Report

On

Energy Audit

At

Shree H.V.P. M's Degree College Of Physical Education, Amravati.

(Year 2020-21)

Prepared by

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Acknowledgement

We at Nutan Urja Solutions, Pune, express our sincere gratitude to the management of Shree H.V.P.M's Degree College Of Physical Education, Amravati 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	41,540	33.2
2	Minimum	11,298	9.0
3	Average	25,281	20.2
4	Total	303,366	242.7

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 20 %.

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 37%.

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 428 Nos T-8 fittings with 20W LED fittings	8,560	94,160	274,348	35
2	Replacement of 341 Nos Old Ceiling Fans with STAR rating fans	4,433	48,763	741,334	182
3	Installation of 200kW grid connected PV panel	300,000	3,300,000	10,000,000	36
	Total	**312,993**	**3,442,923**	**11,015,682**	**38**

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

Shree H.V.P.M's Degree College Of Physical Education, Amravati is runned by world famous institute Shree Hanuman Vyayam Prasarak Mandal. Mandal is established in 1914 and has completed more than 100 years. Mandal started the regular programme of physical education to provide trained and discipline physical education teacher by establishing this training college in the year 1967 with the permission of Government of Maharashtra in urban area at Amravati and affiliated to Nagpur University, Nagpur earlier. This is the only college in Maharashtra which started a three years degree course in physical education on govt. grant basis. This college is now permanently affiliated to Sant Gadge Baba Amravati University, Amravati.

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	Shree H.V.P.M's Degree College Of Physical Education, Amravati
2	Address	Hanuman Vyayam Nagar, H.V.P. Mandal, Amravati, Maharashtra. (444605)
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 tube (20W)	Fan	Computers (65W)	1.5TR Star rated AC
1	Library I		35	19	12	1
2	Class Room 1	3		4		
3	Class Room 2	2		4		
4	Class Room 3	3		4		
5	Class Room 4	3		4		
6	Class Room 5	3		7		
7	Class Room 6	5		5		
8	Class Room 7	5		6		
9	Class Room 8	5		6		
10	Class Room 9	5		6		
11	Class Room 10	5		5		
12	Class Room 11	7		7		
13	Class Room 12	7		7		
14	Class Room 13 - 16	15		8		
15	Library II	15		11	5	
16	B.C. Lab	13		7	65	4
17	Office			5	7	
18	Staff Room	4		4		
19	Meeting Hall			6		4
20	Auditorium hall	32		11		
21	Accounts Section	22		15	10	2
22	Principal office			2		
23	Exam centre	20		3		2
24	IQAC Room			10	10	3
25	Passage			2	3	1
26	**MCA**					
27	Open Hall	11		13	24	
28	Exam Office		2	1	1	
29	Girls Common Room	4		2		

30	NSS Room	6	3	9		
31	Class Room 1	4		2		
32	Principal Room	2	1	1		1
33	Computer lab	27		12	75	3
34	Departmental Office	4		2	4	2
35	Class Room	2	2	5		
36	Department	5	1	1	8	
37	Staff Room	1	1	2		
38	MCA Internet Lab	18		13	6	
39	Tutorial Room	3		3	30	3
40	Class Room 2	6		2		
41	Class Room 3	5		5		
42	Girls Wash Room	2				
43	Boys Wash Room	2				
44	Sraff Wash Room	1				
45	Passage	6				
46	Shooting Hall		20	7		
47	Gymnastic Hall		3	12		
48	Canteen	10		6		
49	Mess	40		20		
	YOGA Dept.					
50	Office 1	1	3	2		2
51	Office 2		2	4	2	
52	Class Room	2	4	4	1	
53	Special Room			4		
54	Passage	2				
55	Class Room 2	2		1		
56	Class Room 3	2		2		
57	Yoga Medicine	1		4		
58	Naturopathy Lab	4		6		
59	Yoga Hall	3	9	13		
60	Bathroom 2	2				
61	Ladies Naturopathy	6		6		
62	Bathroom 2	12	3			
63	Passage					
64	Physiotherapy	12		2		
65	Passage	31		2		
66	OPD	1		3		
	Swimming Tank					

67	Passage		9			
68	Office	2		2	1	
69	Changing Room	12				
	Total	**428**	**98**	**341**	**264**	**28**

Apart from above load, the college has pumps, LED focus lights, CFLs and LED focus street lights on streets and grounds. Individual fitting wise load is as under.

List of LED focus lights and pumps are as follows

Table 2.2: List of LED focus lights

SR no	LED Lights Capacity (W)	Nos
1	100	35
2	200	15
3	150	10

Table 2.3: List of Pumps

Sr no	Pump Capacity (HP)	Nos
1	25	1
2	15	1
3	10	1
4	5	5
5	3	4
6	1	5
7	0.5	1

Table No 2.4: Equipment wise Connected Load

No	Equipment	Qty	Load, W/Unit	Load, kW
1	Ceiling Fan	341	65	22.2
2	AC-New (1.5 TR)	28	1838	51.5
3	LED-20W	98	20	2.0
4	F T L-40 W	428	40	17.1
5	Computers	264	65	17.2
6	Pumps			69.8
7	LED focus lights			8.0
	Total			187.7

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

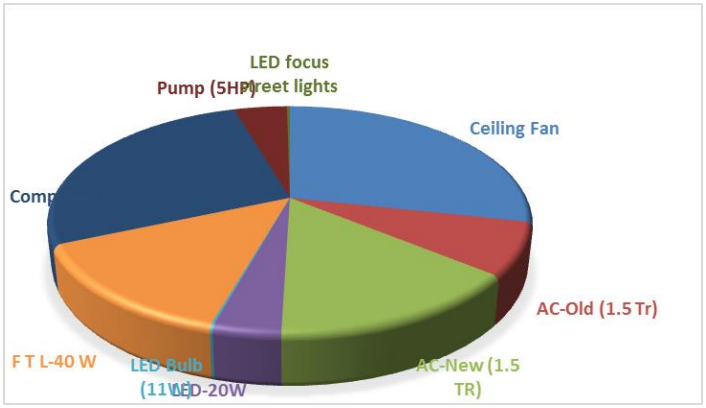

Figure 2.1: Distribution of connected load.

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-21	25,133	292,369
2	May-21	30,317	335,354
3	Apr-21	37,239	405,620
4	Mar-21	41,540	444,886
5	Feb-21	36,547	400,962
6	Jan-21	32,454	369,037
7	Dec-20	21,368	263,001
8	Nov-20	18,060	233,770
9	Oct-20	19,773	247,656
10	Sep-20	11,298	178,747
11	Aug-20	13,977	209,235
12	Jul-20	15,660	224,681
	Total	**303,366**	**3,605,318**

Variation in energy consumption is as follows,

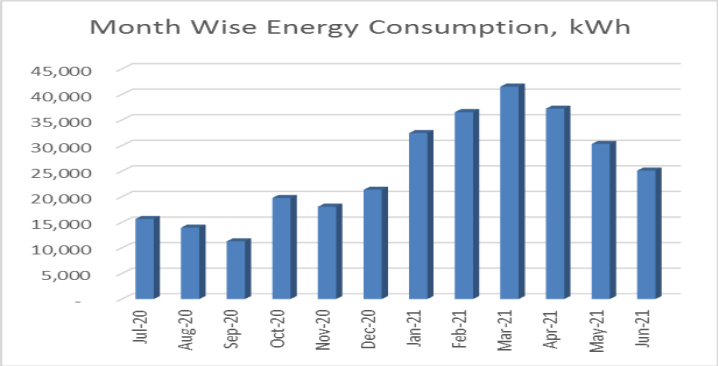

Figure 3.1: Month wise energy consumption

Monthly variation in electricity bill is as follows,

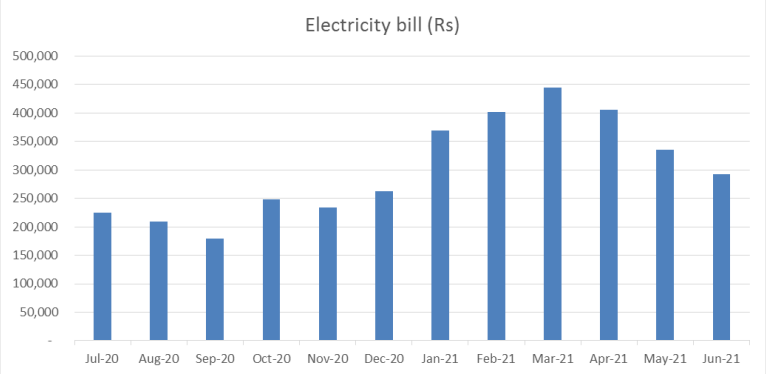

Figure 3.2: Month wise electricity bill

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	41,540	33.2
2	Minimum	11,298	9.0
3	Average	25,281	20.2
4	Total	303,366	242.7

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-21	25,133	20.1
2	May-21	30,317	24.3
3	Apr-21	37,239	29.8
4	Mar-21	41,540	33.2
5	Feb-21	36,547	29.2
6	Jan-21	32,454	26.0
7	Dec-20	21,368	17.1
8	Nov-20	18,060	14.4
9	Oct-20	19,773	15.8
10	Sep-20	11,298	9.0
11	Aug-20	13,977	11.2
12	Jul-20	15,660	12.5
	Total	**303,366**	**242.7**

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

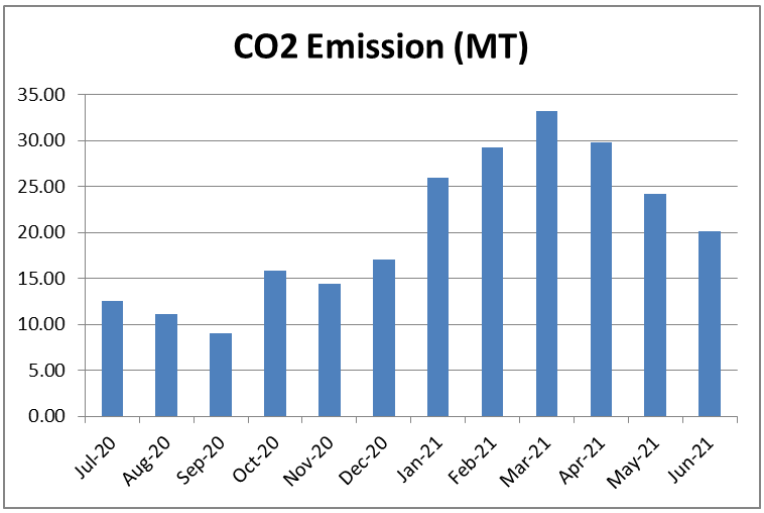

Figure 4.1: Month wise CO2 Emission

5. Study of usage of 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 **50 kWp**.

Table 5.1: Computation of % Usage of Alternate Energy to Annual Energy Requirement

No	Particulars	Value	Unit
1	Annual Energy Purchased from MSEDCL	303,366	kWh/Annum
2	Energy Generated by Roof Top Solar PV System	75,000	kWh/Annum
3	Total Energy Requirement of College	378,366	kWh/Annum
4	% of Usage of Alternate Energy to Annual Energy Requirement	20	**%**

Photograph of Solar PV plant

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 6.1: Total lighting load

No	Particulars	Qty	Load, W/Unit	Load, kW
1	F T L-40 W	428	40	17.12
	LED lighting load			
1	LED tube	98	20	1.96
2	LED focus lights	35	100	3.5
3	LED focus lights	10	150	1.5
4	LED focus lights	15	200	3
	Total LED lighting load			**9.96**
	Total Lighting load			**27.08**

It can be seen that out of total lighting load 37% 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 428 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	428	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	34.24	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	8560	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	94160	Rs/Annum
11	Cost of 20 W LED Tube	641	Rs/Unit
12	Investment required	274348	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 341 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	341	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	17.732	kWh/Day
7	Annual Working Days	250	Nos
8	Annual Energy Saving possible	4433	kWh/Annum
9	Rate of Electrical Energy	11	Rs/kWh
10	Annual Monetary saving	48763	Rs/Annum
11	Cost of STAR Rated Ceiling Fan	2174	Rs/unit
12	Investment required	741334	Rs lump sum
13	Simple Payback period	182	Months

7.3 Installation of Solar PV panel

It is recommended to install 200 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	200	kW
2	Energy saving	300000	kWh/Annum
3	Rate of electrical energy	11	Rs
4	Annual monetory savings	3300000	Rs/ Annum
5	Investment required	10000,000	Rs lump sum
6	Simple payback period	36	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 428 Nos T-8 fittings with 20W LED fittings	8,560	94,160	274,348	35
2	Replacement of 341 Nos Old Ceiling Fans with STAR rating fans	4,433	48,763	741,334	182
3	Installation of 200kW grid connected PV panel	300,000	3,300,000	10,000,000	36
	Total	**312,993**	**3,442,923**	**11,015,682**	**38**