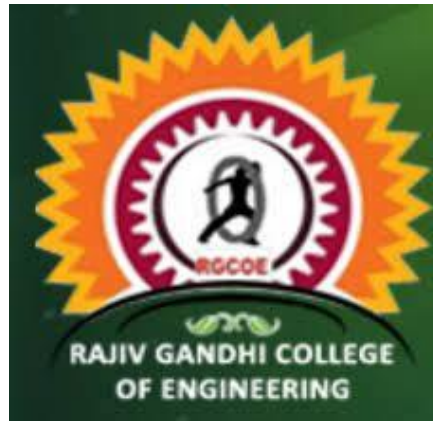


**Report**  
**On**  
**Energy Audit**  
**At**  
**Matoshri Shaikshanik Pratishtan's ,**  
**Rajiv Gandhi College of Engineering,**  
**Karjule Harya**  
**(Year 2019-20)**



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## **Acknowledgement**

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Matoshri Shaikshanik Pratishtan's , Rajiv Gandhi College of Engineering, Karjule Harya 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)	CO <sub>2</sub> Emission (MT)
1	Maximum	8,683	6.95
2	Minimum	2,167	1.73
3	Average	6,325	5.06
4	Total	75,897	60.72

### 2. Energy Conservation Projects already installed

1. Usage of LED lights at 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 Alternate Energy

The College has installed a Roof Top Solar thermal hot water system and 3 nos of solar PV street lights.

### 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 100 %.

## 6. Recommendations

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

<b>No</b>	<b>Recommendation</b>	<b>Annual Saving potential, kWh/Annum</b>	<b>Annual Monetary Gain, Rs.</b>	<b>Investment Required, Rs.</b>	<b>Payback period, Months</b>
1	Replacement of 191 Nos Old Ceiling Fans with STAR rating fans	9,550	105,050	415,234	47
2	Installation of 60kW grid connected PV panel	90,000	990,000	3,000,000	36
	<b>Total</b>	<b>99,550</b>	<b>1,095,050</b>	<b>3,415,234</b>	<b>37</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

Matoshri Shaikshanik Pratishtan's , Rajiv Gandhi College of Engineering, Karjule Harya is established with a vision to create engineers having drive, skill and confidence to become pioneers of tomorrow. The college is located in wide spread beautiful campus and provides an idea and healthy environment for learning and living. The campus is delightfully planed and splendidly landscaped with impressive building,

### 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	Matoshri Shaikshanik Pratishtan's , Rajiv Gandhi College of Engineering, Karjule Harya
2	Address	Akali Dhokeshar, Taluka– Parner, Karjule Hareshwar, Maharashtra 414304
3	Affiliation	Savitribai Phule Pune University

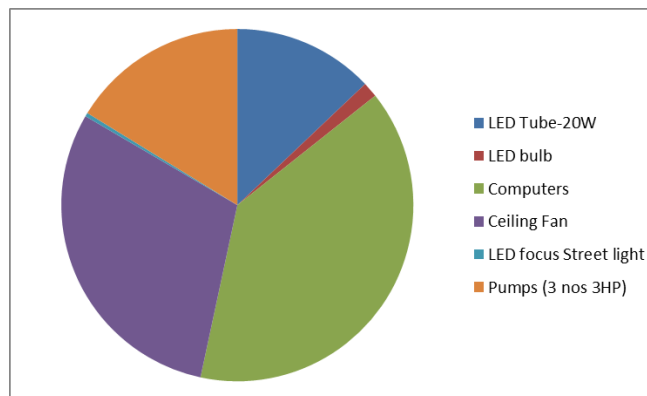
## 2. Study of connected load

In this chapter, we present details of various connected electrical equipment and electrical load. Individual fitting wise load is as under.

**Table No 2.1: Equipment wise Connected Load**

No	Equipment	Qty	Load, W/Unit	Load, kW
1	LED Tube-20W	267	20	5.3
2	LED bulb	48	12	0.6
3	Computers	248	65	16.1
4	Ceiling Fan	191	65	12.4
5	LED focus Street light	4	35	0.1
6	Pumps (3 nos 3HP)			6.7
	<b>Total</b>			<b>19.3</b>

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



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



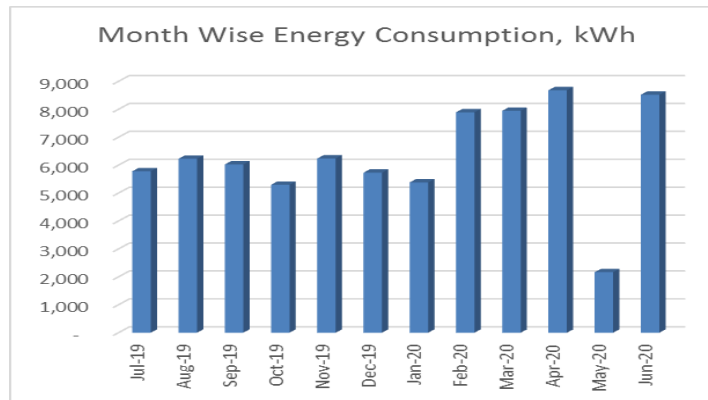
### 3. Study of Electrical Energy Consumption

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

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

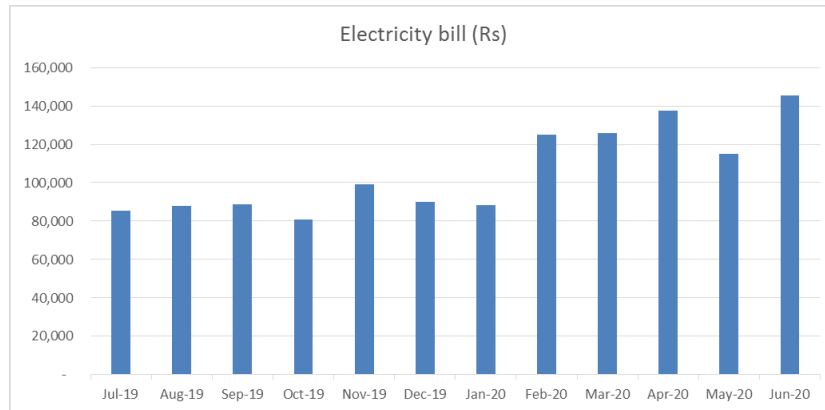
No	Month	Bill	
		Energy (kWh)	Amount (Rs)
1	Jun-20	8,523	145,554
2	May-20	2,167	115,061
3	Apr-20	8,683	137,433
4	Mar-20	7,946	126,027
5	Feb-20	7,892	124,883
6	Jan-20	5,382	88,268
7	Dec-19	5,731	90,022
8	Nov-19	6,239	99,159
9	Oct-19	5,297	80,839
10	Sep-19	6,026	88,531
11	Aug-19	6,230	87,913
12	Jul-19	5,781	85,540
	<b>Total</b>	<b>75,897</b>	<b>1,269,229</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	8,683	6.95
2	Minimum	2,167	1.73
3	Average	6,325	5.06
4	Total	75,897	60.72

## 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.

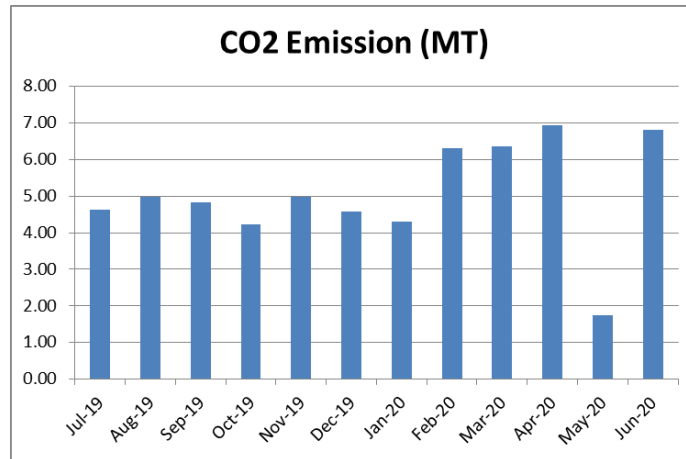
Based on the above Data we compute the CO<sub>2</sub> emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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-20	8,523	6.82
2	May-20	2,167	1.73
3	Apr-20	8,683	6.95
4	Mar-20	7,946	6.36
5	Feb-20	7,892	6.31
6	Jan-20	5,382	4.31
7	Dec-19	5,731	4.58
8	Nov-19	6,239	4.99
9	Oct-19	5,297	4.24
10	Sep-19	6,026	4.82
11	Aug-19	6,230	4.98
12	Jul-19	5,781	4.62
	<b>Total</b>	<b>75,897</b>	<b>60.72</b>

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



**Figure 4.1: Month wise CO2 Emission**

## **5. Study of utilities**

### **5.1 Study of Lighting**

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 267 nos of LED tubes, 48 nos of LED bulbs. There are 4 No of LED street lights.

### **5.2 Ceiling Fans**

At building facility, there are about 191 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.

### **5.3 Water Pumps**

There are in total 3 Water pumps with 3HP capacities respectively.

## 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 Thermal Hot Water System of 4200 liters capacity. Also, college has installed 3 nos of solar PV LED street lights.

### Photograph of Solar Thermal Hot Water System and LED street light



## 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	LED tube	267	20	5.3
2	LED bulbs	48	12	0.6
3	LED street lights	4	35	0.14
	<b>Total LED lighting load</b>			<b>6.1</b>
	<b>Total Lighting load</b>			<b>6.1</b>

It can be seen that out of total lighting load 100% 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 191 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	191	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	38.2	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	9550	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	105050	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	415234	Rs lump sum
13	Simple Payback period	47	Months



## 8.2 Installation of Solar PV panel

It is recommended to install 60 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of 60kW PV unit	60	kW
2	Energy saving	90000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	990000	Rs/ Annum
5	Investment required	3000000	Rs lump sum
6	Simple payback period	36	Months

### 8.3 Summary of Savings

<b>No</b>	<b>Recommendation</b>	<b>Annual Saving potential, kWh/Annum</b>	<b>Annual Monetary Gain, Rs.</b>	<b>Investment Required, Rs.</b>	<b>Payback period, Months</b>
1	Replacement of 191 Nos Old Ceiling Fans with STAR rating fans	9,550	105,050	415,234	47
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