Report

On

Energy Audit

At

Arts & Commerce College warwat Bakal, Buldana.

(Year 2023-24)

Prepared by

Nutan Urja Solutions

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

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Arts & Commerce College Warwat Bakal, 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_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	0	0
2	Minimum	0	0
3	Average	0	0
4	Total	0	0

2. Energy Conservation Projects already installed

1. Usage of LED lights at some indoor locations
2. Usage of LED Lights for outdoor lighting.
3. Usage of STAR rated fans at new installations

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 & CFL. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 94 %.

6. 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 100 %.

7. Recommendations

The total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building. There are not much energy saving recommendations for colleges.

8 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

The mission undertaken by Arts & Commerce College warwat Bakal, Buldana is to strive and provide Education to those poor, downtrodden and exploited communities of the area. It will accelerate the development of this region and establish confidence among the youth.

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	Arts & Commerce College warwat Bakal, Buldana
2	Address	Arts & Commerce College warwat Bakal, Buldana ,Maharashtra 444202
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	LED tube (20W)	CFL	Fans	Computers (65W)
1	IQAC	3		3	2
2	Exam room		1	1	
3	Seminar Hall	4		7	
4	Staff Room	2		3	
5	G1	1		1	
6	G2	1		1	
7	G3	1		1	
8	G4 (Principal room)	1	1	1	
9	G5 (Office)	3		3	4
10	G6	2		1	1
11	F1	1			1
12	F2	1			1
13	F3	1			1
14	F4	1			1
15	F5	2			1
16	S1	1			1
17	S4	1			1
18	S5	3			1
19	Reading room	1			1
20	Library	10		7	1
21	Chemistry lab	2			1
22	Chemistry Dept	1			1
23	Zoology lab	2			1
24	Zoology Dept.	2			1
25	Physics lab	2			1
26	Botany Dept.	2			1
27	Computer lab	2			6
28	Meeting hall	3			2
29	Rest House	1			2

30	NCC	1			1
31	Sports	1			1
32	NSS	1			1
33	Hall	5			5
	Total	**65**	**2**	**29**	**41**

Apart from above load, the school has pump. 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	29	65	1.9
2	LED-20W	65	20	1.3
3	CFL	2	24	0.0
4	Computers	41	65	2.7
5	Pump (2HP)			1.5
	Total			**7.1**

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

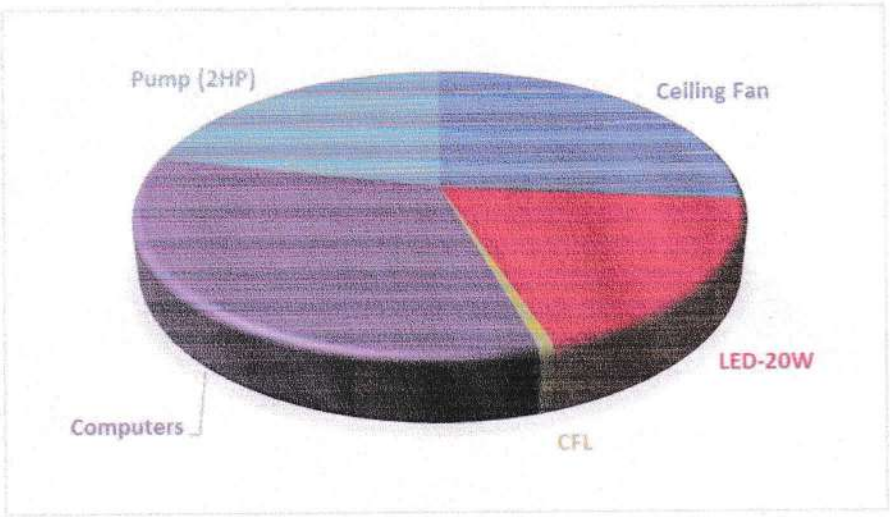

Figure 2.1: Distribution of connected load.

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	-	512
2	May-24	-	512
3	Apr-24	-	512
4	Mar-24	-	512
5	Feb-24	-	512
6	Jan-24	-	512
7	Dec-23	-	512
8	Nov-23	-	512
9	Oct-23	-	512
10	Sep-23	-	440
11	Aug-23	-	440
12	Jul-23	-	440
	Total	**-**	**5,928**

Variation in energy consumption is as follows,

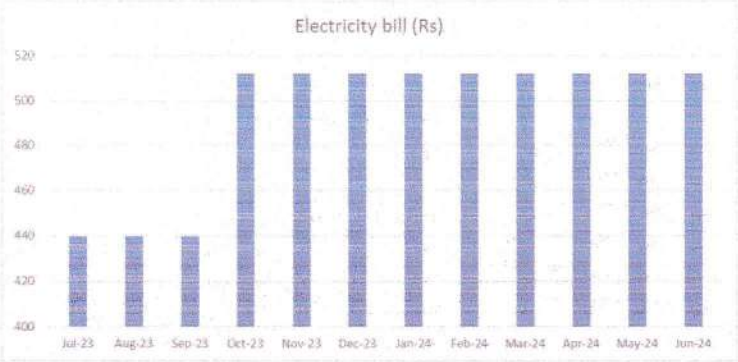

Figure 3.2: Month wise electricity bill

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	0	0
2	Minimum	0	0
3	Average	0	0
4	Total	0	0

It can be seen from above figures and tables that, the total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

Zero Energy Building

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.

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	0	0
2	May-24	0	0
3	Apr-24	0	0
4	Mar-24	0	0
5	Feb-24	0	0
6	Jan-24	0	0
7	Dec-23	0	0
8	Nov-23	0	0
9	Oct-23	0	0
10	Sep-23	0	0
11	Aug-23	0	0
12	Jul-23	0	0
	Total	**0**	**0**

The total energy imported by college from MSEB is zero. The college buildings is zero energy building. CO_2 emissions due to Electrical Energy is zero.

5. Study of utilities

5.1 Study of Lighting

There are 2 CFLs and 65 LEDs in indoor lightings.

5.2 Ceiling Fans

At building facility, there are about 29 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 is 1 Water pump with 2HP 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	CFL	2	24	0.048
	LED lighting load			
1	LED tube	65	20	1.3
	Total LED lighting load			**1.3**
	Total Lighting load			**1.348**

It can be seen that out of total lighting load 96% load is LED lighting load.

7. 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 **12 kWp**.

Table 7.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	0	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	18,000	kWh/Annum
3	Total Energy Requirement of College	18,000	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	100	%

Photograph of Solar PV plant

The total energy imported by college from MSEB is zero. The college buildings can be called as zero energy building.

Definition of zero energy building is as follows.

Zero Energy Building

An energy-efficient building where, on a source energy basis, the actual annual delivered energy is less than or equal to the on-site renewable exported energy.