .....	14
5.2 Air-conditioners .....	14
5.3 Ceiling Fans.....	14
5.4 Water Pumps .....	14
6. Study of usage of alternate energy .....	15
7. Study of usage of LED lighting .....	16
8. Energy conservation proposals .....	17
8.1 Replacement of Old T-8 FTLs with 20 W LED fittings .....	17
8.2 Replacement of old fans with STAR Rated fans.....	18
8.3 Installation of Solar PV panel .....	19
8.4 Summary of Savings .....	20

## **Acknowledgement**

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon 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, (kWh)	CO <sub>2</sub> Emission (MT)
1	Total	1,723	1.38
2	Maximum	537	0.43
3	Minimum	1,269	1.01
4	Average	15,224	12.18

### 2. Energy Conservation Projects already installed

1. Usage of STAR Rated ACs at new installations
2. Usage of LED lights at some indoor locations
3. Usage of LED Lights for outdoor lighting.

### 3. Key Observations

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

### 4. Percentage of Usage of Alternate Energy

The College has installed a Roof Top Solar PV Plant. The percentage of usage of Alternate Energy to Annual Energy Requirement is 33 %.

### 5. 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 61 %.

## 6. 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 19 Nos T-8 fittings with 20W LED fittings	380	4,180	12,179	35
2	Replacement of 76 Nos Old Ceiling Fans with STAR rating fans	3,800	41,800	1,65,224	47
3	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	<b>Total</b>	<b>4,180</b>	<b>45,980</b>	<b>1,77,403</b>	<b>46</b>

## 7 Notes & Assumptions

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

## **Abbreviations**

CFL : Compact Fluorescent Lamp

FTL : Fluorescent Tube Light

LED : Light Emitting Diode

V : Voltage

I : Current

kW : Kilo- Watt

kWh : kilo-Watt Hour

kVA : Active Power

## **1. Introduction**

Loksevak Madhukarrao Chaudhari College of Social Work is located in Jalgaon. The institute established with an aim to spread Social Work Education and practice in the community. It is located at Shankrarao Nagar of Jalgaon city. It provides insight to the significant Social matrix of social and political economy of the problems emerging out of imbalances in Social relationship. It helps to envision students for creation of an effective model of helping mechanism. College of Social Work is providing opportunities of Social Work Education to the youth in Jalgaon District. It is affiliated to the North Maharashtra University, Jalgaon (NMU).

### **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**

<b>No</b>	<b>Head</b>	<b>Particulars</b>
1	Name of Institution	Dhanaji Nana Chaudhari Vidya Prabodhini Sanchalit Loksevak Madhukarrao Chaudhari College of Social Work, Jalgaon
2	Address	Old Khedi Rd, near Talele Colony, Shankarrao Nagar, Sagar Nagar, Jalgaon 425 001.
3	Affiliation	Kaviyitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

## 2. Study of connected load

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

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

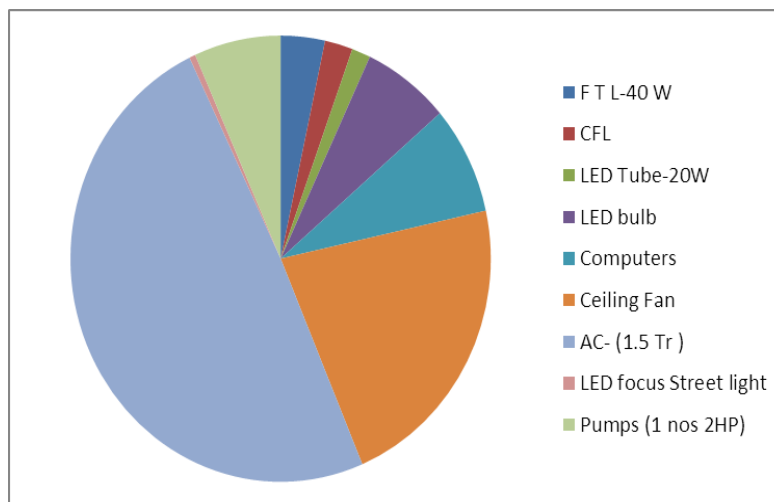
No	Location	FTL (40W)	CFL	LED tube (20W)	LED bulb (12W)	Compu ters (65W)	Fan s	1.5 Tr AC
1	Office	0			15	5	4	
2	Staff Room	5	0	4		1	11	
3	Staff -Washroom	0	1				1	
4	IQAC Room	2					2	1
5	Principal Cabin		0		10		3	1
6	Principal -Washroom		2				0	
7	MSW I- Classroom			2			4	
8	MSW II- Classroom						4	
9	BSW-I Classroom	2					2	
10	BSW-II Classroom	1		1			2	
11	BSW-III Classroom			2			2	
12	Library Room- 1	4		3		3	6	
13	Boy's Toilet-1	1	1				0	
14	Girl's Toilet-1	1	1				0	
15	Auditorium				33		15	
16	Library Room- 2				27		9	
17	Research Lab				8		3	1
18	Language Lab				6	18	2	1
19	Smart Class Room				6	0	2	1
20	Boy's Toilet- 2			2		0	0	
21	Girl's Toilet-2			2		0	0	
22	Corridor-1 BW		7			0	0	
23	Corridor-1 GW		6			0	0	
24	Corridor-2 BW		0		6	0	0	
25	Corridor- 2 GW	1			2	0	0	
26	Boy's Room	1	1		6	0	2	
27	Girl's Room	1	1		6	0	2	
	<b>Total</b>	<b>19</b>	<b>20</b>	<b>16</b>	<b>125</b>	<b>27</b>	<b>76</b>	<b>5</b>

Apart from above load, the college has pumps, street lights. Individual fitting wise load is as under.

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

No	Equipment	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	19	40	0.8
2	CFL	20	24	0.5
3	LED Tube-20W	16	20	0.3
4	LED bulb	125	12	1.5
5	Computers	27	65	1.8
6	Ceiling Fan	76	65	4.9
7	AC- (1.5 Tr )	5	2200	11.0
8	LED focus Street light	3	35	0.1
9	Pumps (1 nos 2HP)			1.5
	<b>Total</b>			<b>17.5</b>

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



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

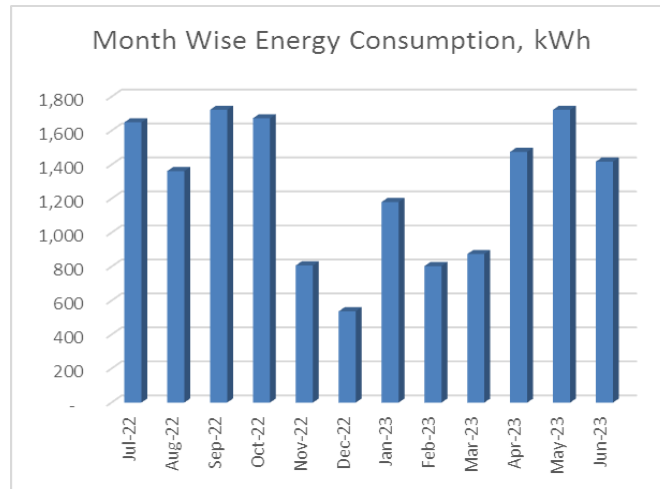
### 3. Study of Electrical Energy Consumption

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

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

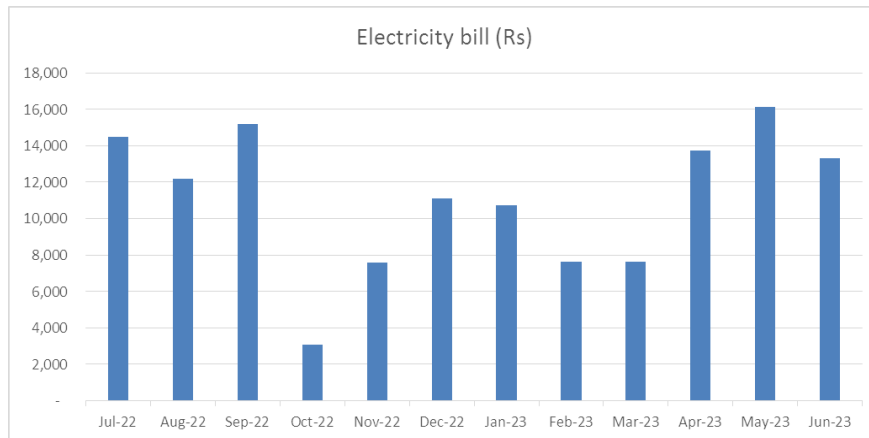
No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	1,418	13,320
2	May-23	1,723	16,122
3	Apr-23	1,475	13,728
4	Mar-23	874	7,615
5	Feb-23	803	7,649
6	Jan-23	1,180	10,720
7	Dec-22	537	11,117
8	Nov-22	807	7,599
9	Oct-22	1,673	3,073
10	Sep-22	1,723	15,192
11	Aug-22	1,362	12,179
12	Jul-22	1,649	14,496
	<b>Total</b>	<b>15,224</b>	<b>1,32,810</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, (kWh)	CO2 Emission (MT)
1	Total	15224	12.18
2	Maximum	1,723	1.38
3	Minimum	537	0.43
4	Average	1,269	1.01

## 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.

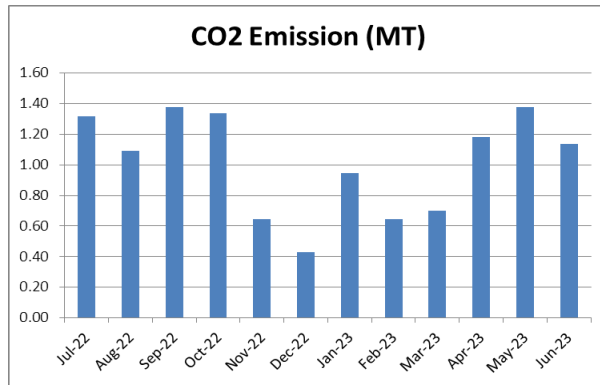
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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-23	1,418	1.13
2	May-23	1,723	1.38
3	Apr-23	1,475	1.18
4	Mar-23	874	0.70
5	Feb-23	803	0.64
6	Jan-23	1,180	0.94
7	Dec-22	537	0.43
8	Nov-22	807	0.65
9	Oct-22	1,673	1.34
10	Sep-22	1,723	1.38
11	Aug-22	1,362	1.09
12	Jul-22	1,649	1.32
	<b>Total</b>	<b>15,224</b>	<b>12.18</b>

In the following Chart we present the CO<sub>2</sub> 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 19 FTL fittings with Electronic/ magnetic chokes , 20 nos of CFLs, 16 nos of LED tubes, 125 nos of LED bulbs. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 3 No of LED street lights.

### **5.2 Air-conditioners**

In the facility, there are about 05 Nos. of 1.5 Tr old Air-conditioners. It is recommended to replace these Old ACs with BEE STAR Rated ACs.

### **5.3 Ceiling Fans**

At building facility, there are about 76 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 is no any Water pump.



## 6. Study of usage of alternate energy

In this Chapter, we compute the percentage of Usage of Alternate/Renewable Energy to Annual Energy Requirement of the College. The College has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is 5 kWp.

**Table 6.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement**

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	15,224	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	7500	kWh/Annum
3	Total Energy Requirement of College	22,724	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	33	%

### Photograph of Solar PV plant



## 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	F T L-40 W	19	40	0.76
2	CFL	20	24	0.48
	LED lighting load			
1	LED tube	16	20	0.32
2	LED bulbs	125	12	1.5
3	LED street lights	3	35	0.105
	Total LED lighting load			1.925
	Total Lighting load			3.165

It can be seen that out of total lighting load 61% load is LED lighting load.

## 8. Energy conservation proposals

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

In the facility, there are about 19 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	19	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 20 W LED fitting	20	W/Unit
4	Reduction in demand	20	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	1.52	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	380	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	4180	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	12179	Rs lump sum
13	Simple Payback period	35	Months

## 8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 76 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	76	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	15.2	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	3800	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	41800	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	165224	Rs lump sum
13	Simple Payback period	47	Months

### 8.3 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 5kW PV unit	5	kW
2	Energy saving	7500	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	82500	Rs/ Annum
5	Investment required	250000	Rs lump sum
6	Simple payback period	36	Months

#### 8.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 19 Nos T-8 fittings with 20W LED fittings	380	4,180	12,179	35
2	Replacement of 76 Nos Old Ceiling Fans with STAR rating fans	3,800	41,800	1,65,224	47
3	Installation of 5kW grid connected PV panel	7,500	82,500	2,50,000	36
	<b>Total</b>	<b>4,180</b>	<b>45,980</b>	<b>1,77,403</b>	<b>46</b>