

**Report
On
Energy Audit
At
Shri Saraswati Vidya Prasarak Mandal's
Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay,
Bhusawal.
(Year 2019-20)**



Prepared by
NutanUrja Solutions
A 703, BalajiWitefield, Near Sunni's World,
Sus Road, Sus, Pune 411 021
Phone: 83568 18381. Email: nutanurja.solutions@gmail.com



NutanUrja Solutions

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

Sus Road, Sus, Pune 411 021

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

Date: 20/12/2020

CERTIFICATE

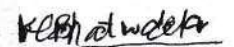
This is to certify that we have conducted **Energy Audit** at Shri Saraswati Vidya Prasarak Mandal's Smt. Padambai Kapurchandji Kotecha Mahila Mahavidyalay, Bhusawal as per the guidelines of Maharashtra Energy Development Agency (www.mahaurja.com) in the year **2019-20**.

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,

Certified Energy Auditor,

EA - 22428



Nutan Urja Solutions, Pune

Contents

Acknowledgement	3
Executive Summary	4
Abbreviations	6
1. Introduction	7
1.1 Objectives	7
1.2 Audit Methodology:	7
1.3 General Details of College	7
2. Study of connected load	8
3. Study of Electrical Energy Consumption	11
4. Carbon Foot printing	13
5. Study of utilities	15
5.1 Study of Lighting	15
5.2 Air-conditioners	15
5.3 Ceiling Fans	15
5.4 Water Pumps	15
6. Study of usage of alternate energy	16
7. Study of usage of LED lighting	17
8. Energy conservation proposals	18
8.1 Replacement of Old T-8 FTLs with 20 W LED fittings	18
8.2 Replacement of old fans with STAR Rated fans	19
8.3 Summary of Savings	20



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 CO₂ 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)	CO2 Emission (MT)
1	Total	2,304	1.84
2	Maximum	0	0
3	Minimum	337	0.27
4	Average	4,038	3.23

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. There are about 111 Nos old T-8 type fittings which need to be replaced by 20 W LEDs.

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 88.1 %.



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 33.7%.

6. Recommendations

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 111 Nos T-8 fittings with 20W LED fittings	1,665	18,315	71,151	47
2	Replacement of 161 Nos Old Ceiling Fans with STAR rating fans	1,570	17,267	350,014	243
	Total	3,235	35,582	421,165	142

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, Bhusawai.
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	3	3		6	6	
2	Principal Cabin		4	8	1	2	1
3	Vice-Principal Cabin		6		1	3	
4	IQAC		8	4	2	2	
5	Office: Passage	1	3				
6	Gym	5				4	
7	Canteen	3				3	
8	A-21:Class Room	2				2	
9	A-20:Class Room	2	1			1	
10	A-19:Class Room	1	1			1	
11	A-18:Class Room	1	1			2	
12	A-17:Class Room	2				1	
13	A-16:Class Room	1	1			2	
14	A-15:Class Room	1				1	
15	A-14 :Sr.Exam Room	3			2	2	
16							
17	A-5 : Jr. Exam Room	1	1			1	
18	A- 4:Class Room	1	2			3	
19	A-3 :Staff Room	2	1			2	
20	A-1,A-2: Computer Sci Lab	8	2		42	8	
21	A-13:Ladies Common Room	1	1			1	
22	A-6: Gym office	2	3		1	2	
23	A:Passage		4				
24	Central Library	9	12		3	12	
25	B-6 : Electronics Lab	3				3	
26	B-4,B-5:Physics Lab	3	4		1	5	
27	B-2,B-3:Chemistry lab	4	4			4	
28	B-1:Chemistry lab PG	2	3		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	5	
34	B:Passage		2				
35	C- 6:Class Room	1				1	
36	C-5 :Class Room	1				2	
37	C-4:Class Room	1	1			5	
38	C-3:Social Science Dept.	1	1		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		7		1	8	
46	Hostel old floor 1	8	5			11	
47	Hostel old floor 2	4	10		1	12	
48	H:Passage		5				
49	Hostel New	12	2			12	
50	H: Passage		4				
51	Cultural Hall	4	6			7	
	Total	111	113	12	84	161	1

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	161	65	10.5
2	AC-New (1.5 TR)	1	1838	1.8
3	LED-20W	113	20	2.3
4	CFL	12	24	0.3
5	F T L-40 W	111	40	4.4
6	Computers	84	65	5.5
7	pump (1.5HP)			0.8
8	LED street lights	4	35	0.1
	Total			25.6

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

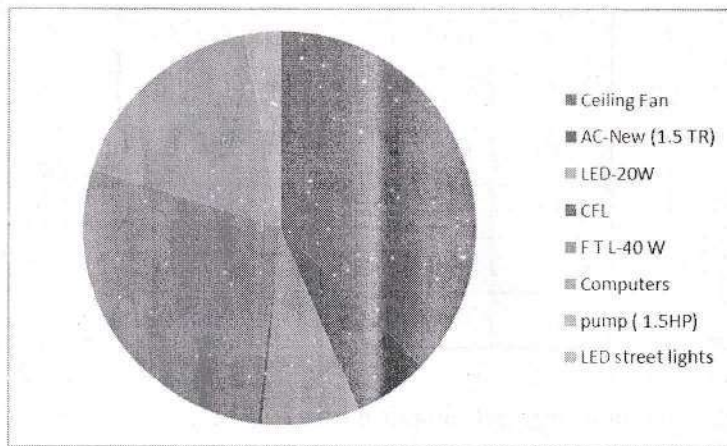


Figure 2.1: Distribution of connected load.



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	Jul-20	0	373
2	Jun-20	0	362
3	May-20	0	373
4	Apr-20	0	373
5	Mar-20	0	360
6	Feb-20	0	362
7	Jan-20	0	362
8	Dec-19	0	351
9	Nov-19	0	351
10	Oct-19	2304	24,313
11	Sep-19	1173	12,066
12	Aug-19	561	5,442
	Total	4038	45088

Monthly variation in energy consumption is as follows.

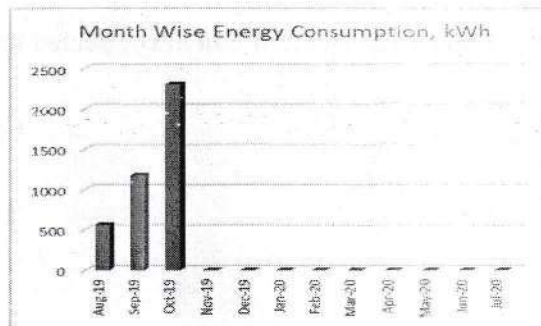


Figure 3.1: Month wise energy consumption



Monthly variation in electricity bill is as follows,

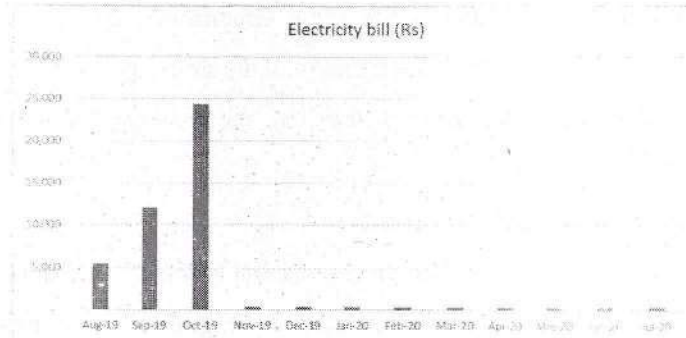


Figure 3.2: Month wise electricity bill

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	2,304	24,313
2	Minimum	-	351
3	Average	337	3,757



4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO₂ 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 CO₂ Emissions:

The basis of Calculation for CO₂ emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO₂** into atmosphere.

Based on the above Data we compute the CO₂ emissions which are being released in to the atmosphere by the College due to its Day to Day operations

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

Table 4.1: Month wise Consumption of Electrical Energy & CO₂ Emissions

No	Month	Energy (kWh)	CO ₂ Emissions, MT
1	Jul-20	0	0
2	Jun-20	0	0
3	May-20	0	0
4	Apr-20	0	0
5	Mar-20	0	0
6	Feb-20	0	0
7	Jan-20	0	0
8	Dec-19	0	0
9	Nov-19	0	0
10	Oct-19	2304	0
11	Sep-19	1173	0
12	Aug-19	561	0
	Total	4038	0



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

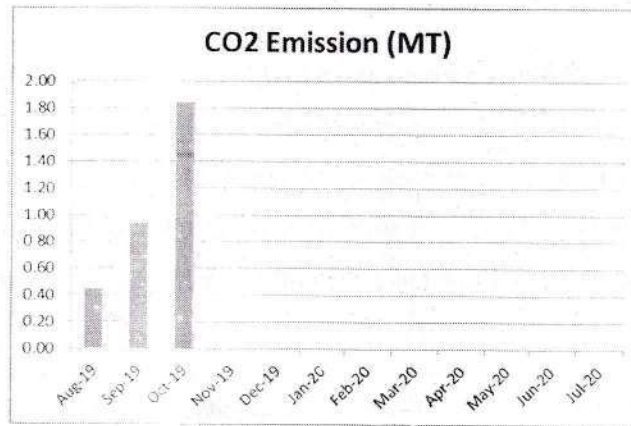


Figure 4.1: Month wise CO2 Emission



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 111 FTL fittings with Electronic/ magnetic chokes, 113 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 161 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.



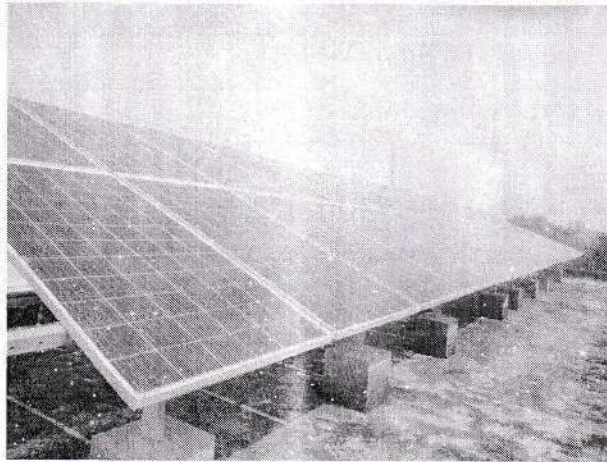
6. Study of usage of alternate energy

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	4038	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	88.1	%

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	111	40	4.44
2	CFL	12	24	0.288
	LED lighting load			
1	LED tube	113	20	2.26
2	LED street lights	4	35	0.14
	Total LED lighting load			2.4
	Total Lighting load			7.13

It can be seen that out of total lighting load 33.7% 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 111 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	111	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	6.66	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1665	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	18315	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	71151	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 161 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	161	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	6.279	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1569.75	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	17267.3	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	350014	Rs lump sum
13	Simple Payback period	243	Months



8.3 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 111 Nos T-8 fittings with 20W LED fittings	1,665	18,315	71,151	47
2	Replacement of 161 Nos Old Ceiling Fans with STAR rating fans	1,570	17,267	350,014	243
	Total	3,235	35,582	421,165	142

