

**Report  
On  
Energy Audit  
At  
Shri Saraswati Vidya Prasarak Mandal's  
Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay,  
Bhusawal.  
(Year 2018-19)**



Prepared by

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Date: 20/12/2019

### CERTIFICATE

This is to certify that we have conducted **Energy Audit** at Shri Saraswati Vidya Prasarak Mandal's Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay, Bhusawal as per the guidelines of Maharashtra Energy Development Agency ([www.mahaurja.com](http://www.mahaurja.com)) in the year **2018-**

**19.**

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

- Usage of Energy Efficient LED Fittings
- Usage of Energy Efficient BEE STAR Rated equipment
- Installation of **20 kW** Roof Top Solar PV Power Plant.
- Installation of 500 liter hot water solar thermal system for hostels
- Installation of Solar Street Lights.

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

NutanUrja Solutions,

*K G Bhatwadekar*

K G Bhatwadekar,

Certified Energy Auditor,

EA - 22428



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## Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shri Saraswati Vidya Prasarak Mandal's Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay, Bhusawal 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 Emmision (MT)
1	Maximum	2,396	1.92
2	Minimum	561	0.4488
3	Average	1,924	1.54
4	Total	23,085	18.47

### 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 57 %.



### 5. Percentage of Usage of LED Lighting

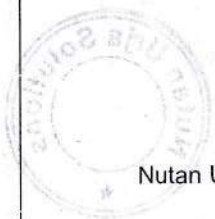
The College has various Types of Light fittings, namely: LED, FTL & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 18.5%.

### 6. Recommendations

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 156 Nos T-8 fittings with 20W LED fittings	2340	25740	99996	47
2	Replacement of 167 Nos Old Ceiling Fans with STAR rating fans	1,628	17,911	363,058	243
	<b>Total</b>	<b>3,968</b>	<b>43,651</b>	<b>463,054</b>	<b>127</b>

### 7. Notes & Assumptions

1. Annual working Days-250 Nos
2. 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 Saraswati Vidya Prasarak Mandal's Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay is located in Bhusawal. The college Provides quality higher education to the women to equip them with modern views and knowledge along with social commitment and to bring them to the main stream for building better Society and stronger Nation. The college works for enrichment of women through quality higher education for better Society and stronger Nation.

### 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 Saraswati Vidya Prasarak Mandal's Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay, Bhusawal.
2	Address	Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay ,3Q4J+M37, Parijat Chowk, Shanti Nagar, Bhusawal, Maharashtra 425201
3	Affiliation	Kavayitri 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.

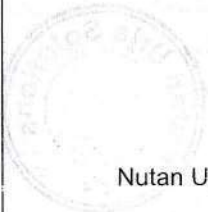
**Table No-2.1: Location wise study of Electrical fittings in various buildings**

No	Location	FTL (40W)	LED tube (20W)	CFL	Computers (65W)	Fan	1.5TR Star rated AC
1	Office	4	2		6	5	
2	Principal Cabin		4	8	1	2	1
3	Vice-Principal Cabin	6			1	3	
4	IQAC		8	4	2	2	
5	Office: Passage	2	2				
6	Gym	5				4	
7	Canteen	3				3	
8	A-21:Class Room	2				2	
9	A-20:Class Room	3				1	
10	A-19:Class Room	2				1	
11	A-18:Class Room	2				2	
12	A-17:Class Room	2				1	
13	A-16:Class Room	2				2	
14	A-15:Class Room	1				1	
15	A-14 :Sr.Exam Room	3			2	3	
16							
17	A-5 : Jr. Exam Room	2				1	
18	A- 4:Class Room	2	1			3	
19	A-3 :Staff Room	3				2	
20	A-1,A-2: Computer Sci Lab	8	2		42	10	
21	A-13:Ladies Common Room		2			1	
22	A-6: Gym office	4	1		1	2	
23	A:Passage	2	2				
24	Central Library	12	9		3	14	
25	B-6 : Electronics Lab	3				3	
26	B-4,B-5:Physics Lab	4	3		1	5	
27	B-2,B-3:Chemistry lab	5	3			4	
28	B-1:Chemistry lab PG	3	2		1	4	



29	B-7: :Class Room		1			1	
30	B- 8 :Class Room		1			1	
31	B 9:Class Room		2			2	
32	B-10: Zoology lab	2	2		1	4	
33	B-11,B-12: Botany and BT lab	9			1	6	
34	B:Passage	2					
35	C- 6:Class Room	1				1	
36	C-5 :Class Room	1				2	
37	C-4:Class Room	2				5	
38	C-3:Social Science Dept.	2			1	5	
39	C-2:Language Dept.	1			8	4	
40	C-1: Comm. and Mgt Dept.	1		4	11	5	
41	C-7:Class Room	2				1	
42	C-8:Class Room	2				1	
43	C-9:Class Room	2				2	
45	C-10: Seminar Hall	4	3		1	9	
46	Hostel old floor 1	8	5			11	
47	Hostel old floor 2	8	6		1	12	
48	H:Passage	3	2				
49	Hostel New	12	2			12	
50	H: Passage	2	2				
51	Cultural Hall	8	2			7	
	<b>Total</b>	<b>156</b>	<b>67</b>	<b>12</b>	<b>84</b>	<b>167</b>	<b>1</b>

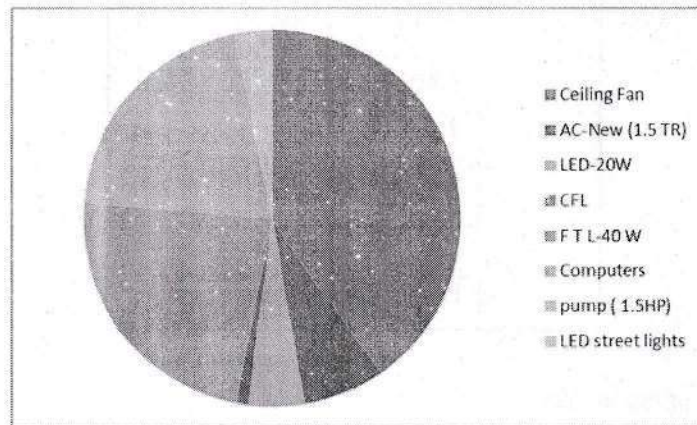
Apart from above load, the college has pump, LED street lights, CFLs and street lights on streets and grounds. Individual fitting wise load is as under.



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

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	167	65	10.9
2	AC-New (1.5 TR)	1	1838	1.8
3	LED-20W	67	20	1.3
4	CFL	12	24	0.3
5	F T L-40 W	156	40	6.2
6	Computers	84	65	5.5
7	pump ( 1.5HP)			0.8
8	LED street lights	4	35	0.1
	Total			26.9

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



**Figure2.1: Distribution of connected load.**





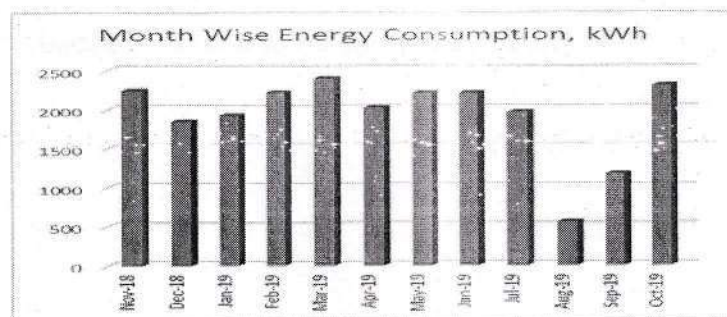
### 3. Study of Electrical Energy Consumption

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	Oct-19	2304	24213
2	Sep-19	1173	12,066
3	Aug-19	561	5,442
4	Jul-19	1964	19,738
5	Jun-19	2213	23,778
6	May-19	2213	23,725
7	Apr-19	2025	21,373
8	Mar-19	2396	24,787
9	Feb-19	2217	23,583
10	Jan-19	1923	19,910
11	Dec-18	1849	19,230
12	Nov-18	2247	23,368
	<b>Total</b>	<b>23085</b>	<b>241213</b>

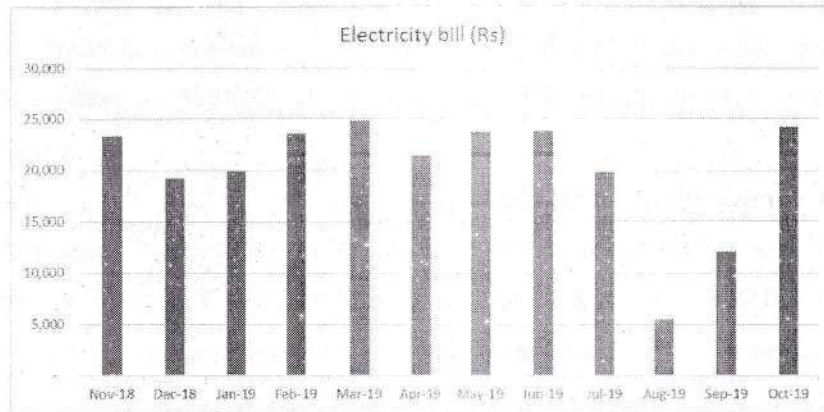
Monthly variation in energy consumption is as follows,



**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)	Bill Amount (Rs)
1	Maximum	2,396	24,787
2	Minimum	561	5,442
3	Average	1,924	20,101



#### 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	Oct-19	2304	1.84
2	Sep-19	1173	0.94
3	Aug-19	561	0.45
4	Jul-19	1964	1.57
5	Jun-19	2213	1.77
6	May-19	2213	1.77
7	Apr-19	2025	1.62
8	Mar-19	2396	1.92
9	Feb-19	2217	1.77
10	Jan-19	1,923	1.54
11	Dec-18	1,849	1.48
12	Nov-18	2,247	1.80
	<b>Total</b>	<b>23,085</b>	<b>18.47</b>





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

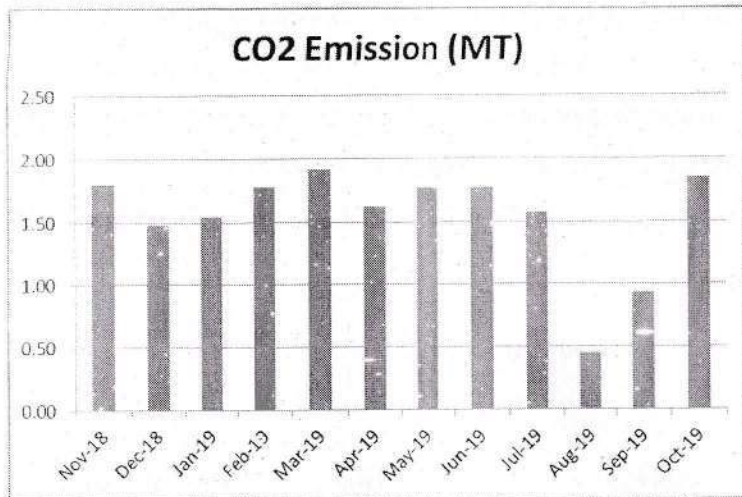


Figure 4.1: Month wise CO2 Emission



## **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 156 FTL fittings with Electronic/ magnetic chokes, 69 LEDs and 12 number of CFL lights in indoor lightings. There are 4 No of. There are 4 FTL fittings with Electronic/ magnetic chokes and 4 no of solar LED streetlights LEDs in outdoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings.

### **5.2 Air-conditioners**

There is 1 no of star rated new AC of 1.5Tr capacity.

### **5.3 Ceiling Fans**

At building facility, there are about 167 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 1 no of water pump with 1.5HP capacity.



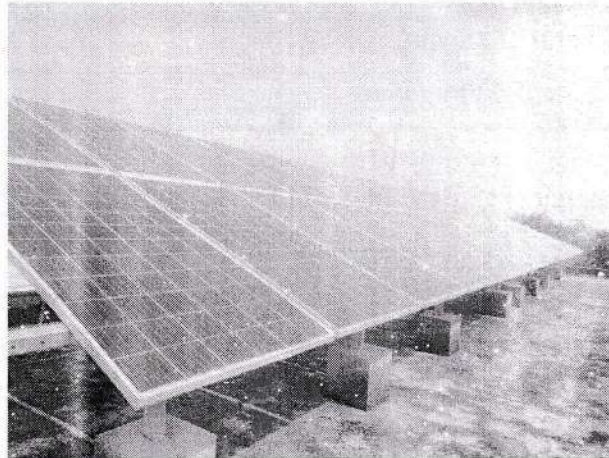
## 6. Study of usage of alternate energy

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 **20kWp**.

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

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	23,085	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	30,000	kWh/Annum
3	% of Usage of Alternate Energy to Annual Energy Requirement	57	%

### 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	156	40	6.24
2	CFL	12	24	0.288
	<b>LED lighting load</b>			
1	LED tube	67	20	1.34
2	LED street lights	4	35	0.14
	<b>Total LED lighting load</b>			<b>1.48</b>
	<b>Total Lighting load</b>			<b>8.008</b>

It can be seen that out of total lighting load 18.5% 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 156 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	156	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	3	Hrs/Day
6	Daily saving in Energy	9.36	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	2340	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	25740	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	99996	Rs lump sum
13	Simple Payback period	47	Months



## 8.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 167 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	167	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	3	Hrs/Day
6	Daily saving in Energy	6.513	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1628.25	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	17910.8	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	363058	Rs lump sum
13	Simple Payback period	243	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 156 Nos T-8 fittings with 20W LED fittings	2340	25740	99996	47
2	Replacement of 167 Nos Old Ceiling Fans with STAR rating fans	1,628	17,911	363,058	243
	<b>Total</b>	<b>3,968</b>	<b>43,651</b>	<b>463,054</b>	<b>127</b>

