Report

On

Energy Audit

At

Motiwala College of Educational Sciences, Nashik

(Year 2022-23)

Prepared by

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Motiwala College of Educational Sciences, Nashik 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, (kWh)	CO2 Emission (MT)
1	Total	110309	88.25
2	Maximum	15,073	12.06
3	Minimum	3,346	2.68
4	Average	9,192	7.35

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. 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 49 %.

5. Percentage of Usage of LED Lighting

The College has various Types of Light fittings. The percentage of Annual LED Lighting Usage to Annual Lighting requirement works out to be 100 %.

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 19 Nos Old Ceiling Fans with STAR rating fans	950	10,450	41,306	47
2	Installation of 50kW grid connected PV panel	75,000	825,000	2,500,000	36
	Total	**75,950**	**835,450**	**2,541,306**	**37**

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

Motiwala College of Educational Sciences is located in Nashik. The college is running with Degree courses in Educational Sciences classes. It was started with the sole aim of creating and developing professional education facilities to train the aspiring young generation and thus provide dedicated, ambitious and skilled professionals to serve the society and the nation at large. The College has today become one of the premier institutions of the city.

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	Motiwala College of Educational Sciences, Nashik
2	Address	Motiwala College of Educational Sciences, Gangapur – Satpur Link Road, Gangapur, Nashik 422 222.
3	Affiliation	Savitribai Phule Pune University

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)	LED bulb (12W)	Computers (65W)	Fans	1.5 Tr Star rated AC
1	Principal Cabin	1	2	1	1	
2	Admin Office	2		3	1	
3	Staff Room	1		1	1	
4	Music Department	1	1		1	
5	S.Y. B.Ed. Class Room	2			1	
6	F.Y. B.Ed. Class Room	3			2	
7	Library	2	7	1	1	
8	Science Methodology	6			1	
9	Maths Methodology	2		1	1	
10	Marathi Methodology	3			1	
11	English Methodology	3				
12	Seminar Hall	7			8	
13	Passage	4				
14	Boy's Common Room	2	3			
15	Ladies Wash Room	2	3			
16	Auditorium		151			4
17	Pantry		4			
18	V.I.P. Room		3			
	Total	**41**	**174**	**7**	**19**	**4**

Apart from above load, the college has pumps, 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	LED tube	41	20	0.8
2	LED bulb	174	12	2.1
3	Computers	7	65	0.5
4	Ceiling Fan	19	65	1.2
5	AC (1.5Tr)	4	1838	7.4
6	LED focus Street light	5	35	0.2
7	Pumps (1 nos 5HP)			1.5
	Total			**10.3**

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

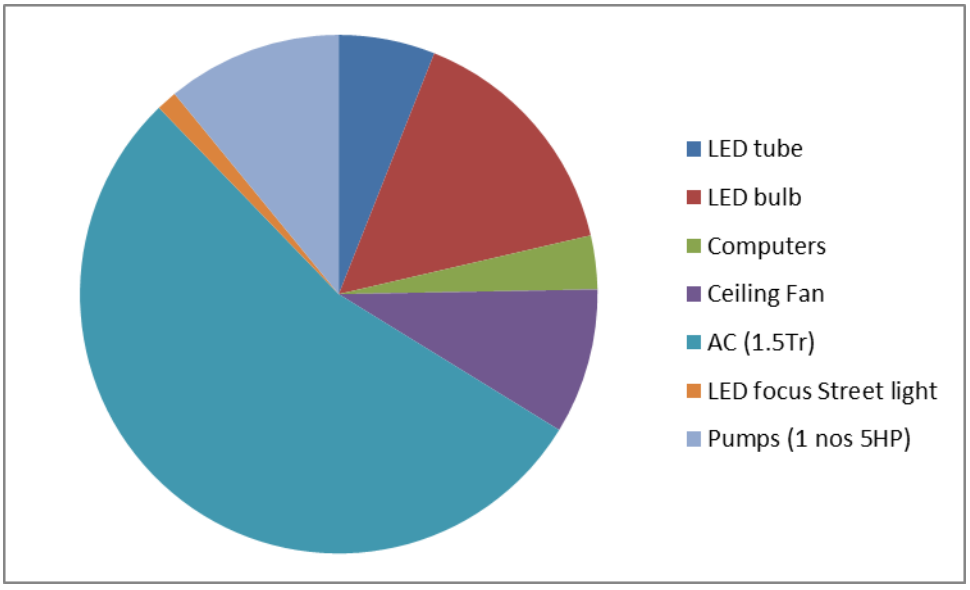

Figure 2.1: Distribution of connected load.

3. Study of Electrical Energy Consumption

In this chapter, electricity bills are studied for the analysis of electrical energy consumption. Motiwala College of Educational Sciences, Nashik is situated in Motiwala Education and Welfare Trust campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

Table no 3.1: Summary of electricity bills

No	Month	Energy (kWh)	Bill Amount (Rs)
1	Jun-23	15073	226248
2	May-23	3346	63558
3	Apr-23	11595	176212
4	Mar-23	11157	157112
5	Feb-23	7614	112120
6	Jan-23	7300	108007
7	Dec-22	10583	152784
8	Nov-22	7449	110224
9	Oct-22	5950	90391
10	Sep-22	10602	150013
11	Aug-22	9783	138885
12	Jul-22	9857	139331
	Total	**1,10,309**	**16,24,885**

Variation in energy consumption is as follows,

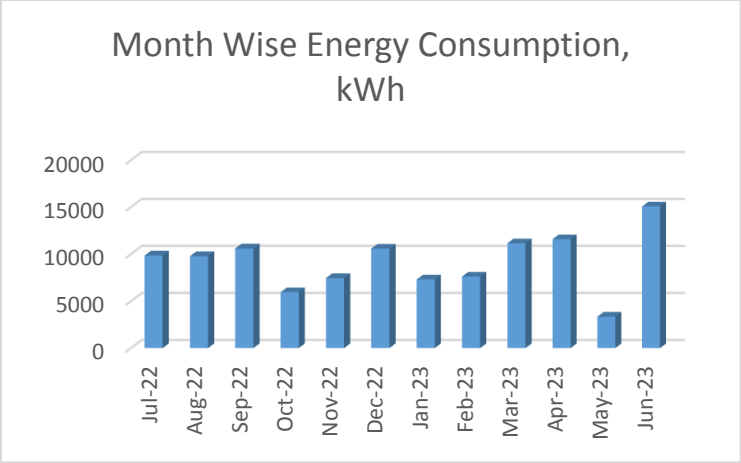

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

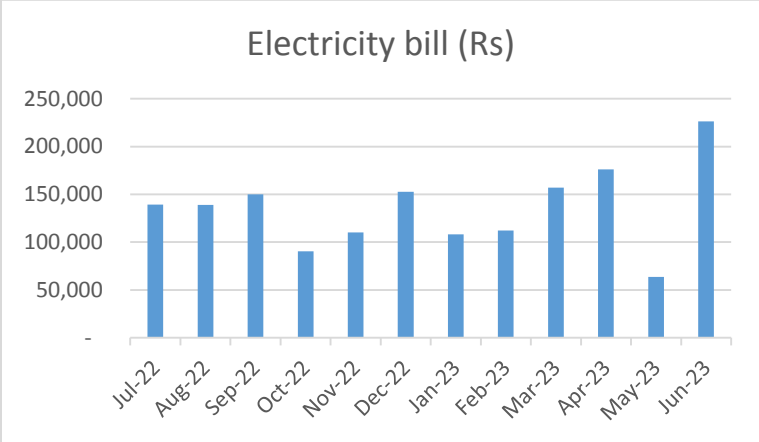

Figure 3.2: Month wise electricity bill

Key observations of electricity bill are as follows,

Table no 3.2: Key observations

Sr no	Parameter	Energy consumed, (kWh)	CO2 Emission (MT)
1	Total	110309	88.25
2	Maximum	15,073	12.06
3	Minimum	3,346	2.68
4	Average	9,192	7.35

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

Motiwala College of Educational Sciences, Nashik is situated in Motiwala Education and Welfare Trust campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.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-23	15,073	12.06
2	May-23	3,346	2.68
3	Apr-23	11,595	9.28
4	Mar-23	11,157	8.93
5	Feb-23	7,614	6.09
6	Jan-23	7,300	5.84
7	Dec-22	10,583	8.47
8	Nov-22	7,449	5.96
9	Oct-22	5,950	4.76
10	Sep-22	10,602	8.48
11	Aug-22	9,783	7.83
12	Jul-22	9,857	7.89
	Total	**1,10,309**	**88.25**

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

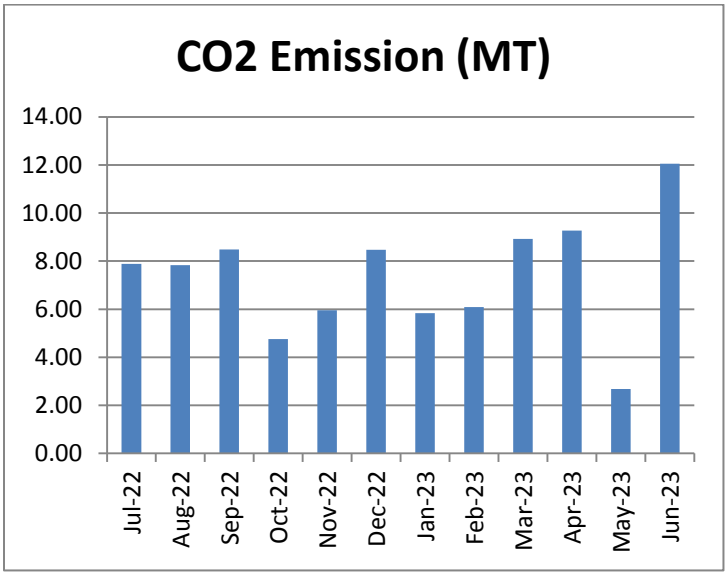

Figure 4.1: Month wise CO2 Emission

5. Study of utilities

5.1 APFC Panel

The Office has already installed the APFC Panel. During the measurements, it was found that the panel is working properly.

5.2 Study of Lighting

In the facility, the lighting system can be divided mainly in to parts, indoor lighting and outdoor lighting. There are 41 nos of LED tubes, 174 nos of LED bulbs.

5.3 Air-conditioners

In the facility, There is 4 nos of star rated new AC of 1.5Tr capacity.

5.4 Ceiling Fans

At building facility, there are about 19 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.

5.5 Water Pumps

There is 1 Water pumps with 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.

Motiwala College of Educational Sciences, Nashik is situated in Motiwala Education and Welfare Trust campus. Entire Campus is having single energy meter for all institutes situated in campus. The bill analysis is carried for electricity bills of entire campus.

The Campus has installed Roof Top Solar PV System. The Installed Capacity of Solar PV Plant is 7**0 kWp**.

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

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	1,10,309	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	105000	kWh/Annum
3	Total Energy Requirement of College	2,15,309	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	49	**%**

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
	LED lighting load			
1	LED tube	41	20	0.8
2	LED bulbs	174	12	2.1
3	LED street lights	5	35	0.2
	Total LED lighting load			**3.1**
	Total Lighting load			**3.1**

It can be seen that out of total lighting load 100% load is LED lighting load.

8. Energy conservation proposals

8.1 Replacement of old fans with STAR Rated fans

During the Audit, it was observed that there are 19 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	19	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	0.988	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	247	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	2717	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	41306	Rs lump sum
13	Simple Payback period	182	Months

8.2 Installation of Solar PV panel

It is recommended to install 50 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	50	kW
2	Energy saving	75000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	825000	Rs/ Annum
5	Investment required	2500000	Rs lump sum
6	Simple payback period	36	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 19 Nos Old Ceiling Fans with STAR rating fans	950	10,450	41,306	47
2	Installation of 50kW grid connected PV panel	75,000	825,000	2,500,000	36
	Total	**75,950**	**835,450**	**2,541,306**	**37**