Report

On

Energy Audit

At

Nagpur Shikshan Mandal's Shri Binzani City College, Nagpur

(Year 2024-25)

Prepared by

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Contents

Acknowledgement 2

Executive Summary 3

Abbreviations 5

1. Introduction 6

1.1 Objectives 6

1.2 Audit Methodology: 6

1.3 General Details of College 6

2. Study of connected load 7

3. Study of Electrical Energy Consumption 10

4. Carbon Foot printing 12

5. Study of usage of LED lighting 14

6. Study of usage of alternate energy 15

7. Energy conservation proposals 16

7.1 Replacement of T-8 FTLs with 20 W LED fittings 16

7.2 Replacement of old fans with STAR Rated fans 17

7.3 Replacement of 1.5 TR Old ACs with STAR Rated ACs 18

7.4 Summary of Savings 19

Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Nagpur Shikshan Mandal's Shri Binzani City College, Nagpur 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	2,957	2.37
2	Minimum	171	0.14
3	Average	1,598	1.28
4	Total	19,177	15.34

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 177 Nos old T-8 type fittings which need to be replaced by 20 W LEDs.
5. There are 2 Nos, 1.5 TR Old ACs which need to be replaced with STAR Rated ACs.

4. Percentage of Usage of Renewable Energy

College has installed 40kW solar PV system. Percentage usage of renewable energy is 76%.

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 17.4 %.

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 177 Nos T-8 fittings with 20W LED fittings	3894	28036.8	113457	49
2	Replacement of 142 Nos Old Ceiling Fans with STAR rating fans	1846	13291.2	308708	279
3	Replacement of 2 Nos Old 1.5 TR Acs with STAR rating Acs	2000	14400	105750	88
	Total	**7740**	**55728**	**527915**	**114**

7. Notes & Assumptions

1. Annual working Days-250 Nos
2. Average Rate of Electrical Energy : **Rs 7.2/- 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. Binzani City College, one of the oldest and premier educational institutions, was established on 17th July 1930. It is run under the aegis of Nagpur Shikshan Mandal, Nagpur. It is affiliated to Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur. The college has an imposing building. It is in five separate blocks. It has a huge play ground, a rich library and a well-equipped Physical Education Dept.

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	Nagpur Shikshan Mandal's Shri Binzani City College, Nagpur
2	Address	Shri Binzani City College, Umred Rd, Sakkardara Rd, Raghuji Nagar, Nagpur, Maharashtra 440009.
3	Affiliation	Rashtrasant Tukdoji Maharaj Nagpur University, Nagpur

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	Fans	ACS (1.5Tr)	Computers
1	Principal office	0	2	7	4	2	3
2	Control room	3			1		2
3	NAAC room	4			2		2
4	IQAC	2	2		1		
5	Staff room		8		5		1
6	Wash room	3					
7	Pri. Passage	1	1	3	1		
8	Office	1	10	2	6		8
9	Commerce Dept	1		1			
10	Program	2	1		2		
11	Pravin	7			4		
12	Hall	10	4	1	13		
13	H-L	2		2			
14	H-R	0		2			
15	D. Water	1					
16	Room 4	4	1		5		
17	Room 5	5			5		
18	Room 6	4	1		5		
19	Room 7	4	1		5		
20	4 Passage	1		2			
21	Room 8	4			2		
22	Room 9	3			2		
23	Room 10	4			2		
24	Room 11	1	5		2		1
25	Room 12	2	4		1		
26	8 Passage	2		4			
27	Wash room	1			1		
28	NSS	2			2		
29	Room 14	3			2		
30	Room 15	2			2		
31	P01 Passage	2					
32	Room 16	2			2		
33	Room 17	1			2		

34	Room 18	2			2		
35	P01 Passage	1					
36	Wash room	3					
37	Room 20	4			2		
38	Room 21	2			2		
39	Room 22	2			2		
40	Room 23	2			2		
41	Room 24	2			2		
42	Room 25	3			3		
43	Room 26	2					
44	Room 27	6					
45	20 Passage	2					
46	NCC room	2					1
47	BCCA class	2			2		
48	BCCA office	4			5		
49	Computer lab	6			6		41
50	Eng Lab	5			3		18
51	Library washroom	1					
52	Library office	2	3	1	2		
53	Library	25	11	6	12		
54	Political Sci Dept	3	1		3		
55	Psychology Dept	11			5		
56	Record room	1	1				
57	Sports Dept		21		10		
	Total	**177**	**77**	**31**	**142**	**2**	**77**

Apart from above load, the school has pumps, LED street lights. Individual fitting wise load is as under.

Table No 2.2: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	177	40	7.1
2	LED-20W	77	20	1.5
3	CFL	31	24	0.7
4	LED street lights	3	35	0.1
5	Ceiling Fan	142	65	9.2
6	AC-Old (1.5 Tr)	2	2200	4.4
7	Computers	77	65	5.0
8	Two pumps (2HP, 1HP)			2.3
	Total			30.4

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

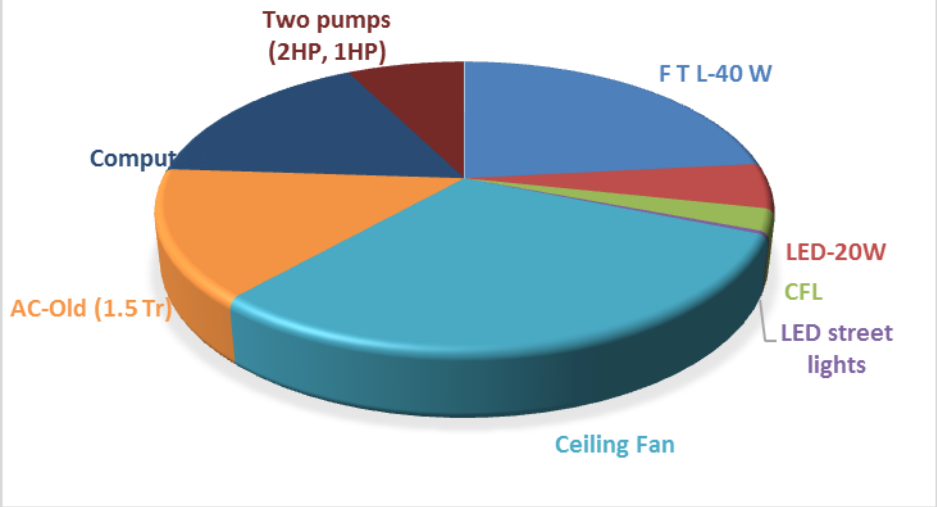

Figure 2.1: Distribution of connected load.

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-25	2,957	24,033
2	Jun-25	2,404	22,099
3	May-25	1,834	23,937
4	Apr-25	1,517	12,531
5	Mar-25	1,613	13,500
6	Feb-25	171	1,413
7	Jan-25	1,149	9,543
8	Dec-24	1,012	8,163
9	Nov-24	1,274	10,344
10	Oct-24	1,340	9,792
11	Sep-24	1,827	11,858
12	Aug-24	2,079	20,493
	Total	**19,177**	**1,67,706**

Variation in energy consumption is as follows,

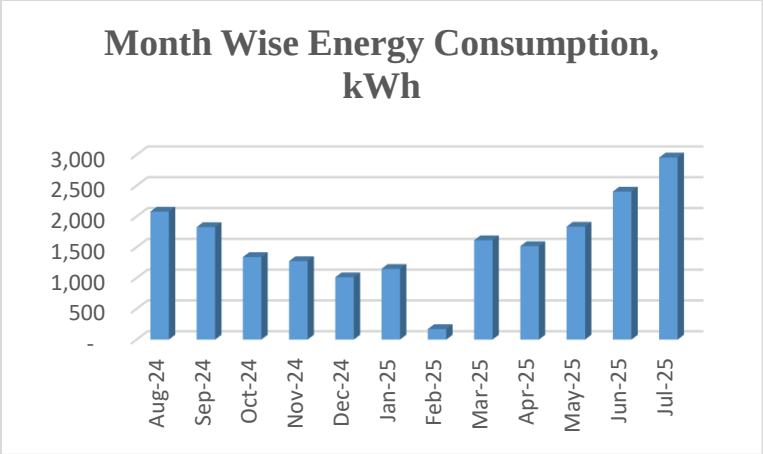

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

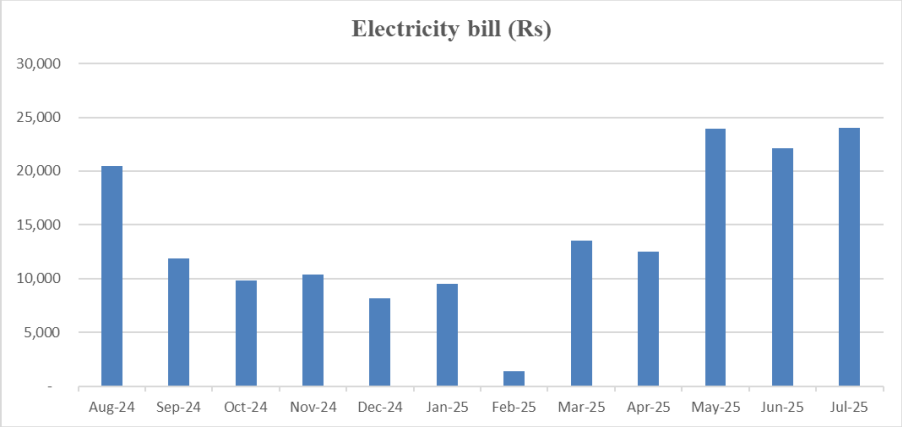

Figure 3.2: Month wise electricity bill

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	2,957	2.37
2	Minimum	171	0.14
3	Average	1,598	1.28
4	Total	19,177	15.34

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	Jul-25	2,957	2.37
2	Jun-25	2,404	1.92
3	May-25	1,834	1.47
4	Apr-25	1,517	1.21
5	Mar-25	1,613	1.29
6	Feb-25	171	0.14
7	Jan-25	1,149	0.92
8	Dec-24	1,012	0.81
9	Nov-24	1,274	1.02
10	Oct-24	1,340	1.07
11	Sep-24	1,827	1.46
12	Aug-24	2,079	1.66
	Total	**19177**	**15.34**

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

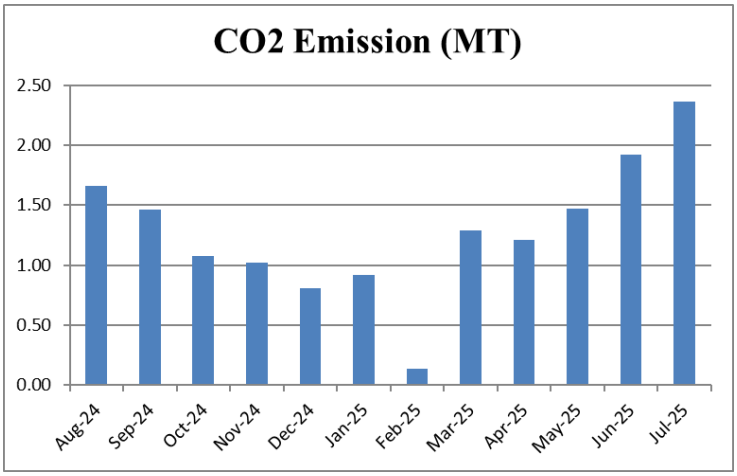

Figure 4.1: Month wise CO2 Emission

5. Study of 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 5.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	177	40	7.08
2	CFL	31	24	0.744
	LED lighting load			
1	LED tube	77	20	1.54
2	LED street lights	3	35	0.105
	Total LED lighting load			**1.645**
	Total Lighting load			**9.469**

It can be seen that out of total lighting load 17.4% load is LED lighting load.

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 **40 kWp**.

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

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	19,177	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	60000	kWh/Annum
3	Total Energy Requirement of College	79,177	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	76	**%**

Photograph of Solar PV plant

7. Energy conservation proposals

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

In the facility, there are about 177 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	177	Nos
2	Energy Demand of T-8 fitting	40	W/Unit
3	Energy Demand of 18 W LED fittin	18	W/Unit
4	Reduction in demad	22	W/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	15.576	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	3894	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	28036.8	Rs/Annum
11	Cost of 18 W LED Tube	641	Rs/Unit
12	Investment required	113457	Rs lump sum
13	Simple Payback period	49	Months

7.2 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 142 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	142	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	7.384	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	1846	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	13291.2	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	308708	Rs lump sum
13	Simple Payback period	279	Months

7.3 Replacement of 1.5 TR Old ACs with STAR Rated ACs

During the Audit, it was observed that there are 2 Nos, of 1.5 TR old ACs. It is recommended to replace these old ACs with STAR Rated ACs.

In the following Table, we present the savings, investment required & payback analysis.

No	Particulars	Value	Unit
1	Present Qty of 1.5 TR Old ACs	2	Nos
2	Energy Demand of Old 1.5 TR AC	2.15	kW/Unit
3	Energy Demand of New AC	1.15	kW/Unit
4	Reduction in demad	1	kW/Unit
5	Average Daily Usage period	4	Hrs/Day
6	Daily saving in Energy	8	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	2000	kWh/Annum
9	Rate of Electrical Energy	7.2	Rs/kWh
10	Annual Monetary saving	14400	Rs/Annum
11	Cost of STAR Rated 1.5 TR AC	52875	Rs/unit
12	Investment required	105750	Rs lump sum
13	Simple Payback period	88	Months

7.4 Summary of Savings

No	Recommendation	Annual Saving potential, kWh/Annum	Annual Monetary Gain, Rs.	Investment Required, Rs.	Payback period, Months
1	Replacement of 177 Nos T-8 fittings with 20W LED fittings	3894	28036.8	113457	49
2	Replacement of 142 Nos Old Ceiling Fans with STAR rating fans	1846	13291.2	308708	279
3	Replacement of 2 Nos Old 1.5 TR Acs with STAR rating Acs	2000	14400	105750	88
	Total	**7740**	**55728**	**527915**	**114**