Report

On

Energy Audit

At

Shri Shivaji Education Society, Amravati's

Jijamata Mahavidyalaya Buldana

(Year 2023-24)

Prepared by

Nutan Urja Solutions

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Date: 11/08/2024

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) in the year 2023-24.

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 20kW solar PV system

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

Contents

Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shri Shivaji Education Society, Amravati's Jijamata Mahavidyalaya Buldhana for awarding us theassignment 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_2 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 Emission (MT)
1	Maximum	1,455	1.2
2	Minimum	298	0.2
3	Average	919	0.7
4	Total	11,029	8.8

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. Usage of Renewable Energy

The college has installed roof top solar PV panel of 20kW capacity. Total percentage usage of renewable energy is 75%.

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 64%.

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 57 Nos T-8 fittings with 20W LED fittings	1,140	12,540	36,537	35
2	Replacement of 181 Nos Old Ceiling Fans with STAR rating fans	2,353	25,883	393,494	182
	Total	**3,493**	**38,423**	**430,031**	**134**

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

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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 Buldhana is run by Shri Shivaji Education Society, Amravati founded by a great visionary, Educationist and first Agricultural Minister of India, Late Dr. Panjabrao alias Bhausaheb 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	Shri Shivaji Education Society, Amravati's, Jijamata Mahavidyalaya, Buldhana
2	Address	Near Devi Mandir, Chikhli Road, Buldhana- 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. The college has various types of loads such as LED tubes FTLs, Fans, pumps etc. Individual fitting wise load is as under.

Table No 2.1: Equipment wise Connected Load

No.	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	181	65	11.8
2	AC-New (1.5 TR)	6	1838	11.0
3	LED-20W	164	20	3.3
4	LED bulb (11W)	58	11	0.6
5	F T L-40 W	57	40	2.3
6	Computers	87	65	5.7
7	Pumps (2.5HP)			1.9
8	LED focus lights	6	35	0.2
	Total			36.7

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

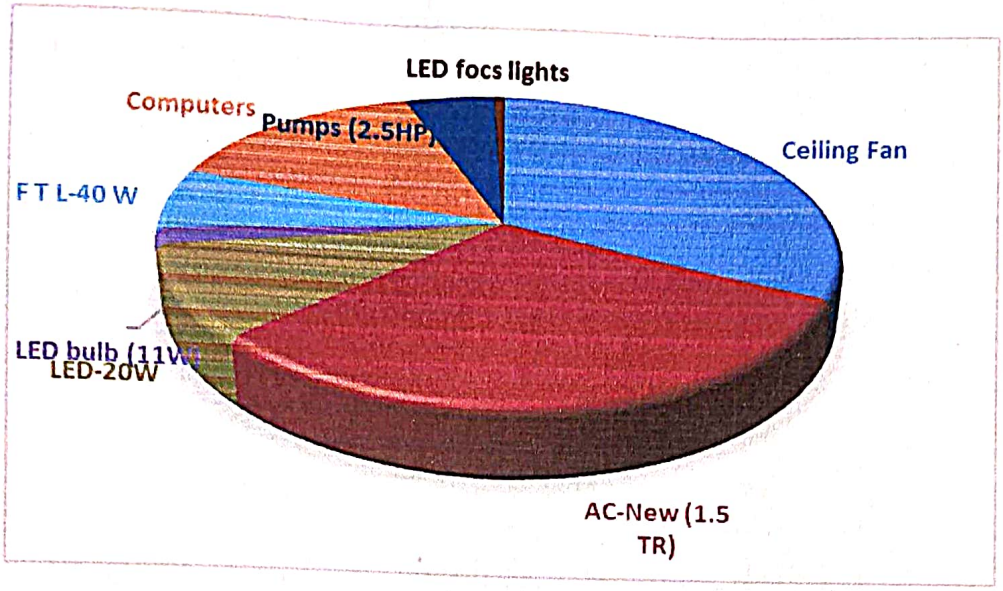


Figure 2.1: Distribution of connected load.

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-24	442	11720
2	May-24	298	3252
3	Apr-24	500	5149
4	Mar-24	400	3967
5	Feb-24	631	6052
6	Jan-24	1161	10739
7	Dec-23	1039	9550
8	Nov-23	1156	10442
9	Oct-23	1306	11488
10	Sep-23	1455	12743
11	Aug-23	1424	12241
12	Jul-23	1217	10528
	Total	**11,029**	**1,07,871**

Variation in energy consumption is as follows,

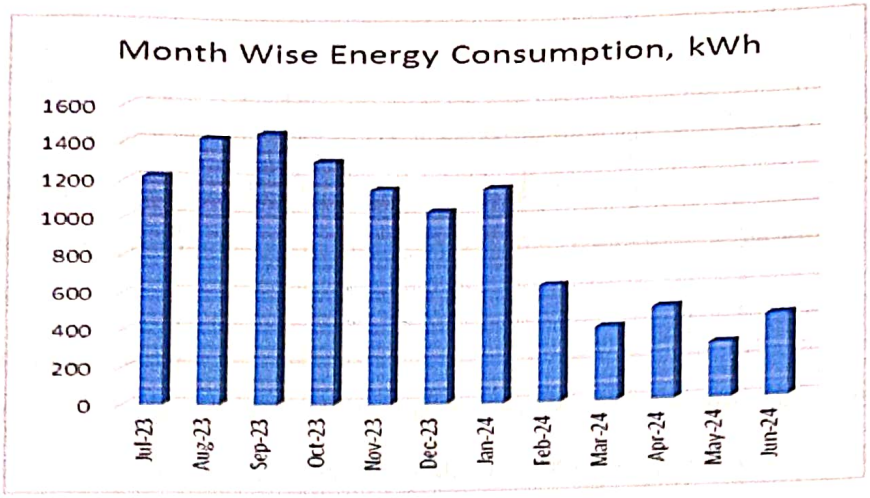


Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

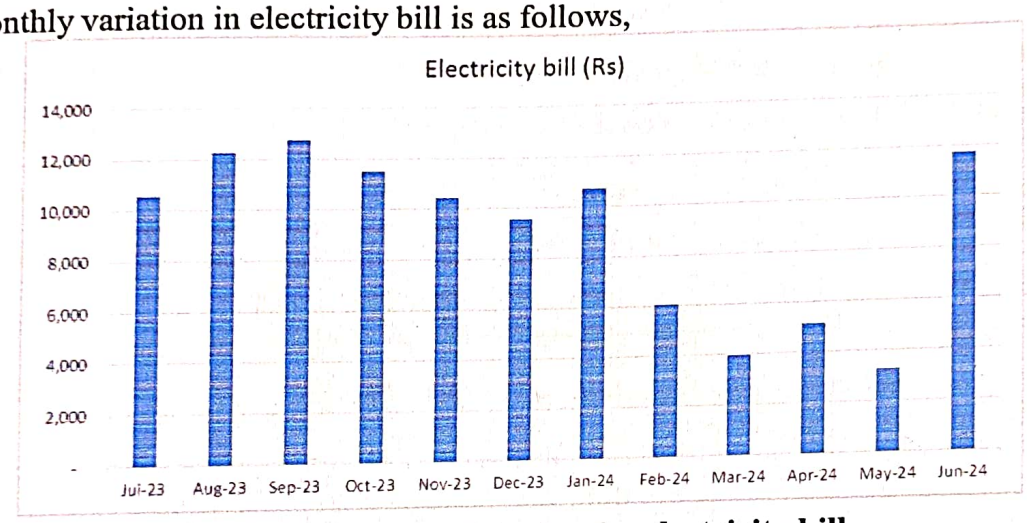


Figure 3.2: Month wise electricity bill

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	1,455	1.2
2	Minimum	298	0.2
3	Average	919	0.7
4	Total	11,029	8.8

4. Carbon Foot printing

1. A Carbon Foot print is defined as the Total Greenhouse Gas emissions (CO_2 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_2 Emissions:

The basis of Calculation for CO_2 emissions due to Electrical Energy is as under

- 1 Unit (kWh) of Electrical Energy releases **0.8 Kg of CO_2** into atmosphere.

Based on the above Data we compute the CO_2 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 Consumed , kWh	CO2 Emissions , MT
1	Jun-24	442	0.4
2	May-24	298	0.2
3	Apr-24	500	0.4
4	Mar-24	400	0.3
5	Feb-24	631	0.5
6	Jan-24	1,161	0.9
7	Dec-23	1,039	0.8
8	Nov-23	1,156	0.9
9	Oct-23	1,306	1.0
10	Sep-23	1,455	1.2
11	Aug-23	1,424	1.1
12	Jul-23	1,217	1.0
	Total	**11,029**	**8.8**

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

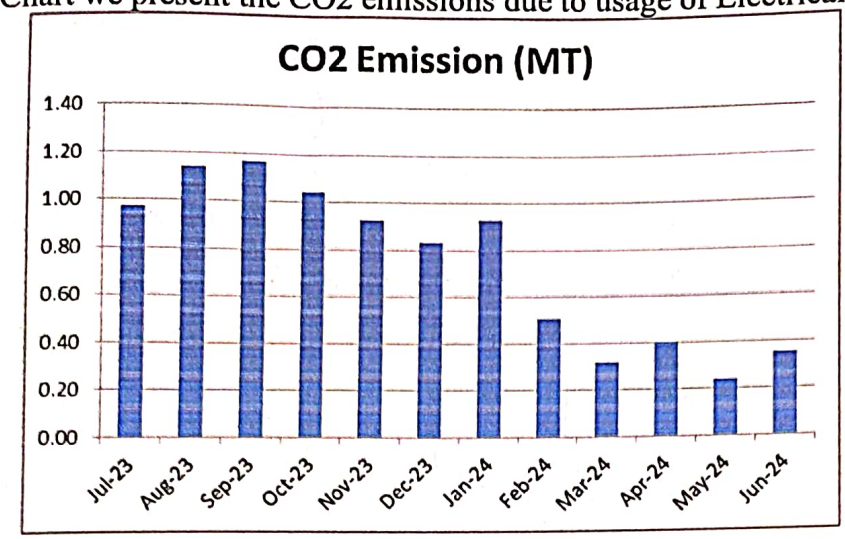


Figure 4.1: Month wise CO2 Emission

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 57 FTL fittings with Electronic/ magnetic chokes, 164 LED tubes and 58 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 6 LED street lights.

5.2 Air-conditioners

In the facility, there are about 6 Nos. of 1.5 Tr new star rated Air-conditioners

5.3 Ceiling Fans

At building facility, there are about 181 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.

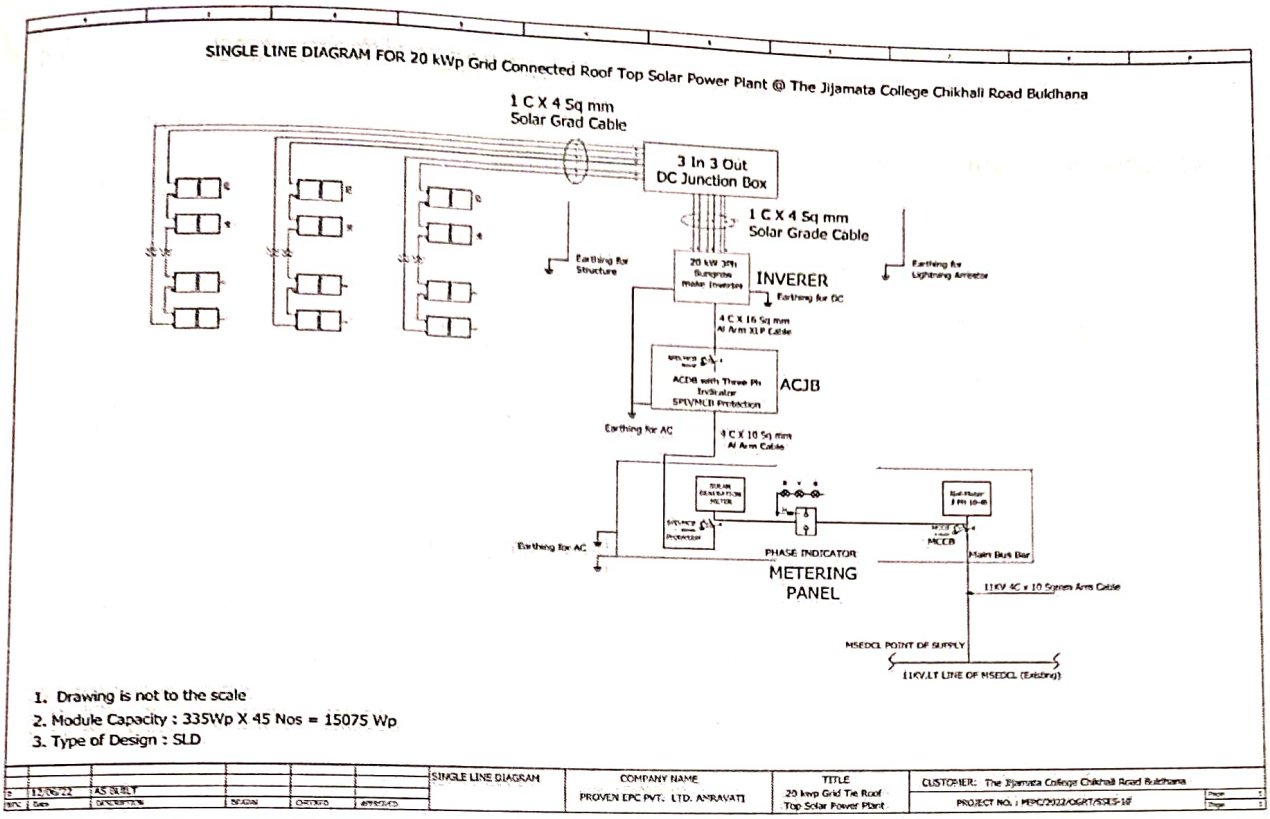
6. Study of usage of alternate energy

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 **20 kWp.**

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

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	9,767	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	30,000	kWh/Annum
3	Total Energy Requirement of College	39,767	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	75	%

Photograph of Solar PV plant



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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	57	40	2.28
	LED lighting load			
1	LED tube	164	20	3.28
2	LED bulb	58	11	0.64
3	LED Focus Light	6	35	0.21
	Total LED lighting load			**4.13**
	Total Lighting load			**6.41**

It can be seen that out of total lighting load 64% 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 57 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	57	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	4.56	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1140	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	12540	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	36537	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 181 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	181	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 demand	13	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	9.412	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	2353	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	25883	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	393494	Rs lump Sum
13	Simple Payback period	182	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 57 Nos T-8 fittings with 20W LED fittings	1,140	12,540	36,537	35
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