

**Report  
On  
Energy Audit  
At**



**Shri Shivaji Education Society, Amravati's  
Jijamata Mahavidyalaya Buldana**



**(Year 2019-20)**

Prepared by

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Date: 05/10/2020

### CERTIFICATE

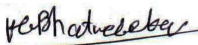
This is to certify that we have conducted Energy Audit at Shri Shivaji Education Society, Amravati's Jijamata Mahavidyalaya Buldana as per the guidelines of Maharashtra Energy Development Agency ([www.mahaurja.com](http://www.mahaurja.com)) in the year 2019-20.

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

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

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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## **Acknowledgement**

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shri Shivaji Education Society, Amravati's Jijamata Mahavidyalaya Buldana 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**

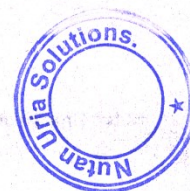
Sr no	Parameter	Energy consumed, (Units)	CO2 Emmision (MT)
1	Maximum	2,037	1.63
2	Minimum	942	0.75
3	Average	1,329	1.06
4	Total	15,954	12.76

### 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.



### 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 27.5 %.

### 6. Recommendations

Table no 1: Recommendations for energy savings

No	Recommendation	Annual Saving potential, kWh/Annunm	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 104 Nos T-8 fittings with 20W LED fittings	2,080	22,880	66,664	35
2	Replacement of 135 Nos Old Ceiling Fans with STAR rating fans	1,755	19,305	293,490	182
3	Replacement of 2 Nos of Halogen lights with LED street lights	460	5,060	2,500	6
4	Installation of 10kW grid connected PV panel	15,000	165,000	500,000	36
	<b>Total</b>	<b>19,295</b>	<b>212,245</b>	<b>862,654</b>	<b>49</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

Jijamata Mahavidyalaya Buldanais run by Shri Shivaji Education Society, Amravati founded by a great visionary, Educationist and first Agricultural Minister of India, Late Dr. Panjabrao alias Bhausahab Deshmukh in 1956. The college started with Arts faculty, Later commerce faculty was added in 1964. Faculty of science is started in 1984. Since then the college is imparting education in the faculty of Arts. Commerce and Science, Junior College, MCVC to Graduation, Post-Graduation and Doctoral Research Programs. College has competent staff. College has well equipped Laboratories, rich central& departmental library, beautiful campus, hostel and a vast playground. University Grants Commission, New Delhi has awarded the status of "College with Potential for Excellence" in 2010.

### 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	ShriShivaji Education Society, Amravati's Jijamata Mahavidyalaya Buldana
2	Address	Jijamata Mahavidyalaya, Chikhali Road,,Buldana-443001
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 Bulb	LED tube (20W)	Computers (65W)	Fans	1.5TR Star rated AC
1	Principal Room		16		1	4	2
2	Staff room		15			1	1
3	Library (Office building)			4	4		
4	Office			5	5	5	
5	YCMOU			3	1	2	
6	NCC			1	1	1	
7	Jr College Department						
8	Maths	3			1	1	
9	Physics	7		5	1	1	
10	Computer Department	13			24	6	
11	Entry Corridor	2					
12	Room no 8			2		3	
13	Room no 7			2		3	
14	NSS	3		2		2	
15	Room no 6			2		3	
16	Room no 9			2		3	
17	Room no 10			2		3	
18	Room no 2			2		3	
19	Room no 1			2		3	
20	Music Department			1	1	2	
21	Principal Cabin		9		3	5	
22	Room no 3			2		3	
23	Room no 4			2		3	
24	History	2			1	2	
25	Chemistry	3		3	2	4	
26	Botany	5		6	2	5	
27	Microbiology	4	1		2	4	
28	Zoology	5		2	2	10	



29	Washroom			1			
30	Gym			10		8	
31	Canteen	5					
32	Hostel	8				6	
33	Organic lab	3		2		4	
34	Auditorium	6				6	
35	Reading room	12		9	6	9	
36	Computer Science	4		3	21	5	
37	English Dpt.	4		3	1	7	
38	Economic Department	1		1	1		
39	Chemistry UG	2				1	
40	Chemistry Lab	9				4	
41	Store	3				3	
	<b>Total</b>	<b>104</b>	<b>41</b>	<b>79</b>	<b>80</b>	<b>135</b>	<b>3</b>

Apart from above load, the school has pumps, LED street lights, CFLs and LED focus 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	135	65	8.8
3	AC-New (1.5 TR)	3	1838	5.5
5	LED-20W	79	20	1.6
6	LED bulb (11W)	41	11	0.5
7	F T L-40 W	104	40	4.2
8	Computers	74	65	4.8
9	Pumps (2.5HP)			1.9
10	Halogen street lights	2	150	0.3
	<b>Total</b>			<b>27.5</b>

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



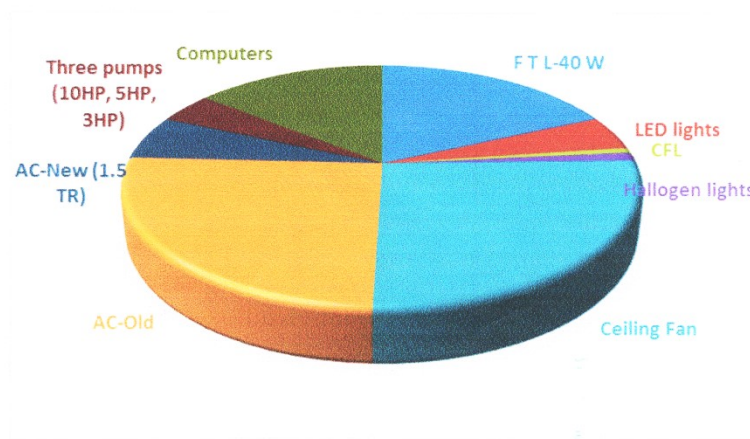


Figure 2.1: Distribution of connected load.



### 3. Study of Electrical Energy Consumption

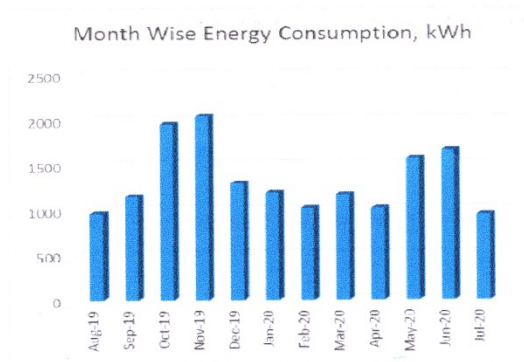
In this chapter, electricity bills are studied for the analysis of electrical energy consumption.

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

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jul-20	942	6594
2	Jun-20	1,660	12,367
3	May-20	1,568	11,917
4	Apr-20	1,017	7,424
5	Mar-20	1,169	9,118
6	Feb-20	1,020	8,058
7	Jan-20	1,192	9,770
8	Dec-19	1,297	10,506
9	Nov-19	2,037	17,420
10	Oct-19	1,950	15,990
11	Sep-19	1,146	8,538
12	Aug-19	956	7,074
	<b>Total</b>	<b>15954</b>	<b>124776</b>

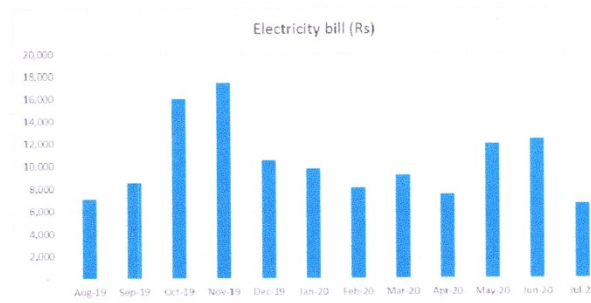
Variation in energy consumption is as follows,





**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	2,037	1.63
2	Minimum	942	0.75
3	Average	1,329	1.06
4	Total	15,954	12.76



#### 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	Jul-20	942	0.75
2	Jun-20	1,660	1.33
3	May-20	1,568	1.25
4	Apr-20	1,017	0.81
5	Mar-20	1,169	0.94
6	Feb-20	1,020	0.82
7	Jan-20	1,192	0.95
8	Dec-19	1,297	1.04
9	Nov-19	2,037	1.63
10	Oct-19	1,950	1.56
11	Sep-19	1,146	0.92
12	Aug-19	956	0.76
	<b>Total</b>	<b>15,954</b>	<b>12.76</b>



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

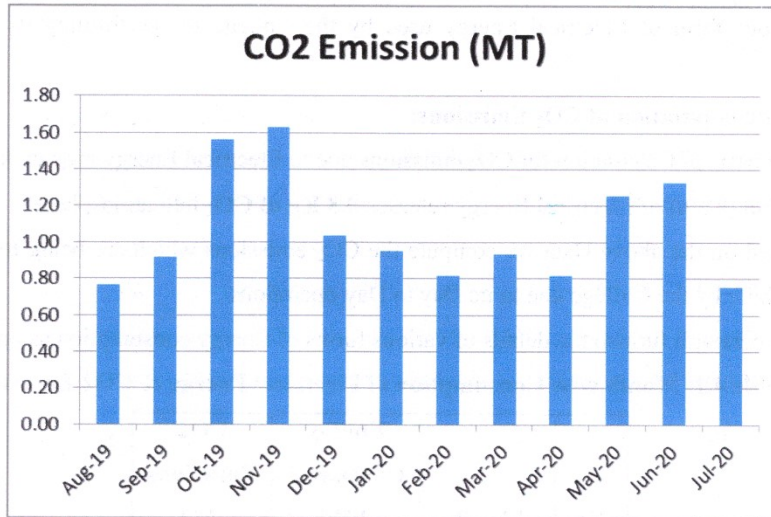


Figure 4.1: Month wise CO2 Emission



## **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 104 FTL fittings with Electronic/ magnetic chokes, 79 LED tubes and 41 no of 11W LED bulbs in indoor lightings. It is recommended to install the 20 W LED Tube light fittings in place of these old T-8 fittings. There are 2 number of halogen focus street lights. It is recommended to replace these halogen focus lights with LED street lights.

### **5.2 Air-conditioners**

In the facility, there are about 02 Nos. of 1.5 Tr new star rated Air-conditioners

### **5.3 Ceiling Fans**

At building facility, there are about 135 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 in total 1 Water pumps with 2.5 HP capacity.





## 6. 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	104	40	4.16
2	Halogen street lights	2	150	0.3
	<b>LED lighting load</b>			
1	LED tube	79	20	1.58
2	LED bulb	41	11	0.451
	<b>Total LED lighting load</b>			<b>2.031</b>
	<b>Total Lighting load</b>			<b>6.491</b>

It can be seen that out of total lighting load 49% load is LED lighting load.



## 7. Energy conservation proposals

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

In the facility, there are about 104 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	104	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	8.32	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	2080	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	22880	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	66664	Rs lump sum
13	Simple Payback period	35	Months



### 7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 135 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	135	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	7.02	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1755	kWh/Annu m
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	19305	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	293490	Rs lump sum
13	Simple Payback period	182	Months



### 7.3 Replacement of Focus halogen street lights LED

In the facility, there are about 02 Nos, focus halogen street lights. It is recommended to install the 35W LED street light fittings in place of these fittings. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of Halogen Street Lights	2	Nos
2	Energy Demand of T-8 fitting	150	W/Unit
3	Energy Demand of LED fitting	35	W/Unit
4	Reduction in demand	115	W/Unit
5	Average Daily Usage period	8	Hrs/Day
6	Daily saving in Energy	1.84	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	460	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	5060	Rs/Annum
11	Cost of LED street light	1250	Rs/Unit
12	Investment required	2500	Rs lump sum
13	Simple Payback period	6	Months



#### 7.4 Installation of 10 kW Solar PV panel

It is recommended to install 10 kW solar PV panel. In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Installation of PV unit	10	kW
2	Energy saving	15000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetary savings	16500 0	Rs/ Annum
5	Investment required	50000 0	Rs lump sum
6	Simple payback period	36	Months



### 7.5 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annunm	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 104 Nos T-8 fittings with 20W LED fittings	2,080	22,880	66,664	35
2	Replacement of 135 Nos Old Ceiling Fans with STAR rating fans	1,755	19,305	293,490	182
3	Replacement of 2 Nos of Halogen lights with LED street lights	460	5,060	2,500	6
4	Installation of 10kW grid connected PV panel	15,000	165,000	500,000	36
	<b>Total</b>	<b>19,295</b>	<b>212,245</b>	<b>862,654</b>	<b>49</b>

